



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

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

| | | | |
|---------------------------------|--|--|---|
| Model: | Easysolar-II 48/3000/35-32 MPPT 250/70GX Easysolar-II 24/3000/70-32 MPPT 250/70GX Easysolar-II 48/5000/70-50 MPPT 250/100GX | | |
| Ratings : | Easysolar-II 48/3000/35-32 MPPT 250/70GX | Easysolar-II 24/3000/70-32 MPPT 250/70GX | Easysolar-II 48/5000/70-50 MPPT 250/100GX |
| Mains voltage: | 230V 50/60Hz | | |
| Mains current: | 11A | | 19A |
| Output power (feed in on-grid): | 2,5kVA / 2,4kW | | 4,5kVA / 4,4kW |
| Output power (off-grid): | 3,0kVA / 2,4kW | | 5,0kVA / 4,0kW |
| Pass through current: | 32A | | 50A |

Intended use:

Battery Inverter with an automatic disconnection device with single phase mains surveillance in accordance with Engineering Recommendation G99-1 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 G99 Issue 1 – Amendment 8; 01 September 2021

Requirements for the connection of generation equipment in parallel with public 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. The units are only compliant with type A inverter connected power generating Module requirements

Report No: 20PP183-16_0

Certificate No: 23-206-00

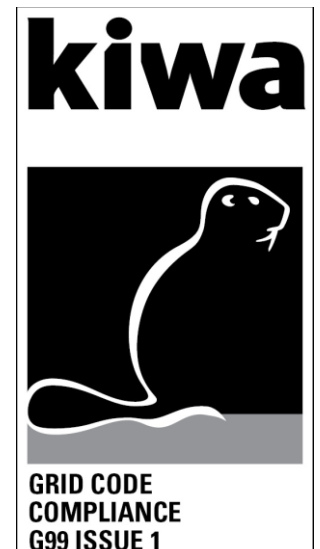
Date of issue: 2023-05-17

CERTIFICATE

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Tanja Rottach
Certification Engineer

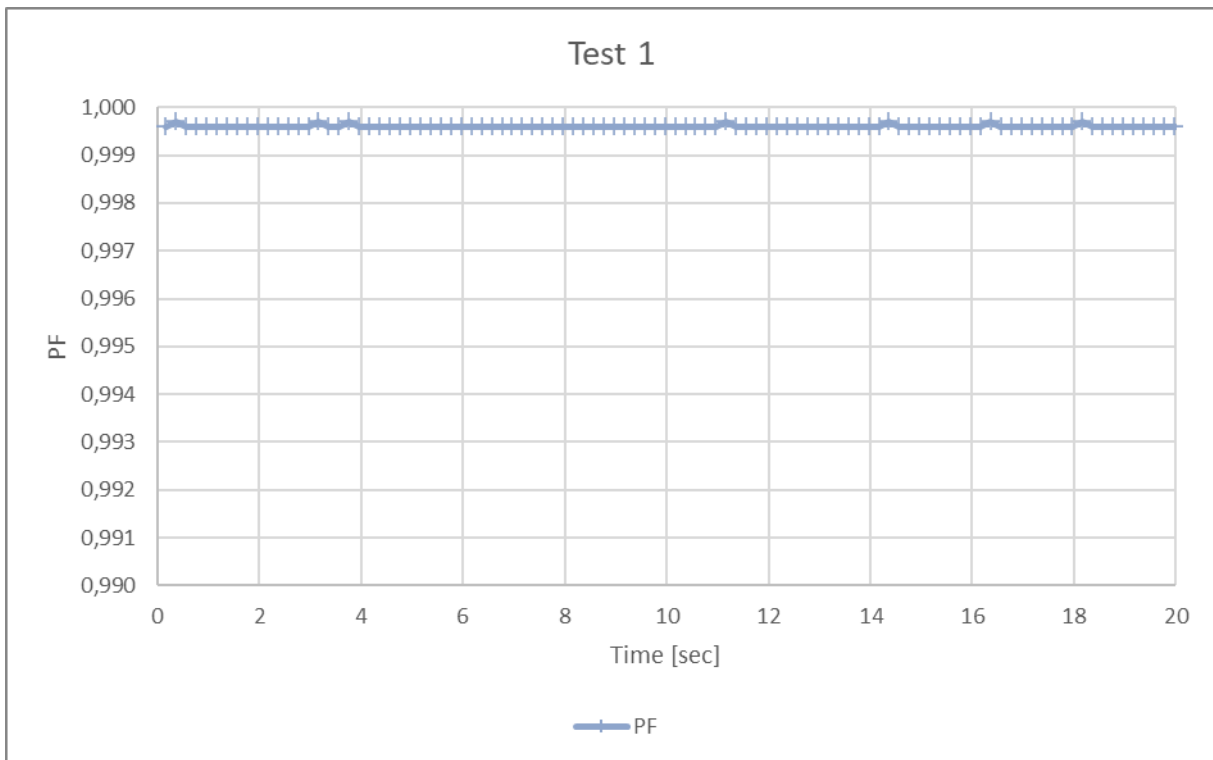
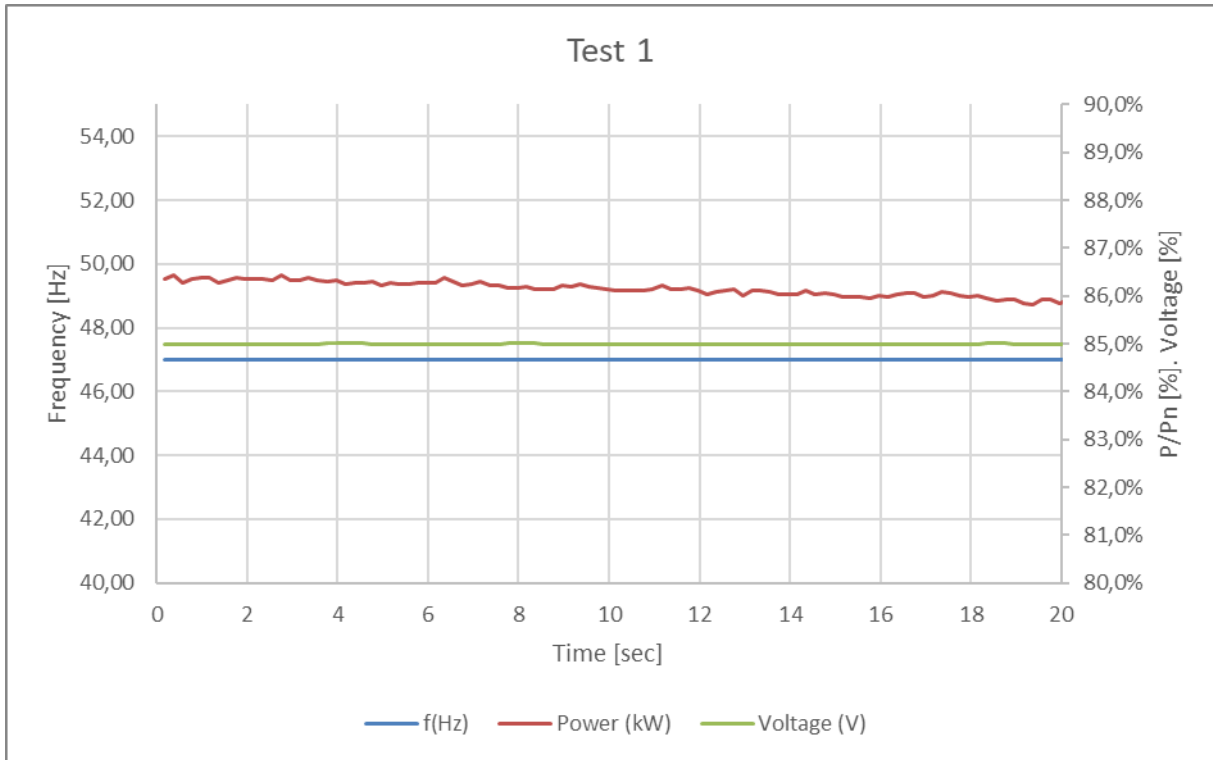




| Operating Range: | | | | | |
|--|-----------------|------------|---------------|---------------------|-------------------------------|
| | U [V] | f [Hz] | Cos ϕ | P [kW] | No disconnection occurs (Y/N) |
| Test 1 | 85%Un 195,5V | 47,00Hz | 1,00 | Registered Capacity | - |
| Measured 20s avg | 195,5 | 47,00 | 1,000 | 2,1* | Y |
| Test 2 | 85%Un 195,5V | 47,50Hz | 1,00 | Registered Capacity | - |
| Measured 90min avg | 195,7 | 47,50 | 1,000 | 2,1* | Y |
| Test 3 | 110%Un 253V | 51,50Hz | 1,00 | Registered Capacity | - |
| Measured 90min avg | 253,0 | 51,50 | 0,998 | 2,4 | Y |
| Test 4 | 110%Un 253V | 52,00Hz | 1,00 | Registered Capacity | - |
| Measured 15min avg | 253,0 | 52,00 | 0,998 | 2,4 | Y |
| Test 5 | 100%Un 230V | 50,00Hz | 1,00 | Registered Capacity | - |
| Measured 90min avg | 230,1 | 50,00 | 1,000 | 2,4 | Y |
| Test 6 | 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 | |
| *The test is performed at registered capacity without limitation of the supplied primary source. The output power is limited because of the low voltage of the grid which trigger the maximum current of the inverter. | | | | | |

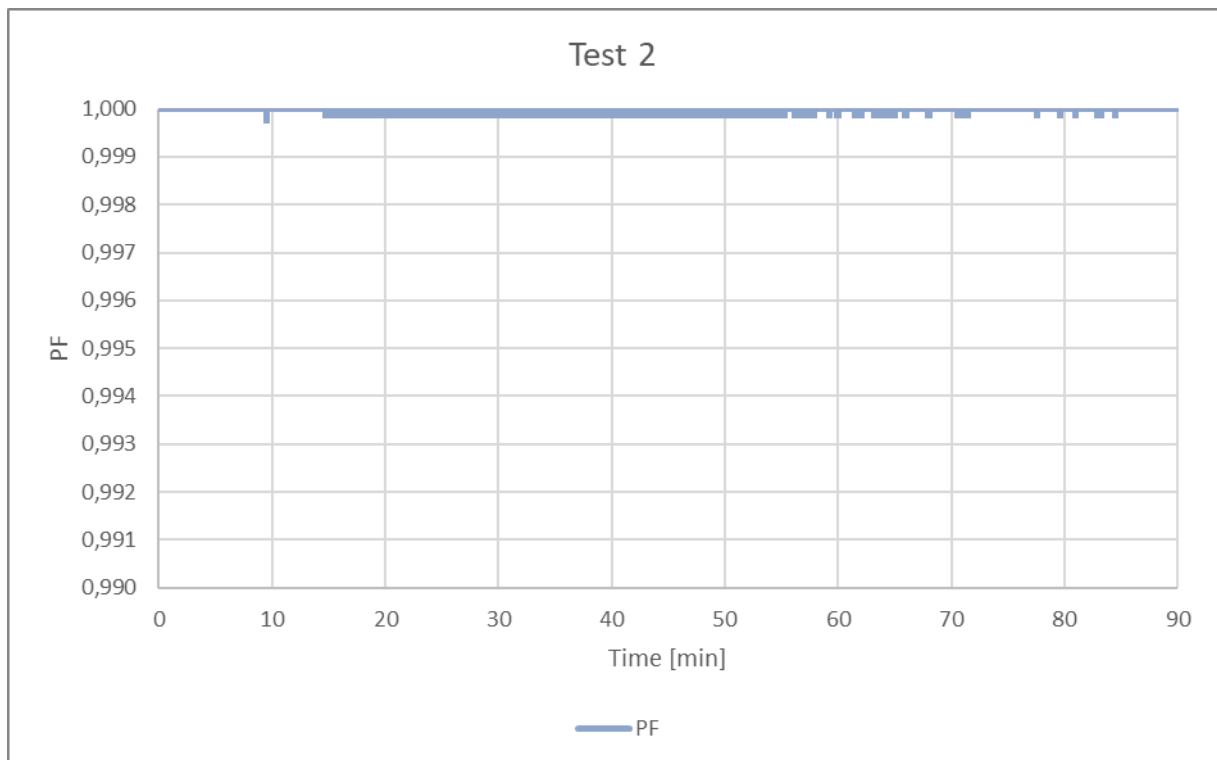
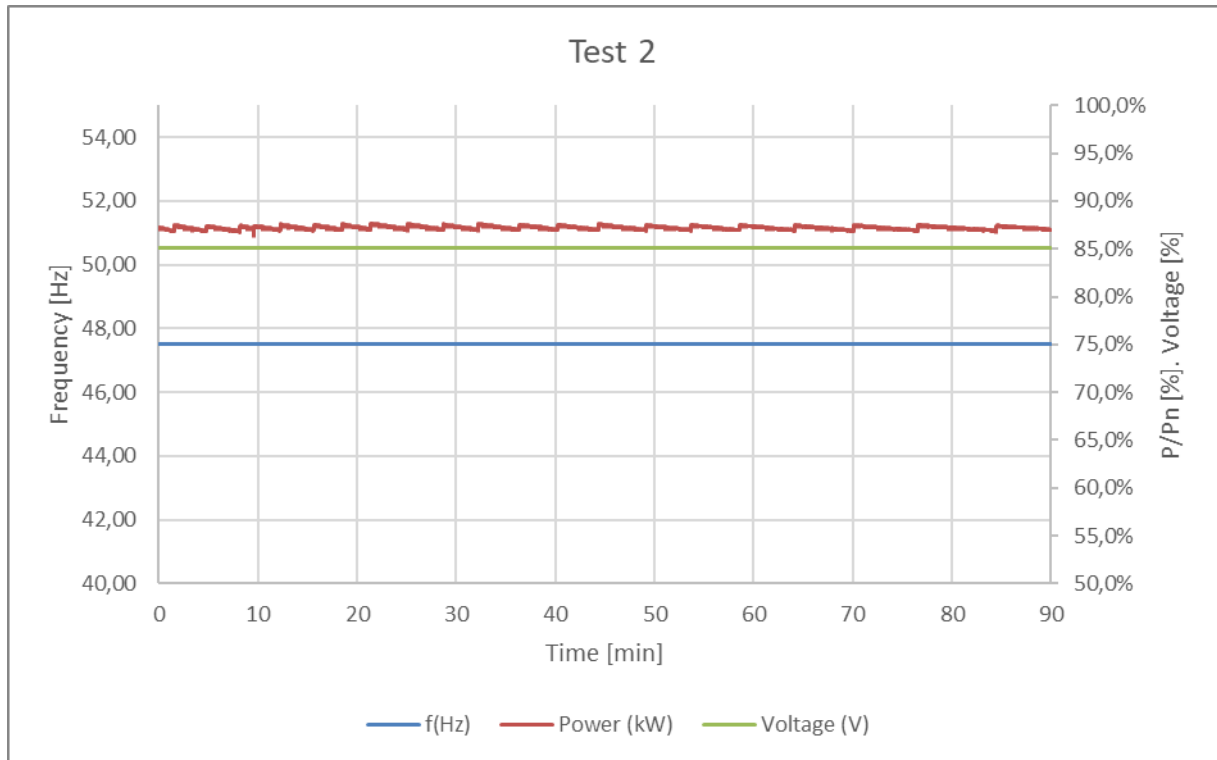


Test 1 - Frequency, Voltage, active power over time diagram



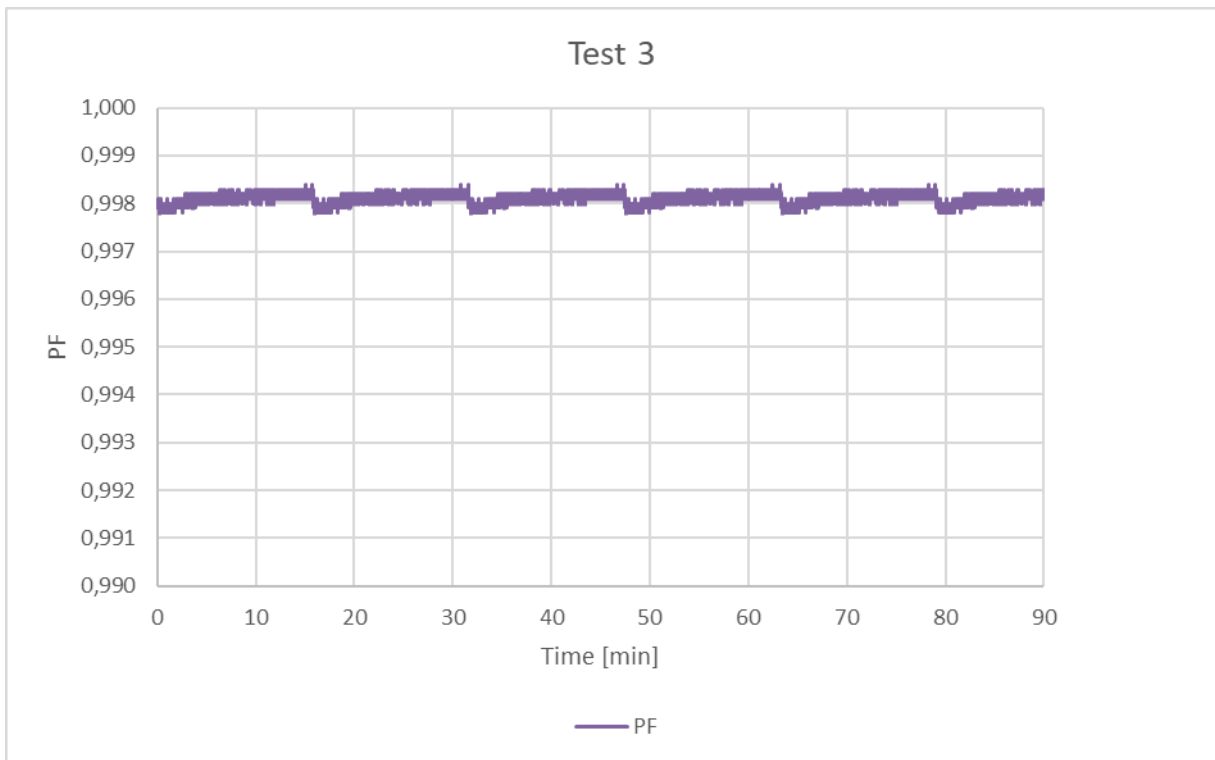
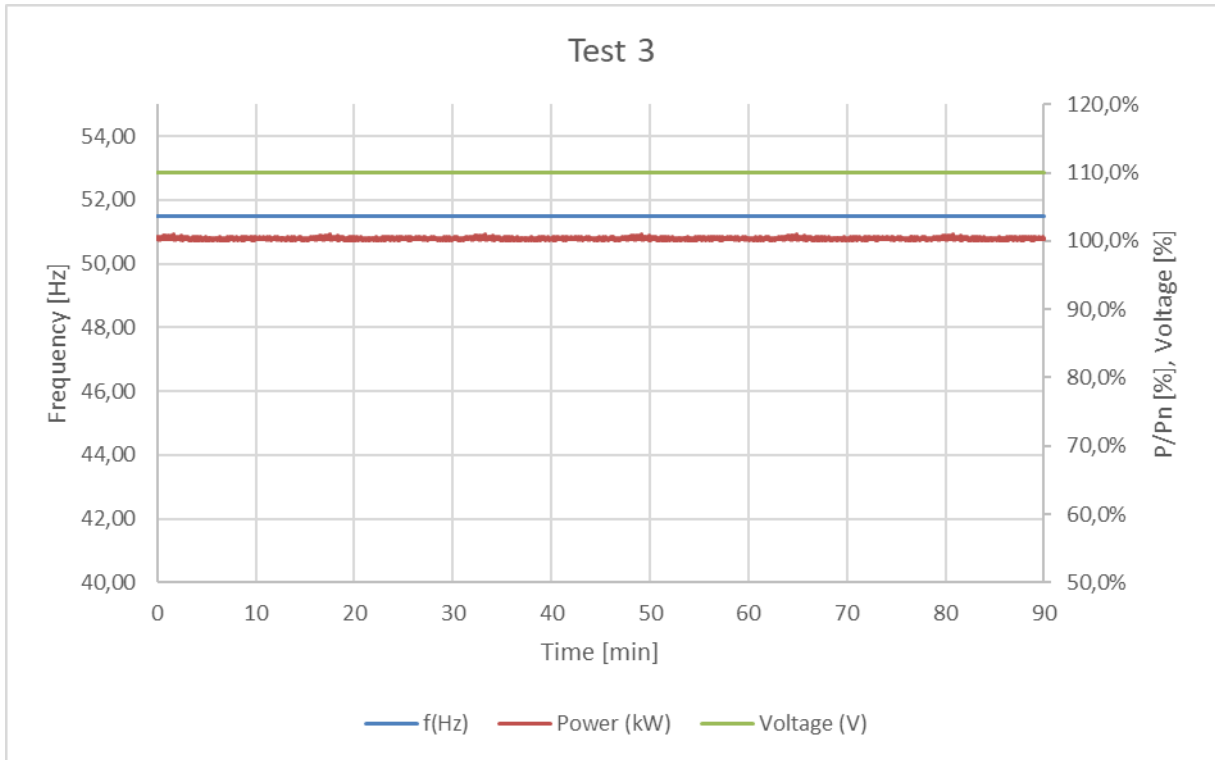


Test 2 - Frequency, Voltage, active power over time diagram



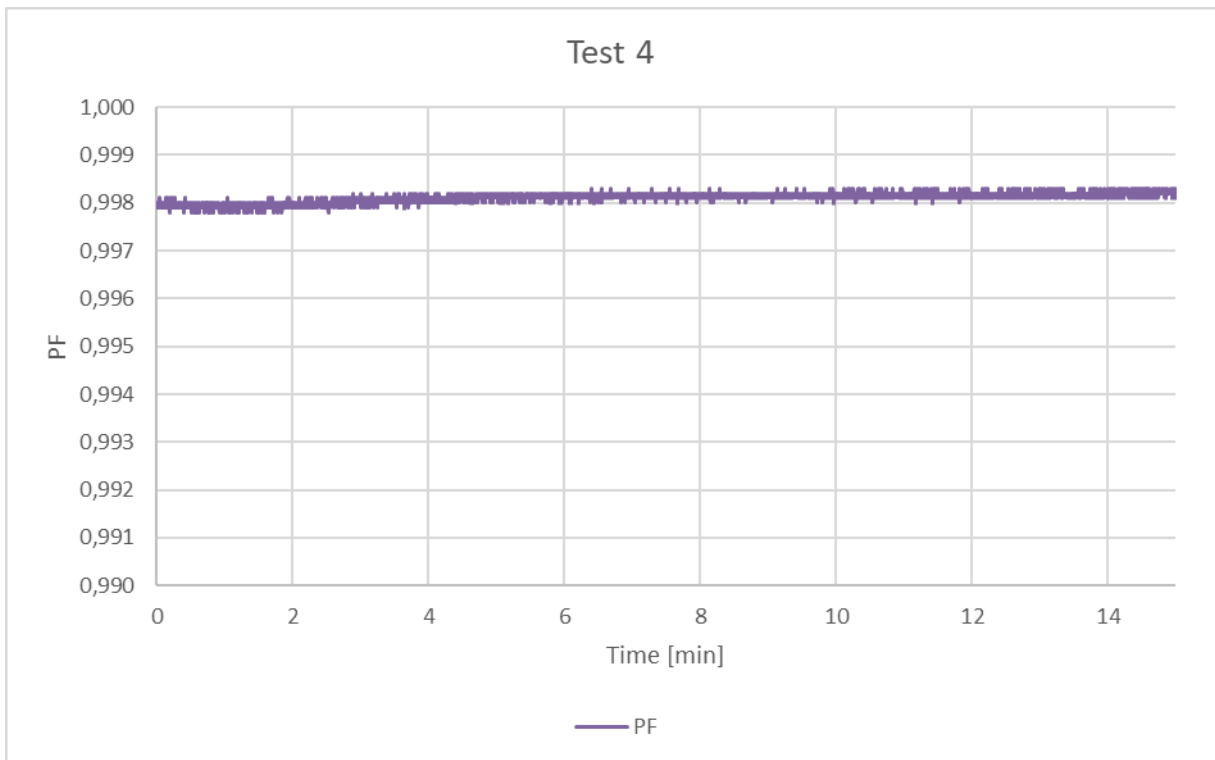
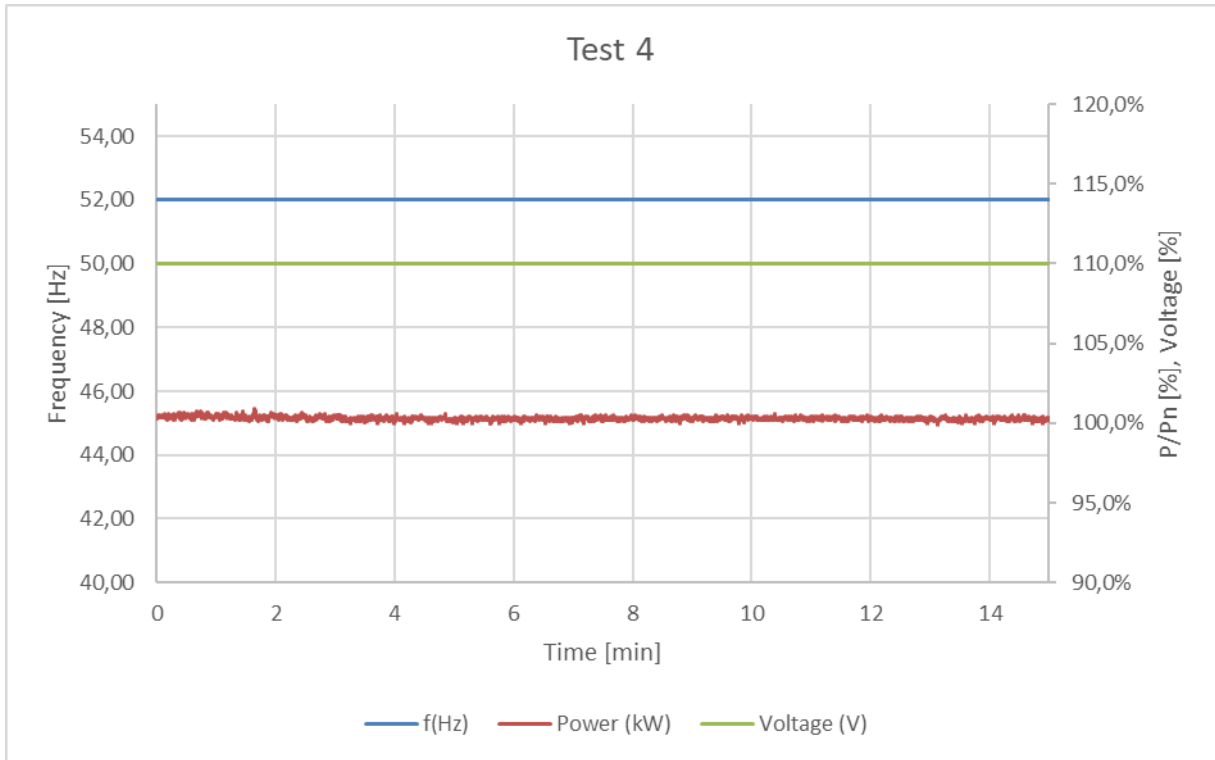


Test 3 - Frequency, Voltage, active power over time diagram



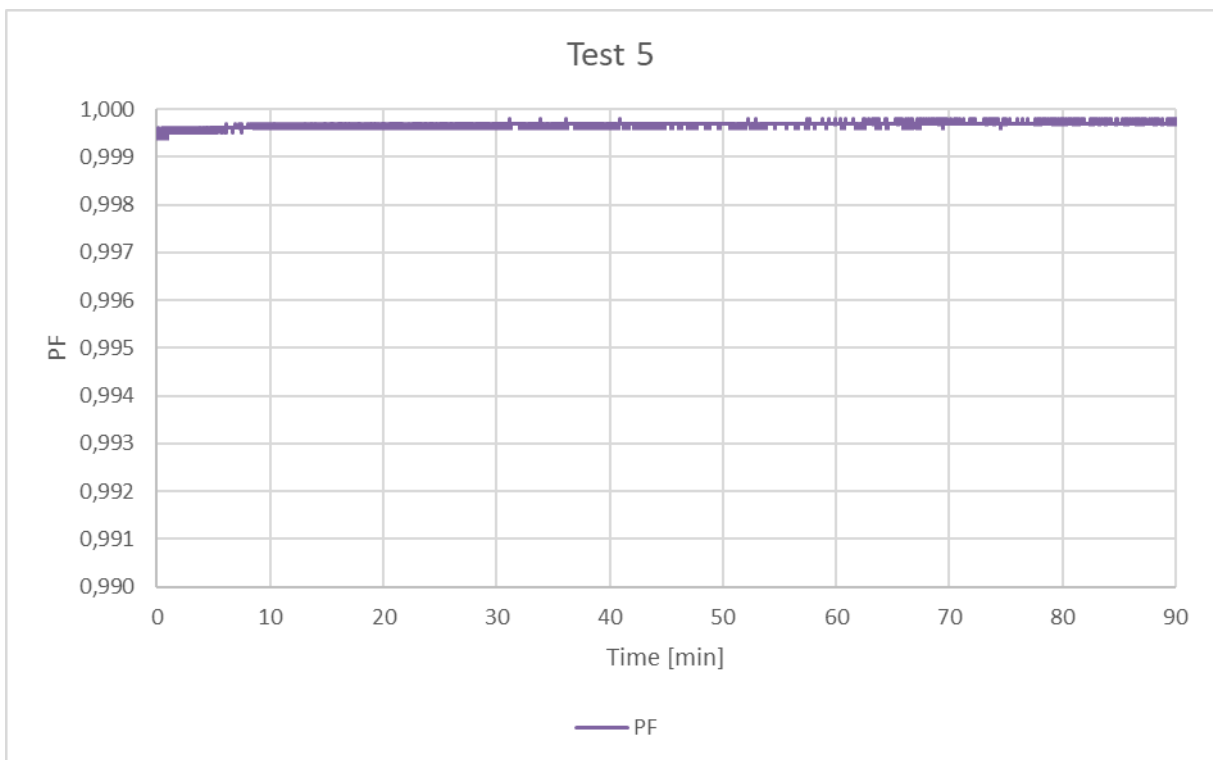
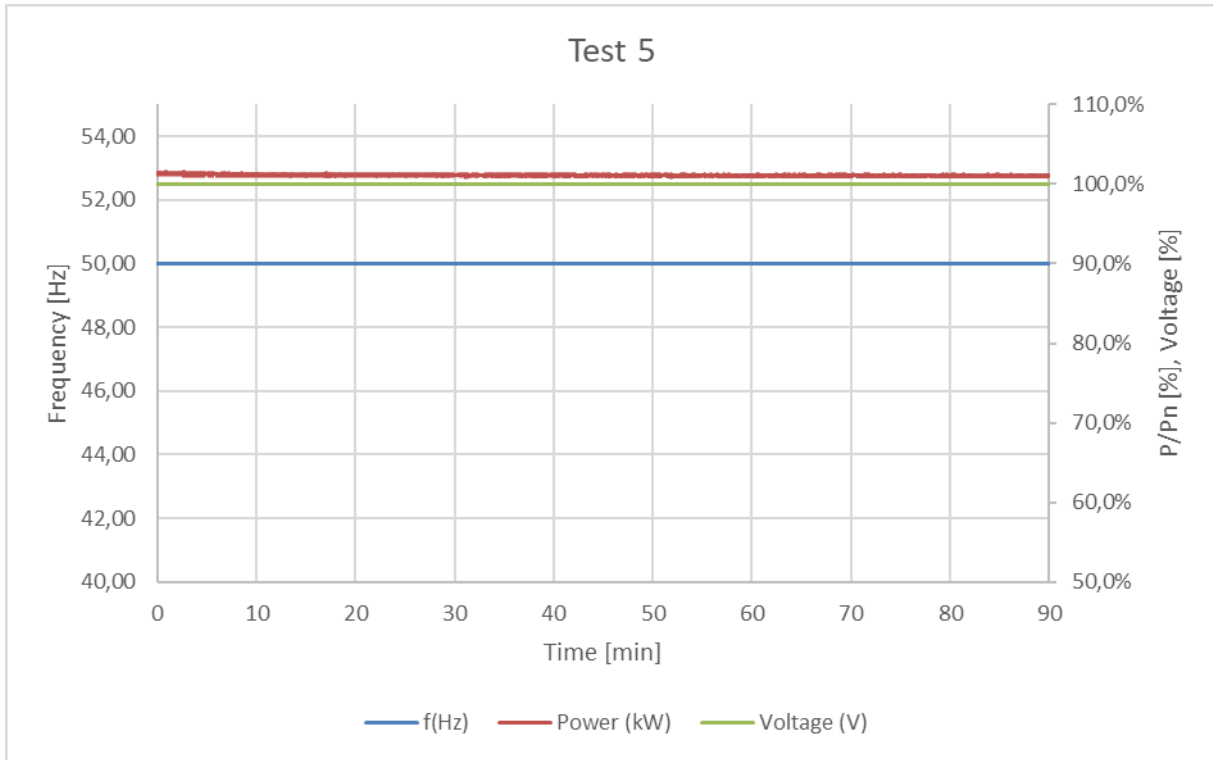


Test 4 - Frequency, Voltage, active power over time diagram



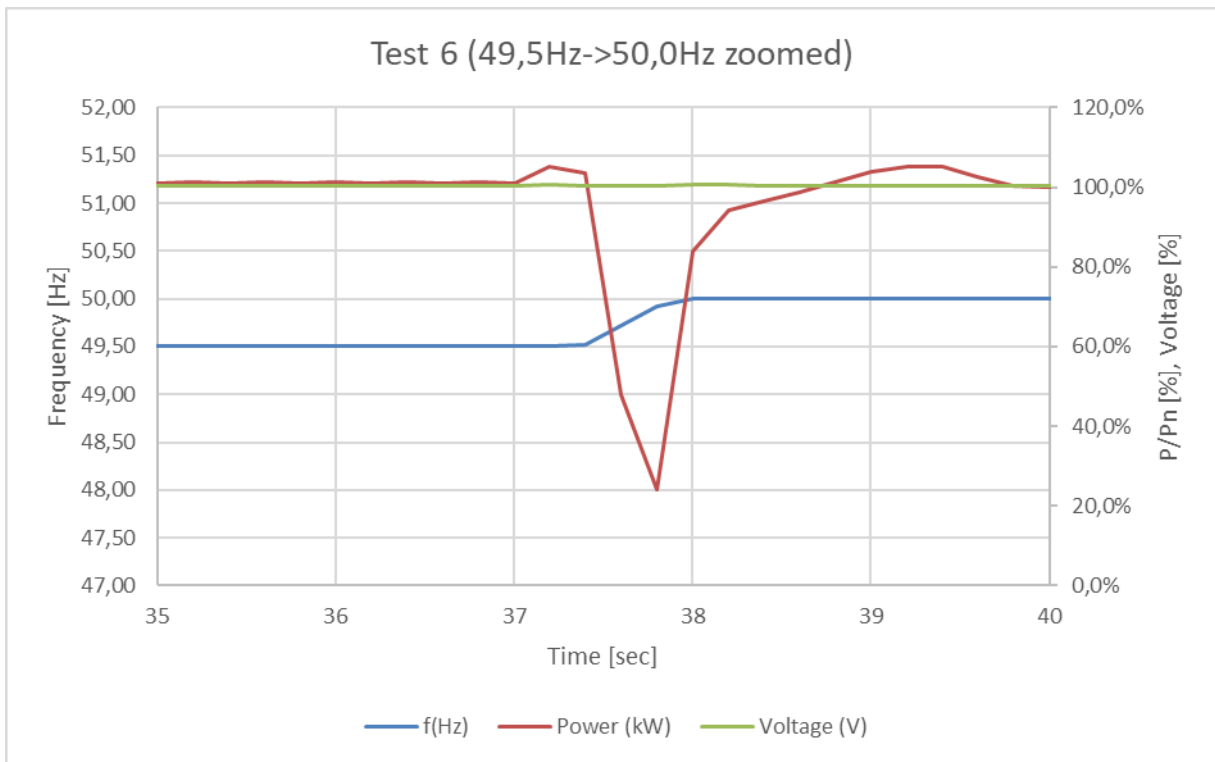
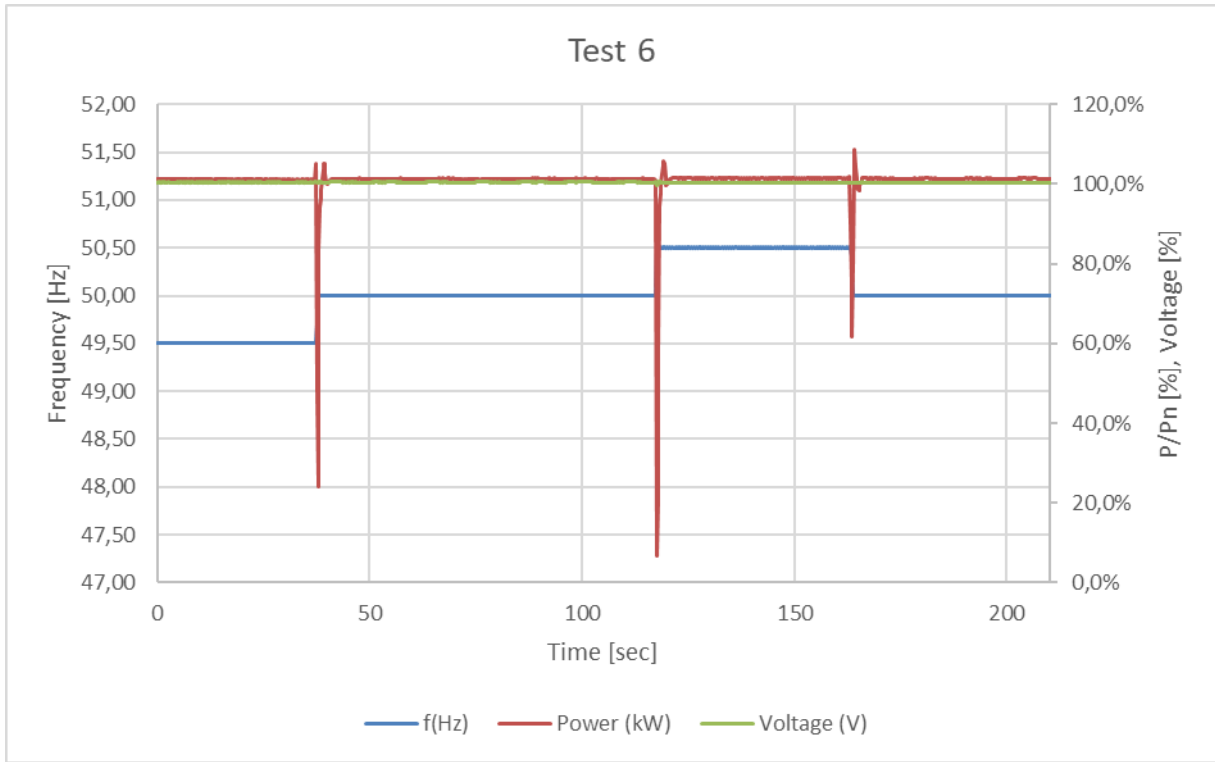


Test 5 - Frequency, Voltage, active power over time diagram





Test 6 - Frequency, Voltage, active power over time diagram







| Power Quality – Harmonics | | | | | | | | |
|--|--------------------------------|----|-----|--------------------|-----|----|---|------------|
| Easysolar-II xx/5000 | | | | | | | | |
| Generating Unit tested to BS EN 61000-3-12 | | | | | | | | |
| Generating Unit rating per phase (rpp) | | | 4,4 | | kVA | | Harmonics % = Measured Value (Amps) x 23/rating per phase (kVA) | |
| Harmonic | At 45-55% of rated output | | | | | | Limit in BS EN 61000-3-12 | |
| | Measured Value (A) | | | Measured Value (%) | | | 1 phase | 3 phase |
| | L1 | L2 | L3 | L1 | L2 | L3 | | |
| 2 | 0,053 | — | — | 0,277 | — | — | 8% | 8% |
| 3 | 0,600 | — | — | 3,136 | — | — | 21,6% | Not stated |
| 4 | 0,055 | — | — | 0,288 | — | — | 4% | 4% |
| 5 | 0,256 | — | — | 1,338 | — | — | 10,7% | 10,7% |
| 6 | 0,038 | — | — | 0,199 | — | — | 2,67% | 2,67% |
| 7 | 0,193 | — | — | 1,009 | — | — | 7,2% | 7,2% |
| 8 | 0,029 | — | — | 0,152 | — | — | 2% | 2% |
| 9 | 0,143 | — | — | 0,748 | — | — | 3,8% | Not stated |
| 10 | 0,021 | — | — | 0,110 | — | — | 1,6% | 1,6% |
| 11 | 0,052 | — | — | 0,272 | — | — | 3,1% | 3,1% |
| 12 | 0,015 | — | — | 0,078 | — | — | 1,33% | 1,33% |
| 13 | 0,027 | — | — | 0,141 | — | — | 2% | 2% |
| THD | — | — | — | 3,694 | — | — | 23% | 13% |
| PWHD | — | — | — | 1,636 | — | — | 23% | 22% |
| Harmonic | At 100% of Registered Capacity | | | | | | Limit in BS EN 61000-3-12 | |
| | Measured Value (A) | | | Measured Value (%) | | | 1 phase | 3 phase |
| | L1 | L2 | L3 | L1 | L2 | L3 | | |
| 2 | 0,048 | — | — | 0,251 | — | — | 8% | 8% |
| 3 | 0,304 | — | — | 1,589 | — | — | 21,6% | Not stated |
| 4 | 0,040 | — | — | 0,209 | — | — | 4% | 4% |
| 5 | 0,285 | — | — | 1,490 | — | — | 10,7% | 10,7% |
| 6 | 0,032 | — | — | 0,167 | — | — | 2,67% | 2,67% |
| 7 | 0,130 | — | — | 0,680 | — | — | 7,2% | 7,2% |
| 8 | 0,023 | — | — | 0,120 | — | — | 2% | 2% |
| 9 | 0,090 | — | — | 0,470 | — | — | 3,8% | Not stated |
| 10 | 0,017 | — | — | 0,089 | — | — | 1,6% | 1,6% |
| 11 | 0,069 | — | — | 0,361 | — | — | 3,1% | 3,1% |
| 12 | 0,011 | — | — | 0,058 | — | — | 1,33% | 1,33% |
| 13 | 0,053 | — | — | 0,277 | — | — | 2% | 2% |
| THD | — | — | — | 2,423 | — | — | 23% | 13% |
| PWHD | — | — | — | 1,275 | — | — | 23% | 22% |



| Easysolar-II xx/3000 | | | | | | | | |
|--|--------------------------------|----|------|--------------------|-----|----|---|------------|
| Generating Unit tested to BS EN 61000-3-12 | | | | | | | | |
| Generating Unit rating per phase (rpp) | | | 2,47 | | kVA | | Harmonics % = Measured Value (Amps) x 23/rating per phase (kVA) | |
| Harmonic | At 45-55% of rated output | | | | | | Limit in BS EN 61000-3-12 | |
| | Measured Value (A) | | | Measured Value (%) | | | 1 phase | 3 phase |
| | L1 | L2 | L3 | L1 | L2 | L3 | | |
| 2 | 0,067 | — | — | 0,628 | — | — | 8% | 8% |
| 3 | 0,076 | — | — | 0,707 | — | — | 21,6% | Not stated |
| 4 | 0,058 | — | — | 0,538 | — | — | 4% | 4% |
| 5 | 0,154 | — | — | 1,435 | — | — | 10,7% | 10,7% |
| 6 | 0,039 | — | — | 0,359 | — | — | 2,67% | 2,67% |
| 7 | 0,112 | — | — | 1,046 | — | — | 7,2% | 7,2% |
| 8 | 0,024 | — | — | 0,219 | — | — | 2% | 2% |
| 9 | 0,063 | — | — | 0,588 | — | — | 3,8% | Not stated |
| 10 | 0,014 | — | — | 0,130 | — | — | 1,6% | 1,6% |
| 11 | 0,054 | — | — | 0,498 | — | — | 3,1% | 3,1% |
| 12 | 0,009 | — | — | 0,080 | — | — | 1,33% | 1,33% |
| 13 | 0,036 | — | — | 0,339 | — | — | 2% | 2% |
| THD | — | — | — | 2,408 | — | — | 23% | 13% |
| PWHD | — | — | — | 3,735 | — | — | 23% | 22% |
| Harmonic | At 100% of Registered Capacity | | | | | | Limit in BS EN 61000-3-12 | |
| | Measured Value (A) | | | Measured Value (%) | | | 1 phase | 3 phase |
| | L1 | L2 | L3 | L1 | L2 | L3 | | |
| 2 | 0,044 | — | — | 0,409 | — | — | 8% | 8% |
| 3 | 0,077 | — | — | 0,717 | — | — | 21,6% | Not stated |
| 4 | 0,040 | — | — | 0,369 | — | — | 4% | 4% |
| 5 | 0,083 | — | — | 0,777 | — | — | 10,7% | 10,7% |
| 6 | 0,027 | — | — | 0,249 | — | — | 2,67% | 2,67% |
| 7 | 0,054 | — | — | 0,498 | — | — | 7,2% | 7,2% |
| 8 | 0,016 | — | — | 0,149 | — | — | 2% | 2% |
| 9 | 0,043 | — | — | 0,399 | — | — | 3,8% | Not stated |
| 10 | 0,010 | — | — | 0,090 | — | — | 1,6% | 1,6% |
| 11 | 0,026 | — | — | 0,239 | — | — | 3,1% | 3,1% |
| 12 | 0,005 | — | — | 0,050 | — | — | 1,33% | 1,33% |
| 13 | 0,014 | — | — | 0,130 | — | — | 2% | 2% |
| THD | — | — | — | 1,459 | — | — | 23% | 13% |
| PWHD | — | — | — | 1,744 | — | — | 23% | 22% |



| Power Quality – Voltage Fluctuations and Flicker | | | | | | | | |
|--|--|-------|-------------------|---------------|------------|-------------------|---------|-------------|
| Test start date | 2019-08-01 | | | Test End date | 2019-08-01 | | | |
| Test Location | Kiwa Primara GmbH, Gewerbestraße 28, 87600 Kaufbeuren, Germany | | | | | | | |
| Easysolar-II xx/5000 | | | | | | | | |
| | Starting | | | Stopping | | | Running | |
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured Values | 3,344 | 3,344 | 150,0ms | -3,469 | -3,377 | 0,0ms | 0,027 | 0,027 |
| Normalised to standard impedance | 3,344 | 3,344 | 150,0ms | -3,469 | -3,377 | 0,0ms | 0,027 | 0,027 |
| Normalised to required maximum impedance | 3,268 | 3,268 | 0,0ms | -3,390 | -3,300 | 0,0ms | 0,026 | 0,026 |
| Limit set under BS EN 61000-3-11 | 4% | 3,3% | 500ms (>3,3%)* | 4% | 3,3% | 500ms (>3,3%)* | 1,0 | 0,65 |
| *500ms is the maximum allowed time above 3,3%. | | | | | | | | |
| Easysolar-II xx/3000 | | | | | | | | |
| | Starting | | | Stopping | | | Running | |
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured Values | 0,313 | 0,313 | 0ms | 0,388 | 0,274 | 0ms | 0,021 | 0,021 |
| Normalised to standard impedance | 0,313 | 0,313 | 0ms | 0,388 | 0,274 | 0ms | 0,021 | 0,021 |
| Normalised to required maximum impedance | - | - | - | - | - | - | - | - |
| Limit set under BS EN 61000-3-11 | 4% | 3,3% | 500ms (>3,3%)* | 4% | 3,3% | 500ms (>3,3%)* | 1,0 | 0,65 |
| *500ms is the maximum allowed time above 3,3%. | | | | | | | | |
| Easysolar-II xx/3000 | | | | | | | | |
| | Starting | | | Stopping | | | Running | |
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| 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 | | |
| Easysolar-II xx/3000 | | | | | | | | |
| | Starting | | | Stopping | | | Running | |
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| 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 | | |



| Power Quality – DC injection | | | |
|-------------------------------------|--------|--------|--------|
| Easysolar-II xx/3000 | | | |
| Test power level | 10% | 55% | 100% |
| Recorded DC value in Amps | -0,021 | -0,001 | -0,015 |
| As % of rated AC current | -0,20% | -0,01% | -0,14% |
| Limit | 0,25% | 0,25% | 0,25% |
| Easysolar-II xx/5000 | | | |
| Test power level | 10% | 55% | 100% |
| Recorded DC value in Amps | -0,001 | 0,001 | 0,005 |
| As % of rated AC current | -0,01% | 0,00% | 0,03% |
| Limit | 0,25% | 0,25% | 0,25% |

| Power Factor | | | |
|---------------------|-------------------|----------------|----------------|
| Voltage | 0,94 pu (216.2 V) | 1,0 pu (230 V) | 1,1 pu (253 V) |
| Measured Value | 1,000 | 1,000 | 1,000 |
| Power Factor Limit | >0,95 | | |



| Protection – Frequency Tests | | | | | | |
|------------------------------|-----------|------------|-----------|------------|-------------------|-----------------|
| Function | Setting | | Trip test | | No trip test | |
| | Frequency | Time delay | Frequency | Time delay | Frequency time | Confirm no trip |
| U/F stage 1 | 47,5 Hz | 20 s | 47,40Hz | 20,06s | 47,7Hz 30s | No trip |
| U/F stage 2 | 47,0 Hz | 0,5 s | 46,90Hz | 0,60s | 47,2 Hz 19,5s | No trip |
| | | | | | 46,8 Hz 0,45 s | No trip |
| O/F | 52,0 Hz | 0,5 s | 52,00Hz | 0,56s | 51,8 Hz 120 s | No trip |
| | | | | | 52,2Hz 0,45s | 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 | 0,8 pu (184V) | 2,5s | 182,5V | 2,54s | 188 V 5 s | No trip |
| | | | | | 180V 2,45 s | No trip |
| O/V stage 1 | 1,14 pu (262,2V) | 1,0s | 261,2V | 1,07s | 258,2 V 5,0 s | No trip |
| O/V stage 2 | 1,19 pu (273,7V) | 0,5s | 273,0 | 0,59s | 269,7 V 0,95 s | No trip |
| | | | | | 277,7 V 0,45 s | 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% P | 33% +5% Q | 66% +5% Q | 100% +5% P |
| Trip time (s) | 0.199 | 0.209 | 0.263 | 0.151 | 0.166 | 0.150 |
| Protection – Frequency change, Vector Shift Stability test. | | | | | | |
| | Start frequency | Change | Confirm no trip | | | |
| Positive vector shift | 49,5Hz | +50 dregrees | No Trip | | | |
| Negative vector shift | 50,5Hz | - 50 dregrees | 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 | +0,95 Hzs ⁻¹ | 2,1 s | No trip | | | |
| 51,0 Hz to 49,0 Hz | -0,95 Hzs ⁻¹ | 2,1 s | No trip | | | |



| Protection – Limited Frequency Sensitive Mode – Over frequency Test | | | | | |
|--|-----------------------------------|--|--------------------------------------|-----------------------|-----------------|
| Easysolar-II xx/3000 | | | | | |
| Active Power response to rising frequency/time plots are attached | | | | | N |
| Test sequence at registered capacity >80% | Measured Active Power output [kW] | Frequency [Hz] | Primary power source (if applicable) | Active Power Gradient | |
| Step a) 50,00Hz ± 0,01Hz | 2,40 | 50,00 | — | — | |
| Step b) 50,45Hz ± 0,05Hz | 2,38 | 50,45 | | — | |
| Step c) 50,70Hz ± 0,10Hz | 2,26 | 50,70 | | — | |
| Step d) 51,15Hz ± 0,05Hz | 2,04 | 51,15 | | — | |
| Step e) 51,70Hz ± 0,10Hz | 2,26 | 50,70 | | — | |
| Step f) 50,45Hz ± 0,05Hz | 2,38 | 50,45 | | — | |
| Step g) 50,00Hz ± 0,01Hz | 2,40 | 50,00 | | 9,5% | |
| Test sequence at registered capacity 40% - 60% | Measured Active Power output [kW] | Frequency [Hz] | Primary power source (if applicable) | Active Power Gradient | |
| Step a) 50,00Hz ± 0,01Hz | 1,22 | 50,00 | — | — | |
| Step b) 50,45Hz ± 0,05Hz | 1,20 | 50,45 | | — | |
| Step c) 50,70Hz ± 0,10Hz | 1,07 | 50,70 | | — | |
| Step d) 51,15Hz ± 0,05Hz | 0,85 | 51,15 | | — | |
| Step e) 50,70Hz ± 0,01Hz | 1,07 | 50,70 | | — | |
| Step f) 50,45 Hz ± 0,05Hz | 1,20 | 50,45 | | — | |
| Step g) 50,00 Hz ± 0,01Hz | 1,22 | 50,00 | | 9,9% | |
| The test was performed using the MultiPlus-II 48/3000/35-32. The behavior of the generator is valid for the whole family 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 and MultiPlus-II 24/3000/70-32 GX. | | | | | |
| Protection – Reconnection Timer | | | | | |
| Time delay setting | Measured delay | Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of Table 10.1. | | | |
| >20s | Max. 27,3 Min. 25,2 | At 1,16 pu (266,2V) | At 0,78pu (180,0V) | At 47,4 Hz | At 52,1 Hz |
| Confirmation that the Power Generating Module does not re-connect. | | No reconnection | No reconnection | No reconnection | No reconnection |



| Fault Level Contribution | | |
|---|-------|------------|
| For Inverter Output | | |
| Time after fault | Volts | Amps |
| 20ms | 85,1 | 19,27 |
| 100ms | 0,0 | 0,0 |
| 250ms | 0,0 | 0,0 |
| 500ms | 0,0 | 0,0 |
| Time to trip | 0,03 | In seconds |
| As SSEGs (small-scale embedded generators) for PV are inverter-connected the max. short circuit current is the max. AC current. | | |

| Self-Monitoring Solid state switching | |
|---|-----|
| It has been verified that in the event of the solid state switching device failing to disconnect the Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 s. | NA* |
| *there are no solid state switching devices in the unit, mechanical relays are provided | |

| Wiring functional Tests | |
|--|-----|
| Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning) | NA |
| Logic interface (input port) | |
| Confirm that an input port is provided and can be used to shut down the module. | YES |
| Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal (the additional comments box below can be used) | YES |
| <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> | |
| Cyber security | |
| Confirm that the Power Generating Module has been designed to comply with cyber security requirements, as detailed in 9.1.7. | YES |
| Additional Comments | |
| Test results indicated with Easysolar-II xx/3000 are representative for models: Easysolar-II 48/3000/35-32 MPPT 250/70GX Easysolar-II 24/3000/70-32 MPPT 250/70GX Test results indicated with Easysolar-II xx/5000 are representative for models: Easysolar-II 48/5000/70-50 MPPT 250/100GX Test results with no model indication are representative for all declared models. | |