SUNGROW
Clean power for all

MANUFACTURER DECLARATION

Conformity of compliance with the requirements of EN 50549 and PPDS4

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Manufacturer Declaration

1. Sungrow Power Supply Co., Ltd. hereby declares that the products listed below meet the requirements of EN 50549:

SG2.0RS-S	SG5.0RT	SH5.0RT	SG33CX	SG25CX-P2	SG125HX
SG2.5RS-S	SG6.0RT	SH6.0RT	SG40CX	SG30CX-P2	SG250HX
SG3.0RS-S	SG7.0RT	SH8.0RT	SG50CX	SG33CX-P2	SG350HX
SG3.0RS	SG8.0RT	SH10RT	SG110CX	SG36CX-P2	
SG3.6RS	SG10RT	SH5T		SG40CX-P2	
SG4.0RS	SG12RT	SH6T		SG50CX-P2	
SG5.0RS	SG15RT	SH8T		SG125CX-P2	
SG6.0RS	SG17RT	SH10T			
	SG20RT	SH12T			
		SH15T			
		SH20T			
		SH25T			

2. The country settings for A1 subcategory for Czech Republic include the following default settings:

Table 2.1 Protection parameters of inverters from A1 generating plant subcategory

Manufacturer's reference number	300274	
Manufacturer name	Sungrow Power Supply Co., Ltd.	
Manufacturer's address	No.2 Tianhu Road,, New & High Technology Industrial Dev Zn, Hefei, Anhui, 230088	
Website	www.sungrowpower.com	
Setting relay protection	Set value	
Setting parameter	Maximum disconnection time [s]	Settings for disconnection
Level 1 overvoltage[1)]	3	230V - 10%
Level 2 overvoltage	0,2(1)	230V - 15%
Level 3 overvoltage	0,1	230V - 20%
Suspension	1,5	230V - 15%
Excessive frequency	0,5	52 Hz
Insufficient frequency	0,5	47.5 Hz
Critical value	>50.2Hz	Power gradient, 40% Pn/Hz
Automatic reconnection after switching off	With a ramp-up curve of 10% Pn per minute	

1) For surge level 1, 10-minute values corresponding to EN 50160 are used. The calculation of the 10-minute value shall correspond to the 10-minute aggregation according to EN 61000-4-30, class S. This function is based on the average effective voltage value over a 10-minute interval. The deviation from EN 61000-4-30 consists of a sliding measurement window. For comparison with the trip limit, it is sufficient to calculate a new 10-minute value at least every 3 s.

3. The country settings for A2 and B1 subcategories for the Czech Republic include the following default settings:

Table 3.1 Protection parameters of inverters from A2, B1, B2 and C generating plant subcategories

Functions	Range of settings	Recommended protection settings (2)	
Overvoltage 3. Grade U >>	1,00 - 1,30 Un	1.25 Un	0,1 s
Overvoltage 2nd stage U >>	1,00 - 1,30 Un	1.2 Un	5s
Overvoltage 1st stage U >	1,00 - 1,30 Un	1.15 Un (1)	≤ 60 s
Undervoltage 1st stage U <	0,10 - 1,00 Un	0.7 Un	0 - 2,7 s
Undervoltage 2nd stage U <<	0,10 - 1,00 Un	0.3 Un (0.45 Un) (3)	≥ 0,15 s
overfrequency f >	50 - 52 Hz	51.5 Hz	≤ 100 ms
underfrequency f <	47.5 - 50 Hz	47.5 Hz (4)	≤ 100 ms
direction of reactive power and undervoltage (Q & U<) (5)	0,70 - 1,00 Un	0.85 Un	t1 = 0.5 s

1) For surge level 1, 10-minute values corresponding to EN 50160 are used. The calculation of the 10-minute value shall correspond to the 10-minute aggregation according to EN 61000-4-30, class S. This function is based on the average effective voltage value over a 10-minute interval. The deviation from EN 61000-4-30 consists of a sliding measurement window. For comparison with the trip limit, it is sufficient to calculate a new 10-minute value at least every 3 s.
2) The tripping times for overvoltage and undervoltage need to be coordinated with the parameters of the FRT curves of the points 4.10 and 4.11.
3) This voltage step will cause a rapid disconnection from the grid during near faults. The 0.3 Un setting is selected for plants connected to 110 kV networks and the voltage measured on the HV side (corresponding to approx. 15% Un at the connection point. A setting of 0.45 Un is selected for plants connected to HV networks and when the voltage is measured on the lower voltage side.
4) This setting is dependent on the power output of the factory and the frequency-dependent power matching.
5) Protection is applied to generating stations with an installed capacity above 30 kVA, unless otherwise specified by DNO.

4. The country settings for A1, A2, and B1 subcategories for the Czech Republic, include the following requirements:

4.1. Automatic reconnection after tripping

If the inverter has been disconnected from the distribution network due to voltage or frequency deviations, it can be automatically reconnected to the distribution network according to the following criteria:

1) Voltage and frequency are within limits for 300 s (5 min).
   a) Voltage - 85 - 110 % of nominal value
   b) Frequency - 47.5 - 50.05 Hz
2) Gradual ramp up to power from zero with a gradient of no more than 10% P_N per minute

If the inverter is not able to gradually ramp up to power (according to point 2), the power plant can be connected back to the distribution network after a period of time determined by the DNO in the interval 0-20 min; while the voltage and frequency limits are being checked according to point 1.

4.2. Power response to overfrequency

The inverter can activate the active power frequency response as specified in Figure 1 at the frequency threshold and static settings determined by the relevant TSO for its control area in coordination with the TSOs of the same synchronously interconnected area to ensure minimum impact on neighbouring areas:

The frequency threshold shall be between 50,05 Hz and 50,5 Hz
Inclusive; the static setting between 4 % and 10 %;
Default threshold frequency in the Czech Republic is 50.2 Hz, static s_2= 5%

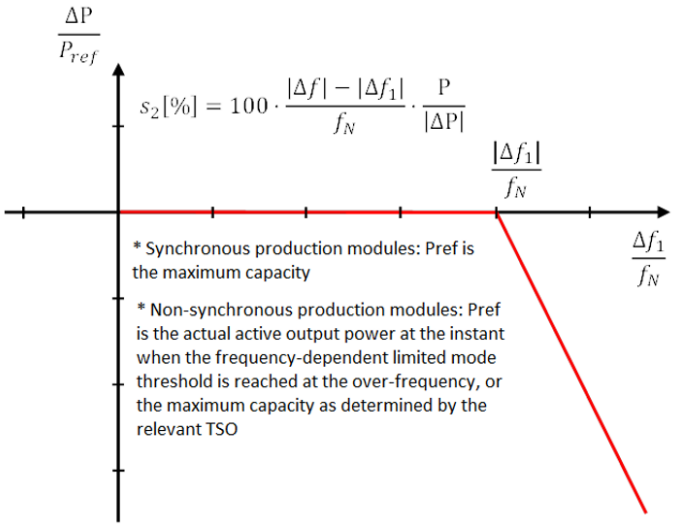

Figure 4.1 Frequency response capability of active power for inverters in limited frequency dependent mode at overfrequency

4.3. Ceasing active power

Inverters are equipped with a logic interface (input port) with capability to cease active power output within five seconds following an instruction being received at the input port. If required by the DSO and the responsible party, this includes remote operation.

4.4. Operating frequency range

During energy production, the inverters will remain connected to the distribution network and operate continuously when the frequency at the point of connection stays within the range of 49 Hz to 51 Hz. If the frequency ranges from 47,5 Hz to 49 Hz and from 51 Hz to 51,5 Hz, the inverters can operate in the frequency ranges, for the duration and for the minimum requirement as indicated in Table 4.1.

Table 4.1 Frequency range

Frequency range	Minimum operating time
47.5 - 48.5 Hz	30 minutes
48.5 - 49 Hz	90 min
49 - 51 Hz	Unlimited
51 - 51.5 Hz	30 minutes

4.5. Continuous operating voltage range

4.5.1. Power plants connected to the LV network (A1 and A2 subcategories)

Inverters listed in Table 4.2 are capable of continuous operation if the voltage at the connection point remains in the range of 85 % Un to 110 % Un.

Table 4.2 EN 50549-1 compliant inverters

SG2.0RS-S	SG5.0RT	SH5.0RT	SG33CX	SG25CX-P2
SG2.5RS-S	SG6.0RT	SH6.0RT	SG40CX	SG30CX-P2
SG3.0RS-S	SG7.0RT	SH8.0RT	SG50CX	SG33CX-P2
SG3.0RS	SG8.0RT	SH10RT	SG110CX	SG36CX-P2
SG3.6RS	SG10RT	SH5T		SG40CX-P2
SG4.0RS	SG12RT	SH6T		SG50CX-P2
SG5.0RS	SG15RT	SH8T		SG125CX-P2
SG6.0RS	SG17RT	SH10T		
	SG20RT	SH12T		
		SH15T		
		SH20T		
		SH25T		

In case of voltages below Un, the inverters will reduce the apparent power to maintain the current limits of the generating plant.

4.5.2. Power plants connected to the HV network (B1 subcategory)

Inverters listed in Table 4.3 are capable of continuous operation within the voltage range of 0.9 U_N to 1.118 U_N at the connection point. The specified time of operation outside that range is detailed in Table 4.4.

Table 4.3 EN 50549-2 compliant inverters

SG33CX	SG25CX-P2	SG125HX
SG40CX	SG30CX-P2	SG250HX
SG50CX	SG33CX-P2	SG350HX
SG110CX	SG36CX-P2	
	SG40CX-P2	
	SG50CX-P2	
	SG125CX-P2	

Table 4.4 Voltage range for generation plants connected to the HV network.

Voltage range	Operation time
0,85 p.j. - 0,90 p.j.	60 minutes
0.90 p.j. - 1.118 p.j.	Unlimited
1,118 p.j. - 1,15 p.j.	60 minutes

In case of voltages below U_N, the inverters will reduce their apparent power to maintain the current limits of the generating plant.

4.6. Minimal requirement for active power delivery at underfrequency

The admissible active power reduction due to underfrequency is limited by the full line in Figure 4.2 and is characterized by a maximum allowed reduction rate of 10 % of P_{MAX} per 1 Hz for frequencies below 49,5 Hz.

It is possible that a more stringent power reduction characteristic is required by the responsible party. Nevertheless, this requirement is expected to be limited to an admissible active power reduction represented by the dotted line in Figure 4.2 which is characterized by a reduction rate of 2 % of the maximum power Pmax per 1 Hz for frequencies below 49 Hz.

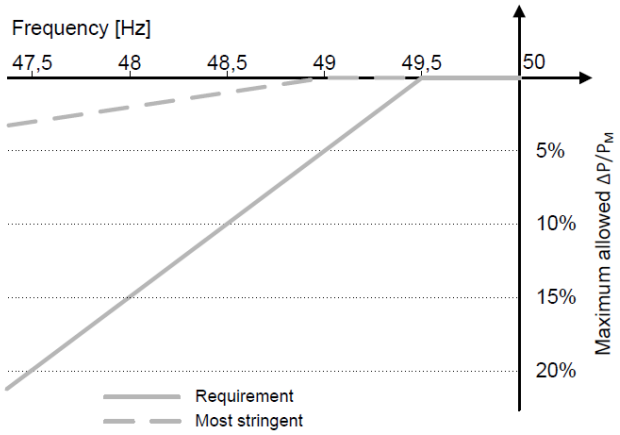

Figure 4.2 Maximum allowable power reduction in case of underfrequency

4.7. Voltage related active power reduction

P(U) function is set according to Figure 4.3.

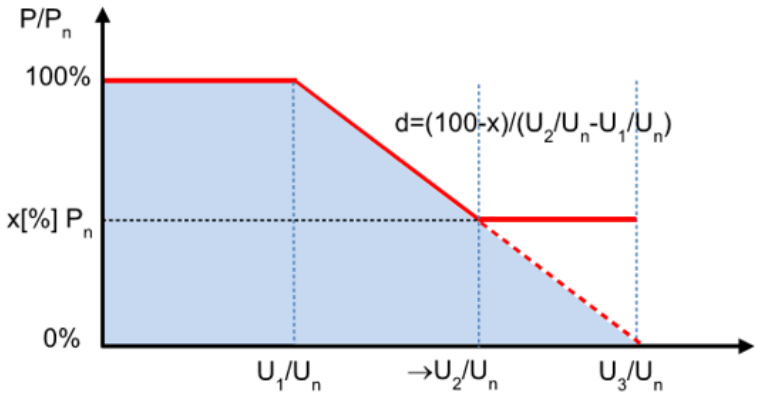

Figure 4.3 Characteristics of the function P(U)

U1 = 251 V (U1/Un = 1.09) for P/Pn 100%
U2 = 253 V (U2/Un = 1.10) for P/Pn 50%
U3 = 255 V (U3/Un = 1.11) for P/Pn 0%

4.8. Voltage related reactive power regulation

Q(U) function is set according to Figure 4.4 defining model ratio of voltage (U) and reactive power (Q).

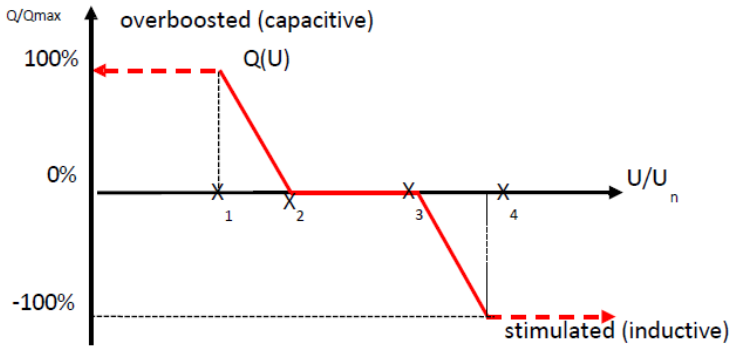

Figure 4.4 Characteristics of the function Q(U)

U1: (X1 = 0.94)
Q1: (Y1 = sin(acos(1)) = 0)

U2: (X2 = 0.97)
Q2: (Y2 = 0)

U3: (X3 = 1.05)
Q3: (Y3 = 0)

U4: (X4 = 1.08)
Q4: (Y4 = sin(acos(-1)) = 0)

4.9. Rate of change of frequency (ROCOF) immunity

The inverters are ROCOF immune and will not be disconnected in case of change in the distribution network frequency up to a value of 2 Hz/s.

The ROCOF immunity is defined with a sliding measurement window of 500 ms.

4.10. Over-voltage ride through (OVRT)

Inverters will remain connected to the distribution network as long as the voltage at the point of connection remains below the voltage-time curve of Figure 4.5.

The highest phase to neutral voltage or if no neutral is present the highest phase to phase voltage will be evaluated.

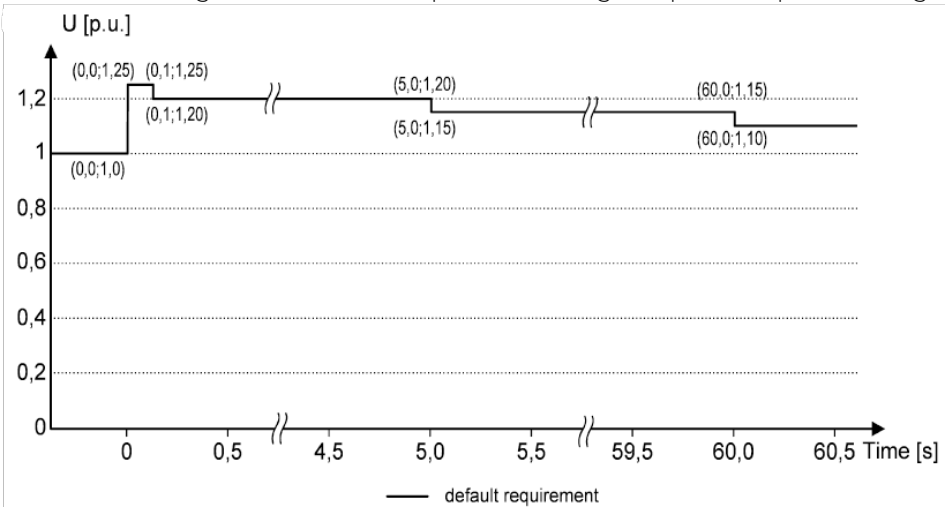

Figure 4.5 Over-voltage ride through capability

4.11. Under-voltage ride through (UVRT)

Inverters will remain connected to the distribution network as long as the voltage at the point of connection remains above the voltage-time curve of Figure 4.6. The voltage is relative to U_N.

The smallest phase to neutral voltage or if no neutral is present the smallest phase to phase voltage will be evaluated.

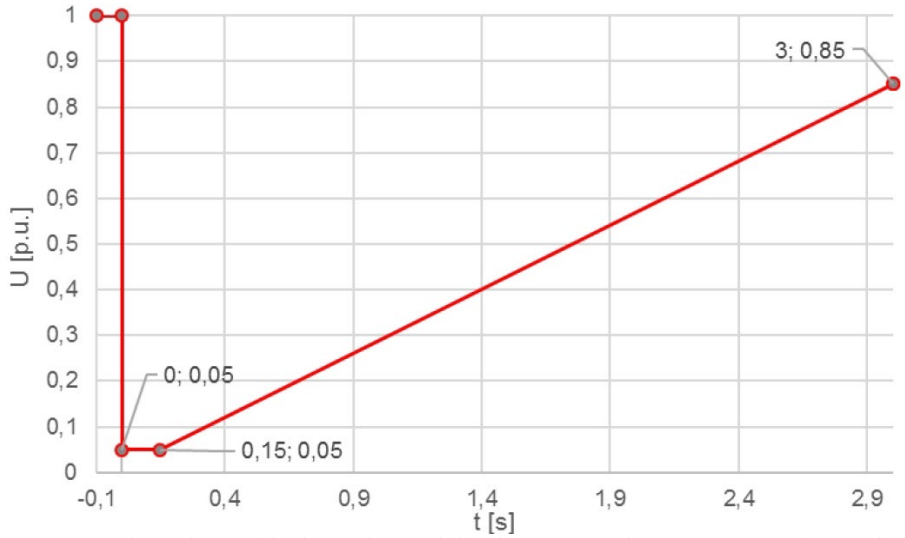

Figure 4.6 Under-voltage ride through capability for non-synchronous generating technology

Table 4.5 FRT curve parameters of Figure 4.6

t [s]	U [p. j.]
0 - 0.15	0.05
3	0.85

Date; place:

2024/2/28

Stamp; Signature:

Lucas Liu

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