Certificate of compliance

Applicant:	**NingBo Deye Inverter Technology Co., Ltd.** No. 26 South YongJiang Road, Daqi, Beilun, NingBo **China**
Product:	**Photovoltaic and battery inverter**
Model:	**SUN-3K-SG04LP1-EU, SUN-3K-SG04LP1-24-EU,** **SUN-3K-SG04LP1-EU-SM1, SUN-3K-SG04LP1-24-EU-SM1,** **SUN-3.6K-SG04LP1-EU, SUN-3.6K-SG04LP1-EU-SM2**

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G98/1 for photovoltaic 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. This serves as a replacement for the disconnection device with isolating function, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G98/1-7:2022
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

DIN V VDE V 0126-1-1:2006 (4.1 Functional safety)
Automatic disconnection device between a generator and the public low-voltage grid

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: ASUE-ESH-P25050531

Certification Program: NSOP-0032-DEU-ZE-V10

Certificate number: U25-0541

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Certification body

Domenik Koll
Head of Energy Systems Germany

Accreditation

DAkkS Deutsche Akkreditierungsstelle D-ZE-12024-01-00

Appendix C Type Test Verification Report			
Extract from test report according to the Engineering Recommendation G98/1			
Type Approval and declaration of compliance with the requirements of Engineering Recommendation G98/1			
PGM Technology	Photovoltaic and battery inverter		
Manufacturer	**NingBo Deye Inverter Technology Co., Ltd.**		
Address	No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China		
Tel	--	**Fax**	--
Email	--	**Website**	--

PGM Model	**SUN-3K-SG04LP1-EU**	**SUN-3K-SG04LP1-24-EU**	**SUN-3K-SG04LP1-EU-SM1**	**SUN-3K-SG04LP1-24-EU-SM1**
Input (DC photovoltaic)				
MPP voltage range [V]	150-425	150-425	150-425	150-425
Max. input voltage [V]	500	500	500	500
Max. input current per MPPT [A]	18	18	18	18
Output (AC)				
Rated AC voltage [V]	230, L/N/PE, 50Hz	230, L/N/PE, 50Hz	230, L/N/PE, 50Hz	230, L/N/PE, 50Hz
Rated output current [A]	13,0	13,0	13,1	13,1
Max. output current [A]	14,3	14,3	14,4	14,4
Nom. converter output (P_{NINV}) [kW]	3,00	3,00	3,00	3,00
Rated apparent power [kVA]	3,30	3,30	3,30	3,30

PGM Model	**SUN-3.6K-SG04LP1-EU**	**SUN-3.6K-SG04LP1-EU-SM2**	--	--
Input (DC photovoltaic)				
MPP voltage range [V]	150-425	150-425	--	--
Max. input voltage [V]	500	500	--	--
Max. input current per MPPT [A]	18+18	18+18	--	--
Output (AC)				
Rated AC voltage [V]	230, L/N/PE, 50Hz	230, L/N/PE, 50Hz	--	--
Rated output current [A]	15,7	15,7	--	--
Max. output current [A]	15,7	15,7	--	--
Nom. converter output (P_{NINV}) [kW]	3,60	3,60	--	--
Rated apparent power [kVA]	3,60	3,60	--	--

Interface protection system and interface switch (Network and system protection "NS-protection")

Type of protection	integrated NS-protection
Assigned to generation unit type	SUN-3K-SG04LP1-EU, SUN-3K-SG04LP1-24-EU, SUN-3K-SG04LP1-EU-SM1, SUN-3K-SG04LP1-24-EU-SM1, SUN-3.6K-SG04LP1-EU, SUN-3.6K-SG04LP1-EU-SM2
Integrated interface switch	Type of switching equipment 1: Relay (Model AZSR143) Type of switching equipment 2: Relay (Model AZSR143)
	Note: The output is switched off by the inverter bridge and two relay in series in each line and neutral.
Firmware version	4384

Differences between Generating Units

Reference Position	SUN-3K-SG04LP1-24-EU	SUN-3K-SG04LP1-EU	SUN-3.6K-SG04LP1-EU	Comments
BOOST1, BOOST2, INV1, INV2	(BOOST1+INV1+INV2)	(BOOST1+INV1+INV2)	(BOOST1+BOOST2+INV1+INV2)	Inverter Choke
C1, C2, C3, C10	NC	NC	NC	Inverter Bus Capacitor
Q30, Q31, Q34, Q35	CRSQ027N10N	NC	NC	DCDC front stage NMOSFET
PV input connector in parallel	1	1	1+1	Number of input connectors
Fan	NC	NC	NC	Extemal fan

Reference Position	SUN-3K-SG04LP1-24-EU-SM1	SUN-3K-SG04LP1-EU-SM1	SUN-3.6K-SG04LP1-EU-SM2	Comments
BOOST1, BOOST2, INV1, INV2	(BOOST1+INV1+INV2)	(BOOST1+INV1+INV2)	(BOOST1+BOOST2+INV1+INV2)	Inverter Choke
C1, C2, C3, C10	NC	NC	NC	Inverter Bus Capacitor
Q30, Q31, Q34, Q35	CRSQ027N10N	NC	NC	DCDC front stage NMOSFET
PV input connector in parallel	1	1	1+1	Number of input connectors
W*H*D(mm)	327*313*88	327*313*88	327*313*88	Heat sink

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G98/1. 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 Engineering Recommendation G98/1.	
Operating Range.	
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47,0 Hz Power Factor = 1 Period of test 20 seconds
Connection	Always connected
Limit	No disconnection allowed
Test 2	Voltage = 85% of nominal (195,5 V) Frequency = 47,5 Hz Power Factor = 1 Period of test 90 minutes
Connection	Always connected
Limit	No disconnection allowed
Test 3	Voltage = 110% of nominal (253 V) Frequency = 51,5 Hz Power Factor = 1 Period of test 90 minutes
Connection	Always connected
Limit	No disconnection allowed
Test 4	Voltage = 110% of nominal (253 V) Frequency = 52,0 Hz Power Factor = 1 Period of test 15 minutes
Connection	Always connected
Limit	No disconnection allowed
Test 5	Voltage = 100% of nominal (230 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes
Connection	Always connected
Limit	No disconnection allowed
Test 6	Confirm that the Micro-Generating Plant is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs-1 as measured over a period of 500 ms.
Connection	Always connected
Limit	No disconnection allowed

Protection. Voltage tests.						
Phase 1						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage [V]	**Time delay [s]**	**Voltage [V]**	**Time delay [s]**	**Voltage / time**	**Confirm no trip**
U/V	184,0	2,5	184,02	2,528	188V / 5s	No trip
					180V / 2,45s	No trip
O/V stage 1	262,2	1,0	261,67	1,007	258,2V 5,0s	No trip
O/V stage 2	273,7	0,5	273,92	0,506	269,7V 0,95s	No trip
					277,7V 0,45s	No trip
Note. For Voltage tests the Voltage required to trip is the setting ±3,45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Frequency tests.						
Function	**Setting**		**Trip test**		**No trip test**	
	Frequency [Hz]	**Time delay [s]**	**Frequency [Hz]**	**Time delay [s]**	**Frequency / time**	**Confirm no trip**
U/F stage 1	47,5	20	47,52	20,049	47,7Hz / 30s	No trip
U/F stage 2	47	0,5	47,00	0,508	47,2Hz / 19,5s	No trip
					46,8Hz / 0,45s	No trip
O/F stage 2	52	0,5	52,02	0,508	51,8Hz / 120s	No trip
					52,2Hz / 0,45s	No trip
Note. For Frequency Trip tests the Frequency required to trip is the setting ± 0,1Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The "No-trip tests" need to be carried out at the setting ± 0,2Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Loss of Mains.						
Inverters tested according to BS EN 62116.						
Balancing load on islanded network	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. Ph1 fuse removed [ms]	196,0	170,3	412,4	155,0	181,5	408,9
Note. Trip time limit is 0,5s.						

Protection. Re-connection timer.				
Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 2.				
Over Voltage (258,2V)				
Time delay setting [s]	**Measured delay [s]**			
20	72,5			
Under Voltage (188,0V)				
Time delay setting [s]	**Measured delay [s]**			
20	73,1			
Over Frequency (51,9Hz)				
Time delay setting [s]	**Measured delay [s]**			
20	73,6			
Under Frequency (47,6Hz)				
Time delay setting [s]	**Measured delay [s]**			
20	74,0			
	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	At 266,2V	At 180,0V	At 47,4Hz	At 52,1Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection

Protection. Frequency change, Stability test.				
	Start Frequency [Hz]	**Change**	**Test Duration**	**Confirm no trip**
Positive Vector Shift	49,5	+50 degrees		No trip
Negative Vector Shift	50,5	-50 degrees		No trip
Positive Frequency drift	49,0 to 51,0	+0,95Hz/sec	2,1s	No trip
Negative Frequency drift	51,0 to 49,0	-0,95Hz/sec	2,1s	No trip

Limited Frequency Sensitive Mode – Over Frequency							
1-min mean value [Hz]:	**a) 50,00**	**b) 50,45**	**c) 50,70**	**d) 51,15**	**e) 50,70**	**f) 50,45**	**g) 50,00**
1. Measurement a) to g): Active power output > 80% P_n							
Frequency [Hz]	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [kW]	3,600	3,564	3,384	3,060	3,384	3,564	3,600
$P_{measured}$ [kW]	3,599	3,562	3,385	3,033	3,385	3,562	3,599
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n							
Frequency [Hz]	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [kW]	1,800	1,764	1,584	1,260	1,584	1,764	3,600
$P_{measured}$ [kW]	1,802	1,768	1,587	1,265	1,587	1,768	3,609

Output Power with falling Frequency			
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	49,60	47,60
Active power [W]	3598	3597	3590
ΔP/Pmax [%]			0,28
Note. No Power reduction take place for electronic inverter.			

Power Quality. Harmonics.

SUN-3.6K-SG04LP1-EU

SSEG rating per phase (rpp)						
	At 45-55% of rated output 1793W		100% of rated output 3591W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2nd	0,012	0,075	0,018	0,114	1,080	
3rd	0,003	0,017	0,004	0,025	2,300	
4th	0,013	0,083	0,020	0,129	0,430	
5th	0,027	0,174	0,051	0,329	1,140	
6th	0,002	0,010	0,002	0,016	0,300	
7th	0,011	0,069	0,027	0,171	0,770	
8th	0,005	0,033	0,005	0,033	0,230	
9th	0,002	0,013	0,003	0,020	0,400	
10th	0,006	0,036	0,007	0,048	0,184	
11th	0,048	0,306	0,104	0,667	0,330	
12th	0,002	0,012	0,002	0,013	0,153	
13th	0,041	0,262	0,068	0,437	0,210	
14th	0,003	0,018	0,004	0,023	0,131	
15th	0,002	0,010	0,002	0,012	0,150	
16th	0,002	0,011	0,001	0,009	0,115	
17th	0,030	0,195	0,038	0,243	0,132	
18th	0,002	0,013	0,002	0,012	0,102	
19th	0,022	0,142	0,039	0,252	0,118	
20th	0,001	0,005	0,001	0,007	0,092	
21th	0,002	0,011	0,002	0,012	0,107	0,160
22th	0,002	0,014	0,002	0,010	0,084	
23th	0,016	0,103	0,026	0,165	0,098	0,147
24th	0,001	0,006	0,001	0,007	0,077	
25th	0,016	0,103	0,023	0,147	0,090	0,135
26th	0,001	0,007	0,001	0,004	0,071	
27th	0,001	0,009	0,002	0,011	0,083	0,124
28th	0,001	0,006	0,001	0,008	0,066	
29th	0,011	0,072	0,017	0,106	0,078	0,117
30th	0,001	0,006	0,001	0,006	0,061	
31th	0,011	0,073	0,017	0,107	0,073	0,109
32th	0,002	0,010	0,001	0,006	0,058	
33th	0,002	0,015	0,002	0,014	0,068	0,102
34th	0,001	0,007	0,002	0,012	0,054	
35th	0,011	0,068	0,017	0,109	0,064	0,096
36th	0,001	0,008	0,001	0,006	0,051	
37th	0,007	0,045	0,008	0,053	0,061	0,091
38th	0,001	0,009	0,001	0,008	0,048	
39th	0,002	0,013	0,001	0,006	0,058	0,087
40th	0,001	0,008	0,002	0,010	0,046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

Power Quality. Harmonics.

SUN-3K-SG04LP1-EU

	SSEG rating per phase (rpp)					
	At 45-55% of rated output 1499W		100% of rated output 3008W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2nd	0,071	0,546	0,098	0,755	1,080	
3rd	0,015	0,118	0,020	0,151	2,300	
4th	0,054	0,413	0,061	0,465	0,430	
5th	0,083	0,636	0,102	0,780	1,140	
6th	0,016	0,123	0,025	0,189	0,300	
7th	0,023	0,179	0,067	0,514	0,770	
8th	0,042	0,322	0,038	0,291	0,230	
9th	0,010	0,074	0,005	0,037	0,400	
10th	0,017	0,131	0,025	0,191	0,184	
11th	0,132	1,009	0,320	2,451	0,330	
12th	0,006	0,047	0,005	0,042	0,153	
13th	0,076	0,581	0,195	1,495	0,210	
14th	0,010	0,077	0,036	0,273	0,131	
15th	0,005	0,035	0,005	0,041	0,150	
16th	0,011	0,084	0,024	0,181	0,115	
17th	0,029	0,221	0,123	0,945	0,132	
18th	0,004	0,028	0,004	0,029	0,102	
19th	0,020	0,152	0,076	0,583	0,118	
20th	0,009	0,068	0,016	0,120	0,092	
21th	0,007	0,051	0,010	0,079	0,107	0,160
22th	0,008	0,058	0,013	0,101	0,084	
23th	0,031	0,235	0,026	0,202	0,098	0,147
24th	0,005	0,036	0,004	0,033	0,077	
25th	0,027	0,210	0,016	0,120	0,090	0,135
26th	0,008	0,058	0,008	0,061	0,071	
27th	0,006	0,043	0,005	0,036	0,083	0,124
28th	0,005	0,036	0,006	0,044	0,066	
29th	0,015	0,115	0,012	0,088	0,078	0,117
30th	0,006	0,045	0,004	0,030	0,061	
31th	0,014	0,107	0,014	0,104	0,073	0,109
32th	0,004	0,029	0,009	0,068	0,058	
33th	0,006	0,043	0,004	0,034	0,068	0,102
34th	0,007	0,050	0,007	0,057	0,054	
35th	0,013	0,103	0,013	0,103	0,064	0,096
36th	0,004	0,030	0,004	0,027	0,051	
37th	0,013	0,102	0,012	0,091	0,061	0,091
38th	0,008	0,059	0,008	0,060	0,048	
39th	0,005	0,037	0,005	0,040	0,058	0,087
40th	0,005	0,042	0,007	0,055	0,046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

Power Quality. Power factor.				
Output power	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1,5% of the stated level during the test.
20%	0,9965	0,9962	0,9952	
50%	0,9994	0,9993	0,9991	
75%	0,9997	0,9997	0,9997	
100%	0,9998	0,9998	0,9998	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			**Stopping**			**Running**	
	d_{max} [%]	**dc [%]**	**$d_{(t)}$ [%]**	**d_{max} [%]**	**dc [%]**	**$d_{(t)}$ [%]**	**Pst**	**Plt 2 hours**
Measured values at test impedance	0,527	0,089	0,00	0,550	0,078	0,00	0,108	0,108
Measured values at standard impedance	0,527	0,089	0,00	0,550	0,078	0,00	0,108	0,108
Values for maximum impedance	0,527	0,089	0,00	0,550	0,078	0,00	0,108	0,108
Limits set under BS EN 61000-3-11	4,0	3,3	3,3 500ms	4,0	3,3	3,3 500ms	1,0	0,65

Test impedance	R	0,4	Ω	Xl	0,25	Ω
	Z	0,47	Ω			
Standard impedance	R	0,4	Ω	Xl	0,25	Ω
	Z	0,40	Ω			
Maximum impedance	R	0,4	Ω	Xl	0,25	Ω
	Zmax	0,47	Ω			

Power Quality. DC injection.				
SUN-3.6K-SG04LP1-EU				
Phase 1				
Test level power [%]	20	50	75	100
Recorded value [mA]	8,9	9,7	--	10,7
Recorded value [%]	0,06	0,06	--	0,07
Limit [%]	0,25	0,25	0,25	0,25
Note. DC-injection is tested at each phase of the inverter and a limit of 0,25% per phase was used as pass criteria.				
Sum of all Phases Tests are carried out at three defined power levels ± 5%. At 230 V a 3,6 kW three phase Inverter has a current output of 15,7 A so DC limit is 39,1 mA. These tests is undertaken in accordance with Annex A.1.3.4 The % DC injection ("as % of rated AC current" below) is calculated as follows: % DC injection = Recorded DC value in Amps / Base current where the base current is the Registered Capacity (W) / V phase. The % DC injection should not be greater than 0,25%.				
Sum of all Phases				
Test level power [%]	20	55	75	100
Recorded value [mA]	8,9	9,7	--	10,7
Recorded value [%]	0,06	0,06	--	0,07
Limit [%]	0,25	0,25	0,25	0,25

Fault level Contribution.					
For a directly coupled SSEG			**For a Inverter SSEG**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts [V]**	**Amps [A]**
Peak Short Circuit current	I_p	N/A	20 ms	30,8	0,002
Initial Value of aperiodic current	A	N/A	100 ms	30,8	0,023
Initial symmetrical short-circuit current*	I_k	N/A	250 ms	30,4	0,001
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500 ms	31,9	0,016
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,002	
For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.					

Self Monitoring – Solid state switching.	**N/A**
It has been verified that in the event of the solid state switching device failing to disconnect the Generating Unit, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.	
Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1).	

Cyber security	**P**
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
Note. Different levels of access, all are password protected, only certain parameters can be changed on maintenance level.	

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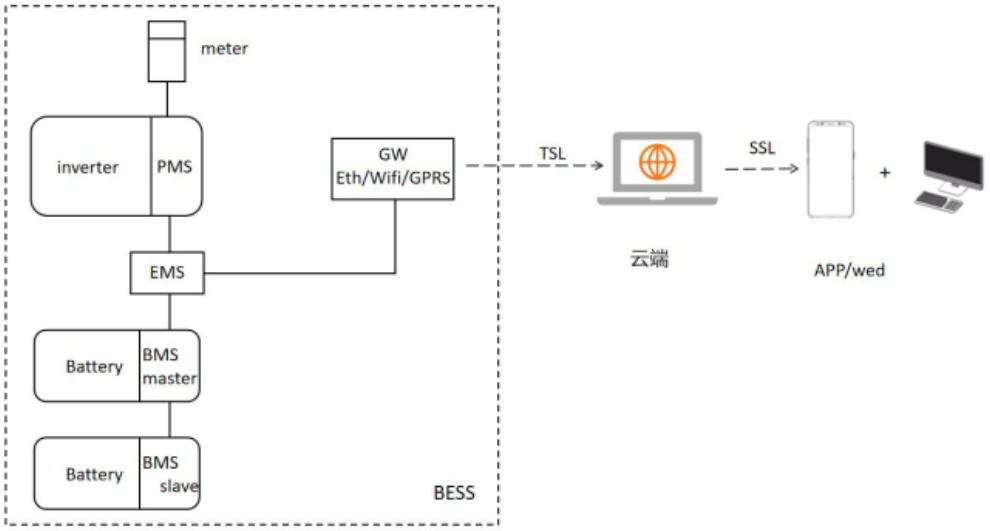
Manufacturer's declaration

NingBo Deye Inverter Technology Co.,Ltd.
No.26 South YongJiang Road, Daqi, Beilun, NingBo, China.
The undersigned Bard Dai as Certification Manager of the Company NingBo Deye Inverter Technology Co.,Ltd.On behalf of the same Company declares the following:

The inverter in accordance with the requirements of G98-Amd. 6 (2021-09) standard Sec.s 9.7.1, 9.7.2, and G99-Amd. 8 (2021-09) standard Sec.s 9.1.7, 9.1.8 regarding "Cyber Security"

The NingBo Deye Inverter Technology Co.,Ltd. Battery Energy Storage Systems (BESS) include a system of internal and external logic communications as summarized in the following scheme:



where the main components involved and their main functions are explained in the following table:

acronym/ name	*meaning*	*function*	*location*
PMS	Power Management System	monitoring and management of power fluxes through the inmverter, execution of EMS's commands or local logic functions depending on grid parameters values *Note: The PMS performs operational safety functions aimed at prevent physical damage/harm, typically by interrupting currents and/or opening contacts on some inverter ports when voltage, current or temperature limits are violated; no safety operation performed by PMS can be compromised/skypped by commands/signals originating outside the inverter.*	inverter
BMS	Battery Management System	monitoring of cells's status, execution of PMS's commands within safety conditions *Note: The BMS performs operational safety functions aimed at prevent physical damag/harm, typically by interrupting currents and/or opening contacts on some battery or BMS ports when voltage, current or temperature limits are violated; no safety operation performed by BMS can be compromised/skypped by commands/signals originating outside the BMS and batteries.*	battery
EMS	Energy Management System	monitoring of all field's measures, calculus of power and currents for every component of the system, reception of external commands, transmission of commands to PMS. *Note: No operational safety function aimed at preventing physical damage/harm is performed by the EMS; no operation performed by EMS can force the operational safety functions performed by BMS, PMS and electrical protections.*	Monitor Board
GW	Gate-Way	transmission of data to cloud server, reception of commands/settings from external stakeholder	Stick Logger
Meter	External Power Meter	meter at AC port of third party generator/inverter, for power measures	Meter

1) All communications between internal components of the BESS, and between EMS and supplied External Power Meter(s), take place via appropriate serial lines (RS485, CanBus) and are not directly connected to any device or system outside the BESS.

2) The only communication port between the BESS and the outside is constituted by the he Gate-Way layer (GW) on the machine; the communication between BESS and the outside world can take place via an Ethernet line, WiFi or GPRS router according to the customer's request.
The BESS is a not-constrained customer IoT device according to the definitions in ETSI EN 303 645 sec. 3.1.

3) The direct recipients/senders of communications with the BESS is the in-cloud server –the communication is made secure by the use of TSL (Transport Layer Security) techology on GW, and by the use of SSL (Secure Sockets Layer) technology on Final User's device side and web-tools side;

4) The cyber-security assessment of the BESS was performed according to the ETSI EN 303 645 standard, and it is reported according to the Table B.1 form of the same standard:

EN 303 645 v2.1.1 (2020-06) Table B.1: Implementation of provisions for consumer IoT security			
Clause number and title			
Reference	Status	Support	Detail
5.1 No universal default passwords			
Provision 5.1-1	M C (1)	N/A	Device don not permit final user's login
Provision 5.1-2	M C (2)	N/A	
Provision 5.1-3	M	N/A	
Provision 5.1-4	M C (8)	N/A	
Provision 5.1-5	M C (5)	N/A	
5.2 Implement a means to manage reports of vulnerabilities			
Provision 5.2-1	M	Y	
Provision 5.2-2	R	Y	
Provision 5.2-3	R	Y	
5.3 Keep software updated			
Provision 5.3-1	R	Y	
Provision 5.3-2	M C (5)	Y	
Provision 5.3-3	M C (12)	Y	
Provision 5.3-4	R C (12)	Y	The manufacturer manages the updates of the systems by means of remote automatisms, selectively by type of machine or by activating special functions at the request of the user
Provision 5.3-5	R C (12)	N	see note at 5.3-4
Provision 5.3-6	R C (9, 12)	N	see note at 5.3-4

EN 303 645 v2.1.1 (2020-06) Table B.1: Implementation of provisions for consumer IoT security			
Clause number and title			
Reference	Status	Support	Detail
Provision 5.3-7	M C (12)	Y	
Provision 5.3-8	M C (12)	N	see note at 5.3-4
Provision 5.3-9	R C (12)	N	
Provision 5.3-10	M (11, 12)	Y	
Provision 5.3-11	R C (12)	N	
Provision 5.3-12	R C (12)	N	
Provision 5.3-13	M	Y	
Provision 5.3-14	R C (3, 4)	N/A	not constrained device
Provision 5.3-15	R C (3, 4)	N/A	not constrained device
Provision 5.3-16	M	Y	
5.4 Securely store sensitive security parameters			
Provision 5.4-1	M	Y	
Provision 5.4-2	M C (10)	Y	
Provision 5.4-3	M	N/A	hard-coded identity not used in source code
Provision 5.4-4	M	Y	
5.5 Communicate securely			
Provision 5.5-1	M	Y	
Provision 5.5-2	R	Y	
Provision 5.5-3	R	Y	
Provision 5.5-4	R	N	
Provision 5.5-5	M	Y	
Provision 5.5-6	R	Y	
Provision 5.5-7	M	Y	
Provision 5.5-8	M	Y	
5.6 Minimize exposed attack surfaces			
Provision 5.6-1	M	Y	
Provision 5.6-2	M	Y	
Provision 5.6-3	R	Y	
Provision 5.6-4	M C (13)	N/A	no debug interface accessible
Provision 5.6-5	R	Y	
Provision 5.6-6	R	Y	
Provision 5.6-7	R	Y	
Provision 5.6-8	R	N	
Provision 5.6-9	R	Y	
5.7 Ensure software integrity			
Provision 5.7-1	R	N	
Provision 5.7-2	R	N	
5.8 Ensure that personal data is secure			
Provision 5.8-1	R	N/A	no personal data transit through BESS hw/sw
Provision 5.8-2	M	Y	applicable to server/cloud services and to the customer App for mobile devices
Provision 5.8-3	M	Y	
5.9 Make systems resilient to outages			
Provision 5.9-1	R	Y	
Provision 5.9-2	R	Y	
Provision 5.9-3	R	Y	
5.10 Examine system telemetry data			
Provision 5.10-1	R C (6)	N	

EN 303 645 v2.1.1 (2020-06) Table B.1: Implementation of provisions for consumer IoT security			
Clause number and title			
Reference	Status	Support	Detail
5.11 Make it easy for users to delete user data			
Provision 5.11-1	M	N/A	
Provision 5.11-2	R	N/A	
Provision 5.11-3	R	N/A	
Provision 5.11-4	R	N/A	
5.12 Make installation and maintenance of devices easy			
Provision 5.12-1	R	Y	
Provision 5.12-2	R	Y	
Provision 5.12-3	R	Y	
5.13 Validate input data			
Provision 5.13-1	M	Y	
6 Data protection provisions for consumer IoT			
Provision 6.1	M	N/A	no personal data transit through BESS hw/sw
Provision 6.2	M C (7)	N/A	
Provision 6.3	M	N/A	
Provision 6.4	R C (6)	N/A	
Provision 6.5	M C (6)	N/A	

Conditions:

1) passwords are used;
2) pre-installed passwords are used;
3) software components are not updateable;
4) the device is constrained;
5) the device is not constrained;
6) telemetry data being collected;
7) personal data is processed on the basis of consumers' consent;
8) the device allowing user authentication;
9) the device supports automatic updates and/or update notifications;
10) a hard-coded unique per device identity is used for security purposes;
11) updates are delivered over a network interface;
12) an update mechanism is implemented;
13) a debug interface is physically accessible.

Status' Column:

M	Mandatory provision
R	Recommended provision
M C	Mandatory and conditional provision
R C	Recommended and conditional provision

Support' Column:

Y	Implemented
N	Not implemented
N/A	Not applicable

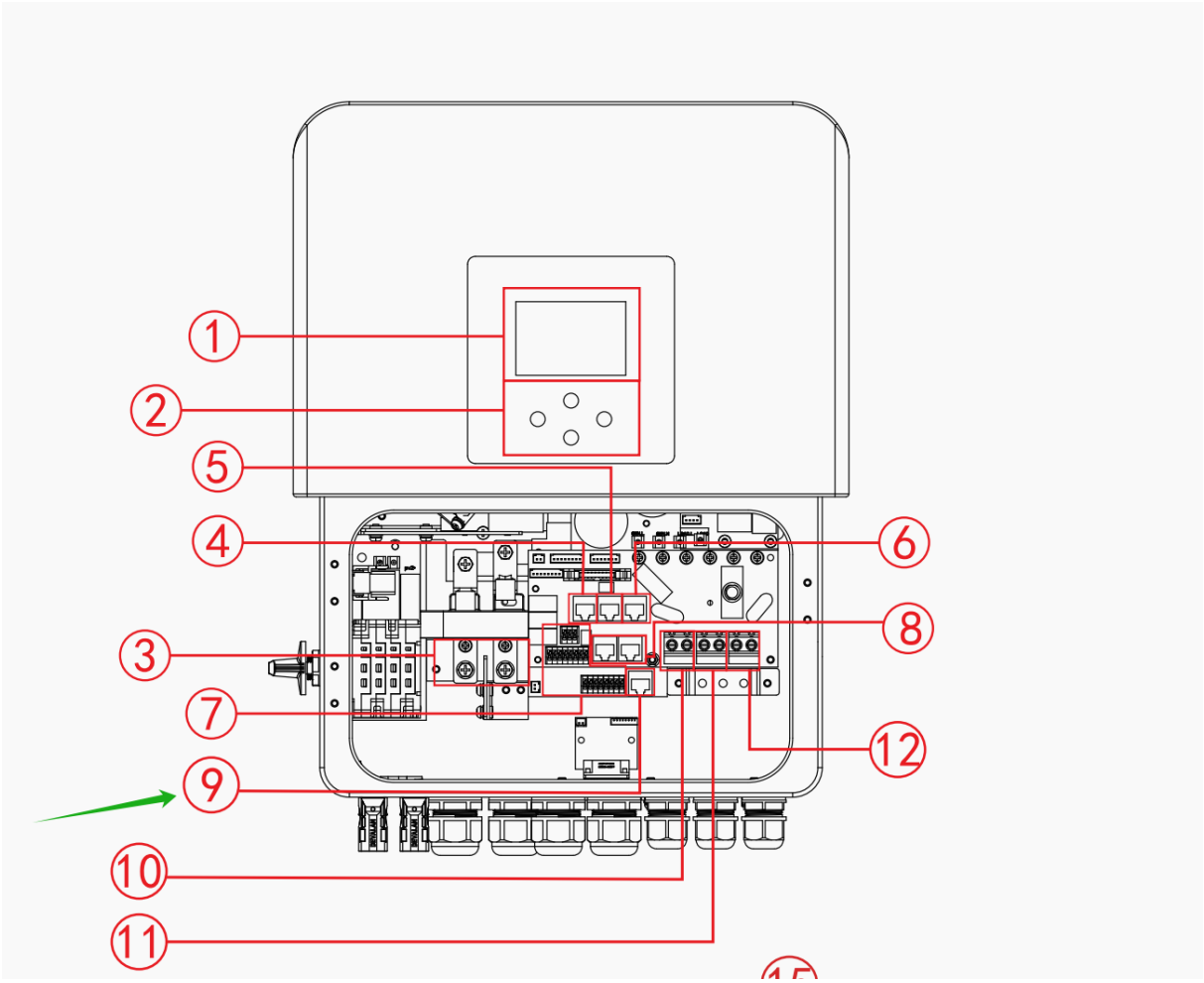
宁波德业变频技术有限公司
NINGBO DEYE INVERTER TECHNOLOGY CO.,LTD.

Bard Dai
Senior Standard and Certification Engineer
On behalf of NingBo Deye Inverter Technology Co.,Ltd.
December 3,2021
Place: NingBo, China

Logic Interface (input port) Required by paragraph 9.4.4	**P**
Confirm that an input port is provided and can be used to reduce the Active Power output to zero	Yes
Note. Manufacturer information provided.	
Provide high level description of logic interface, e.g. details in 9.4.4 such as AC or DC signal	Yes

Note.

The inverter has a DRM logical port,A 15K resistor needs to be connected to PIN 5 of the DRM port. The connection between PIN 1 and PIN 6 can be controlled by a switch, When the switch is closed, the inverter will reduce the active power to 0 within 5 seconds.



No.	DRM Pin
1	DRM1/5
2	DRM2/6
3	DRM3/7
4	DRM4/8
5	REF-GEN/0
6	GND
7	NetDRM_7
8	NetDRM_7