



# Certificate of compliance

**Applicant:** SMA Solar Technology AG  
Sonnenallee 1  
34266 Niestetal  
Germany

**Product:** Battery Inverter

**Model:** SBS3.7-10  
SBS5.0-10  
SBS6.0-10

## Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with EN 50438:2013 for systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

## Applied rules and standards:

### EN 50438:2013

Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks

### DIN V VDE V 0126-1-1:2006-02 (Functional safety)

Automatic disconnection device between a generator and the public low-voltage grid

The generator(s) SBS5.0-10, SBS6.0-10 are rated >16A per phase. However all requirements of the EN 50438:2013 are fulfilled.

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

**Report number:** 17TH0338\_EN50438\_0

**Certificate number:** U18-0642

**Date of issue:** 2018-11-28

**Certification body**



Holger Schaffer

Certification body of Bureau Veritas Consumer Products Services Germany GmbH  
Accredited according to DIN EN ISO/IEC 17065





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**Appendix E Type Verification Test Report**

Extract from test report according to EN 50438

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**Type Approval and declaration of compliance with the requirements of EN 50438.**

|                                  |  |           |           |
|----------------------------------|--|-----------|-----------|
| <b>Manufacturer / applicant:</b> | SMA Solar Technology AG<br>Sonnenallee 1<br>34266 Niestetal<br>Germany |           |           |
| <b>Micro-generator Type</b>      | Battery Inverter   |           |           |
| <b>Rated values</b>              | SBS3.7-10  | SBS5.0-10 | SBS6.0-10 |
| <b>Maximum rated capacity</b>    | 3680   | 5000      | 6000      |
| <b>Rated voltage</b>             | 230V   | 230V      | 230V      |
| <b>Firmware version</b>          | 1.00   |           |           |
| <b>Measurement period:</b>       | 2018-05-18 to 2018-11-07   |           |           |

**Description of the structure of the power generation unit:**

The power generation unit is equipped with a DC and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.

The above stated micro-generators are tested according to the requirements in the EN 50438. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the EN 50438.

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**Type testing of the interface protection**

| Over-/under-voltage tests |                  |                        |                |                        |                          |                        |
|---------------------------|------------------|------------------------|----------------|------------------------|--------------------------|------------------------|
| Parameter                 | Protection limit |                        | Actual setting |                        | Trip value (test result) |                        |
|                           | Voltage [V]      | Disconnection time [s] | Voltage [V]    | Disconnection time [s] | Voltage [V]              | Disconnection time [s] |
| Over-voltage stage 1      | 253,0            | 600*                   | 253,0          | 600*                   | 253,0                    | 499,4                  |
| Over-voltage stage 2      | 264,5            | 0,2                    | 264,5          | 0,2                    | 264,5                    | 0,176                  |
| Under-voltage stage 1     | 195,5            | 1,5                    | 195,5          | 1,5                    | 195,4                    | 1,478                  |

Note.  
Minimum operation time according to default interface protection:  
Over-voltage stage 1 -  
Over-voltage stage 2 0,1s  
Under-voltage 1,2s

\* The over-voltage-stage 1 is a 10-min-mean-value according to EN 50160. The disconnection after detection of an overvoltage at the 10-min-mean-value takes place within 200ms.

| Over-/under-frequency tests |                  |                        |                |                        |                          |                        |
|-----------------------------|------------------|------------------------|----------------|------------------------|--------------------------|------------------------|
| Parameter                   | Protection limit |                        | Actual setting |                        | Trip value (test result) |                        |
|                             | Frequency [Hz]   | Disconnection time [s] | Frequency [Hz] | Disconnection time [s] | Frequency [Hz]           | Disconnection time [s] |
| Over-frequency              | 52,0             | 0,5                    | 52,0           | 0,5                    | 52,00                    | 0,481                  |
| Under-frequency             | 47,5             | 0,5                    | 47,5           | 0,5                    | 47,50                    | 0,467                  |

Note.  
Minimum operation time according to default interface protection:  
Over-frequency 0,5 s  
Under-frequency 0,5 s

| LoM test                             |                      |                      |                      |                      |                      |                       |
|--------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| Method used                          | EN 62116             |                      |                      |                      |                      |                       |
|                                      | 33% of -5% Q Test 22 | 66% of -5% Q Test 12 | 100% of -5% P Test 5 | 33% of +5% Q Test 31 | 66% of +5% Q Test 21 | 100% of +5% P Test 10 |
| Trip time. Phase 1 fuse removed [ms] | 989                  | 990                  | 985                  | 1154                 | 993                  | 1007                  |

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**Type testing of a micro-generator**

**Operating range SBS5.0-10**

Test 1: U = 195,5 V; f = 47,5 Hz; P = 1,00 Sn; cosφ = 1

Test 2: U = 253,0 V; f = 51,5 Hz; P = 1,00 Sn; cosφ = 1

| Test sequence | Voltage [V] | Frequency [Hz] | Output power [W] | Cos φ [1] |
|---------------|-------------|----------------|------------------|-----------|
| 1             | 195,5       | 47,5           | 4451,8           | 1,000     |
| 2             | 253,0       | 51,5           | 5012,9           | 1,000     |

**Active power at under-frequency SBS5.0-10**

| 5-min mean value (each) | a) 50 ± 0,01 [Hz] | b) - 0,4 to - 0,5 [Hz] | c) - 2,4 to - 2,5 [Hz] |
|-------------------------|-------------------|------------------------|------------------------|
| Frequency [Hz]:         | 50,00             | 49,55                  | 47,55                  |
| Active power [kW]:      | 4,968             | 4,968                  | 4,966                  |
| ΔP/PM [%] per 1 Hz:     |                   |                        | 0                      |

**Power response to over-frequency SBS5.0-10**

| 1-min mean value [Hz]:  | a) 50,00                 | b) 50,25 | c) 50,70 | d) 51,15 | e) 50,70 | f) 50,25 | g) 50,00 |
|---|--------------------------|----------|----------|----------|----------|----------|----------|
| <b>1. Measurement a) to g): Active power output &gt; 80% P<sub>n</sub></b>                            |                          |          |          |          |          |          |          |
| Frequency [Hz]:   | 50,00                    | 50,25    | 50,70    | 51,15    | 50,70    | 50,25    | 50,00    |
| PM [kW]:  | NA                       | 4,927    | 4,546    | 4,167    | 4,546    | 4,927    | NA       |
| PE60 [kW]:  | 4,969                    | 4,928    | 4,547    | 4,167    | 4,547    | 4,928    | 4,969    |
| ΔPE60/PM [%]:   | NA                       | 0,012    | 0,010    | 0,004    | 0,012    | 0,013    | NA       |
| <b>2. Measurement a) to g): Active power output 40% and 60% after freezing &gt; 80% P<sub>n</sub></b> |                          |          |          |          |          |          |          |
| Frequency [Hz]:   | 50,00                    | 50,25    | 50,70    | 51,15    | 50,70    | 50,25    | 50,00    |
| PM [kW]:  | NA                       | 2,501    | 2,308    | 2,115    | 2,308    | 2,501    | NA       |
| PE60 [kW]:  | 2,526                    | 2,505    | 2,311    | 2,118    | 2,311    | 2,505    | 2,525    |
| ΔPE60/PM [%]:   | NA                       | 0,080    | 0,066    | 0,054    | 0,065    | 0,082    | NA       |
| Limit ΔP/P <sub>1min</sub> :  | + 10 % of P <sub>M</sub> |          |          |          |          |          |          |



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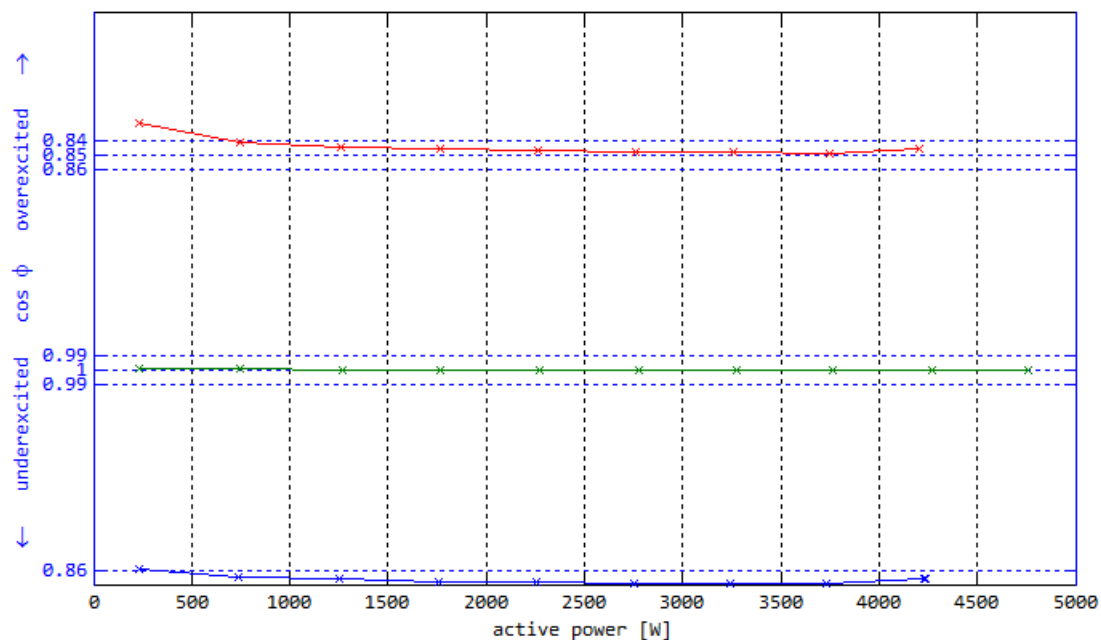
| Controllable reactive power              |                  |                      |                               |                |
|--|------------------|----------------------|-------------------------------|----------------|
| Inductive (supply reactive power)        |                  |                      |                               |                |
| Power-BIN                                | Active power [W] | Reactive power [Var] | Power factor (cos $\varphi$ ) | AC voltage [V] |
| 0% - 10%                                 | 208,4            | 202,8                | 0,861                         | 230            |
| 10% - 20%                                | 693,1            | 705,6                | 0,856                         | 230            |
| 20% - 30%                                | 1208,1           | 1220,5               | 0,853                         | 230            |
| 30% - 40%                                | 1713,8           | 1725,6               | 0,852                         | 230            |
| 40% - 50%                                | 2215,2           | 2226,6               | 0,851                         | 230            |
| 50% - 60%                                | 2723,2           | 2734,7               | 0,851                         | 230            |
| 60% - 70%                                | 3222,7           | 3233,7               | 0,850                         | 230            |
| 70% - 80%                                | 3719,3           | 3729,7               | 0,850                         | 230            |
| 80% - 90%                                | 4233,4           | 4229,0               | 0,854                         | 230            |
| 90% - 100%                               | 4732,9           | 4715,3               | 0,853                         | 230            |
| Capacitive (supply reactive power)       |                  |                      |                               |                |
| Power-BIN                                | Active power [W] | Reactive power [Var] | Power factor (cos $\varphi$ ) | AC voltage [V] |
| 0% - 10%                                 | 208,4            | 202,8                | 0,828                         | 230            |
| 10% - 20%                                | 693,1            | 705,6                | 0,841                         | 230            |
| 20% - 30%                                | 1208,1           | 1220,5               | 0,844                         | 230            |
| 30% - 40%                                | 1713,8           | 1725,6               | 0,846                         | 230            |
| 40% - 50%                                | 2215,2           | 2226,6               | 0,847                         | 230            |
| 50% - 60%                                | 2723,2           | 2734,7               | 0,848                         | 230            |
| 60% - 70%                                | 3222,7           | 3233,7               | 0,848                         | 230            |
| 70% - 80%                                | 3719,3           | 3729,7               | 0,849                         | 230            |
| 80% - 90%                                | 4233,4           | 4229,0               | 0,846                         | 230            |
| 90% - 100%                               | 4732,9           | 4715,3               | 0,846                         | 230            |
| Reactive power supply with set point Q=0 |                  |                      |                               |                |
| Power-BIN                                | Active power [W] | Reactive power [Var] | Power factor (cos $\varphi$ ) | AC voltage [V] |
| 0% - 10%                                 | 208,4            | 202,8                | 0,999                         | 230            |
| 10% - 20%                                | 693,1            | 705,6                | 1,000                         | 230            |
| 20% - 30%                                | 1208,1           | 1220,5               | 1,000                         | 230            |
| 30% - 40%                                | 1713,8           | 1725,6               | 1,000                         | 230            |
| 40% - 50%                                | 2215,2           | 2226,6               | 1,000                         | 230            |
| 50% - 60%                                | 2723,2           | 2734,7               | 1,000                         | 230            |
| 60% - 70%                                | 3222,7           | 3233,7               | 1,000                         | 230            |
| 70% - 80%                                | 3719,3           | 3729,7               | 1,000                         | 230            |
| 80% - 90%                                | 4233,4           | 4229,0               | 1,000                         | 230            |
| 90% - 100%                               | 4732,9           | 4715,3               | 1,000                         | 230            |

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**Diagram of inductive reactive power absorption**



| Q adjustment |                                  |                                 |                      |  |
|--------------|----------------------------------|---------------------------------|----------------------|--|
|              | Reactive power set point Q [Var] | Measured reactive power Q [Var] | Measured $\cos \phi$ | Deviation compared to setpoint $\Delta Q / PN$ [%] |
| - Qmin       | -3000,00                         | 3015,52                         | N/A                  | 0,15   |
| 0            | 0                                | 9,77                            | N/A                  | 0,20   |
| + Qmax       | 3000,00                          | -2992,34                        | N/A                  | 0,31   |

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| Connection and starting to generate electrical power |   |  |
|--|---|--|
| Test according EN 50438 with standard setting        | Min. voltage for connection to grid:  | 193,2V   |
|  | Max. voltage for connection to grid:  | 255,3V   |
|  | Min. frequency for connection to grid:  | 47,40Hz  |
|  | Max. frequency for connection to grid:  | 50,20Hz  |
|  | Observation time ( $\geq 60s$ )   | 60s  |
| <b>Test</b>  |   |  |
| <b>Voltage conditions</b>                            |   |  |
| a) Start up for voltage range                        | <84% $U_n$ for twice of observation time  | >111% $U_n$ for twice of observation time                |
| Connection:  | No connection   | No connection  |
| Limit:   | No connection allowed   |  |
| b) In voltage range at start-up                      | $\geq 84\% U_n$ within twice setting observation time   | $\leq 111\% U_n$ within twice setting observation time   |
| Reconnection time [s]                                | 67,06   | 66,06  |
| Limit:   | Connected after setting observation time ( $\geq 60s$ )   |  |
| Gradient:  | For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10% $P_n$ /min. |  |
| c) In voltage range after voltage failure            | $\geq 84\% U_n$ for twice of setting observation time   | $\leq 111\% U_n$ for twice of setting observation time   |
| Reconnection time [s]                                | 67,06   | 66,06  |
| Limit:   | Reconnection after setting observation time ( $\geq 60s$ )  |  |
| Gradient:  | For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10% $P_n$ /min. |  |
| <b>Frequency conditions</b>                          |   |  |
| d) Start up for frequency range                      | <47,45 Hz for twice of setting observation time   | >50,15 Hz for twice of setting observation time          |
| Connection:  | No connection   | No connection  |
| Limit:   | No connection allowed   |  |
| e) In frequency range at start-up                    | $\geq 47,45$ Hz within twice of setting observation time  | $\leq 51,15$ Hz within twice of setting observation time |
| Reconnection time [s]                                | 66,69   | 66,24  |
| Limit:   | Connected after setting delay time ( $\geq 60s$ )   |  |
| Gradient:  | For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10% $P_n$ /min. |  |
| f) In frequency range after frequency failure        | $\geq 47,45$ Hz for twice of setting observation time   | $\leq 51,15$ Hz for twice of setting observation time    |
| Reconnection time [s]                                | 66,69   | 66,24  |
| Limit:   | Reconnection after setting observation time ( $\geq 60s$ )  |  |
| Gradient:  | For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10% $P_n$ /min. |  |

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| Short-circuit current contribution                       |          |       |                                |        |            |
|--|----------|-------|--------------------------------|--------|------------|
| Short-circuit current parameters SBS 3.7-10              |          |       |                                |        |            |
| For a directly coupled micro-generator                   |          |       | For a Inverter micro-generator |        |            |
| Parameter  | Symbol   | Value | Time after fault               | Volts  | Amps       |
| Peak Short Circuit current                               | $I_p$    | N/A   | 20ms                           | 231,72 | 21,29      |
| Initial Value of aperiodic current                       | A        | N/A   | 100ms                          | 12,72  | 0,09       |
| Initial symmetrical short-circuit current*               | $I_k$    | N/A   | 250ms                          | 11,47  | 0,09       |
| Decaying (aperiodic) component of short circuit current* | $i_{dc}$ | N/A   | 500ms                          | 11,67  | 0,07       |
| Reactance/Resistance Ratio of source*                    | X/R      | N/A   | Time to trip                   | 0,53   | In seconds |
| Short-circuit current parameters SBS 6.0-10              |          |       |                                |        |            |
| For a directly coupled micro-generator                   |          |       | For a Inverter micro-generator |        |            |
| Parameter  | Symbol   | Value | Time after fault               | Volts  | Amps       |
| Peak Short Circuit current                               | $I_p$    | N/A   | 20ms                           | 231,48 | 32,7       |
| Initial Value of aperiodic current                       | A        | N/A   | 100ms                          | 13     | 0,08       |
| Initial symmetrical short-circuit current*               | $I_k$    | N/A   | 250ms                          | 11,43  | 0,08       |
| Decaying (aperiodic) component of short circuit current* | $i_{dc}$ | N/A   | 500ms                          | 12,1   | 0,07       |
| Reactance/Resistance Ratio of source*                    | X/R      | N/A   | Time to trip                   | 0,53   | In seconds |



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| Power Quality. Harmonic current emission |  |                  |         |  |
|--|--|------------------|---------|--|
| micro-generator                          |  | SBS5.0-10        |         |  |
| Harmonic order n                         | Current Magnitude [A] at 100% rated output power | % of Fundamental | Phase   | Harmonic current limit EN 61000-3-2, Class A [A] |
| 1st                                      | 21,6310  | 21,622           | Phase 1 | -  |
| 2nd                                      | 0,0230   | 0,005            | Phase 1 | 1,080  |
| 3rd                                      | 0,2300   | 0,169            | Phase 1 | 2,300  |
| 4th                                      | 0,0190   | 0,01             | Phase 1 | 0,430  |
| 5th                                      | 0,2110   | 0,15             | Phase 1 | 1,140  |
| 6th                                      | 0,0220   | 0,006            | Phase 1 | 0,300  |
| 7th                                      | 0,1140   | 0,079            | Phase 1 | 0,770  |
| 8th                                      | 0,0180   | 0,008            | Phase 1 | 0,230  |
| 9th                                      | 0,1270   | 0,083            | Phase 1 | 0,400  |
| 10th                                     | 0,0200   | 0,004            | Phase 1 | 0,184  |
| 11th                                     | 0,1080   | 0,059            | Phase 1 | 0,330  |
| 12th                                     | 0,0180   | 0,004            | Phase 1 | 0,153  |
| 13th                                     | 0,1120   | 0,067            | Phase 1 | 0,210  |
| 14th                                     | 0,0150   | 0,004            | Phase 1 | 0,131  |
| 15th                                     | 0,0800   | 0,048            | Phase 1 | 0,150  |
| 16th                                     | 0,0150   | 0,004            | Phase 1 | 0,115  |
| 17th                                     | 0,0880   | 0,056            | Phase 1 | 0,132  |
| 18th                                     | 0,0130   | 0,004            | Phase 1 | 0,102  |
| 19th                                     | 0,0670   | 0,041            | Phase 1 | 0,118  |
| 20th                                     | 0,0110   | 0,003            | Phase 1 | 0,092  |
| 21th                                     | 0,0680   | 0,044            | Phase 1 | 0,107  |
| 22th                                     | 0,0130   | 0,002            | Phase 1 | 0,084  |
| 23th                                     | 0,0620   | 0,038            | Phase 1 | 0,098  |
| 24th                                     | 0,0110   | 0,002            | Phase 1 | 0,077  |
| 25th                                     | 0,0520   | 0,041            | Phase 1 | 0,090  |
| 26th                                     | 0,0110   | 0,002            | Phase 1 | 0,071  |
| 27th                                     | 0,0520   | 0,034            | Phase 1 | 0,083  |
| 28th                                     | 0,0090   | 0,002            | Phase 1 | 0,066  |
| 29th                                     | 0,0530   | 0,034            | Phase 1 | 0,078  |
| 30th                                     | 0,0100   | 0,002            | Phase 1 | 0,061  |
| 31th                                     | 0,0460   | 0,032            | Phase 1 | 0,073  |
| 32th                                     | 0,0090   | 0,002            | Phase 1 | 0,058  |
| 33th                                     | 0,0410   | 0,029            | Phase 1 | 0,068  |
| 34th                                     | 0,0080   | 0,002            | Phase 1 | 0,054  |
| 35th                                     | 0,0430   | 0,031            | Phase 1 | 0,064  |
| 36th                                     | 0,0090   | 0,002            | Phase 1 | 0,051  |
| 37th                                     | 0,0390   | 0,027            | Phase 1 | 0,061  |
| 38th                                     | 0,0080   | 0,002            | Phase 1 | 0,048  |
| 39th                                     | 0,0380   | 0,027            | Phase 1 | 0,058  |
| 40th                                     | 0,0080   | 0,002            | Phase 1 | 0,046  |

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| Voltage fluctuation and Flicker. |   |             |                       |        |        |
|----------------------------------|---|-------------|-----------------------|--------|--------|
| SBS6.0-10                        | Maximum permissible flicker and voltage fluctuation as per EN 61000-3-3 |             |                       |        |        |
| Value                            | Pst   | Plt 2 hours | d(t) <sub>500ms</sub> | dc     | dmax   |
| Limit                            | 1,0   | 0,65        | 3,3%                  | 3,3%   | 4%     |
| Test value                       | 0,093   | 0,093       | 0,00%                 | 0,080% | 0,240% |

| DC-Injection.                   |   |      |      |       |
|---------------------------------|---|------|------|-------|
| Protection limit SBS5.0-10      | Tested at four power levels, limit 0,5% of IAC <sub>nom</sub> (109mA) |      |      |       |
| Output power                    | ~20%  | ~50% | 75%  | ~100% |
| Max. test value (phase L1) [mA] | 5,79  | 9,18 | 9,08 | 13,38 |