SG3125HV-30 Series
LVRT &HVRT FUNCTION

Technical Information

SUNGROW

SG3125HV-30 LVRT & HVRT FUNCTION

The grid faults require the support from PV inverters by staying connected to the grid and generating reactive currents to support the grid voltage in corresponding grid code. These currents are related to the correct dimensions of the wiring and protection devices at the PV plant and grid levels. Therefore, maximum values of short-circuit currents or characteristic values (as for example Ik'' and Ip) and currents at defined times during voltage drop need to be confirmed.

SG3125HV-30 Series Short Circuit Current

SG3125HV-30 will stay connected from the grid in the event of voltage drop and support the grid voltage by feeding a reactive current into the grid according to a certain characteristic. These apply to all types of short circuits (i.e. to single-phase, two-phase and three-phase short circuits).

The voltage drop causes an immediate reaction of the PV inverter with the peak short-circuit current Ip which is just a peak of max. 40 μs with no significant area under the current characteristic curve; afterwards, the inverter limits the current immediately to prevent the inverter from thermal overload, with the initial symmetrical short-circuit current I_k'' which will not last longer than 30ms.

The value for the steady-state short-circuit current I_k will be reached after 30 ms and will be maintained during the entire duration of the voltage drop. Furthermore, the value of feed-in reactive current are related to the remaining voltage and the $k_{-factor}$ (default $k_{-factor}$ = 2).

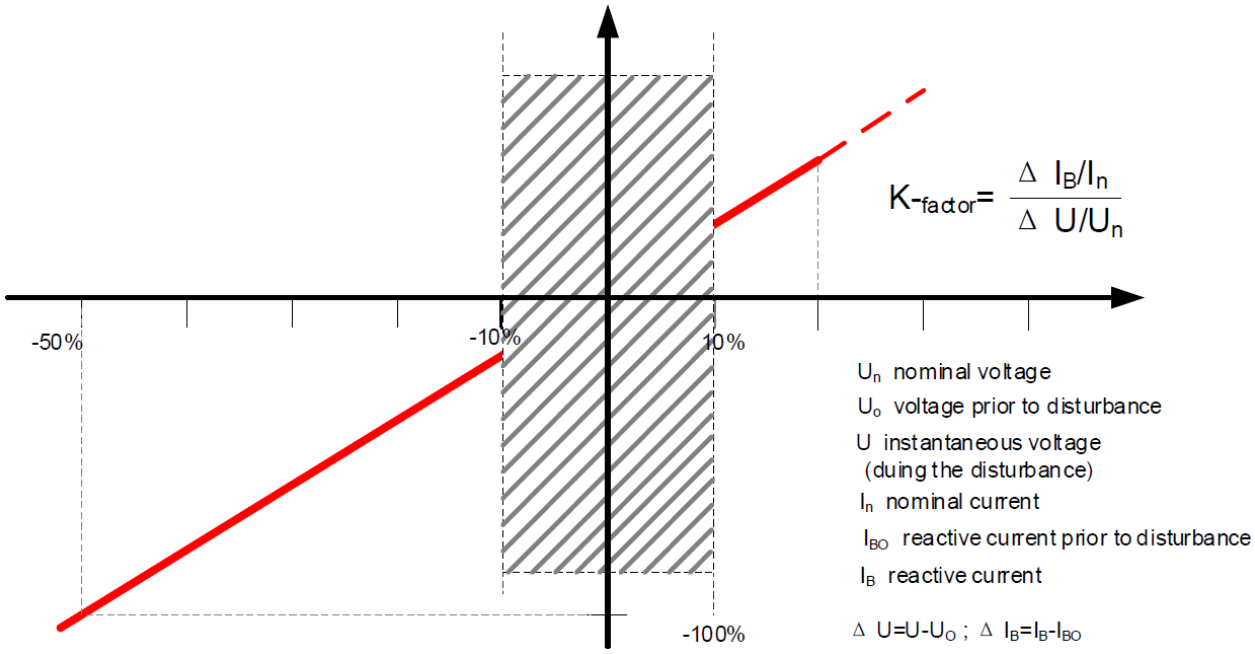

Figure 1. Principle of voltage support in the event of grid fault

The response of voltage drop contains one static and two dynamic parts, as shown in the Figure 1. The instantaneous values of AC currents and voltages are recorded synchronously with 50 kHz (20 μs). Positive sequence component is based on measurement of instantaneous voltages and currents are calculated according to IEC 61400-21 (2008). The following table shows the test results for SG3125HV-30.

Inverter type	Peak short-circuit current I_p(A)	Initial symmetrical short-circuit current I_k"(A)	Steady-state short-circuit current I_k(A)	Maximal current I_{max}(A)
SG3125HV-30	<8000	3640	3157(settable)	3157

Low Voltage Righ Through (LVRT)

Technical Requirements for Connecting Photovoltaic Power Station to Power System requires medium-and-large PV plant should be equipped with Low Voltage Ride Through (LVRT) ability.
LVRT requires: PV plant can operate normally within certain voltage drop range and duration when the voltage of the grid-connected point drops due to the power system failure or disturbance; PV plant can provide the dynamic reactive power support during the period.

Dynamic Reactive Current Support

During LVRT, power station should feed reactive current to the power system as per requirements. For a station whose 500kV or 750kV voltage is stepped up from the 220kV or 330kV voltage and then connects to the power station group, it should feed reactive current to the grid when a short-circuit occurs and the voltage drops.

Zero Voltage Ride Through

When the grid-connection point voltage drops to zero, the power station can operate normally for 1 second.
UT is the grid-connection point voltage; Upu is the grid-connection point nominal voltage.

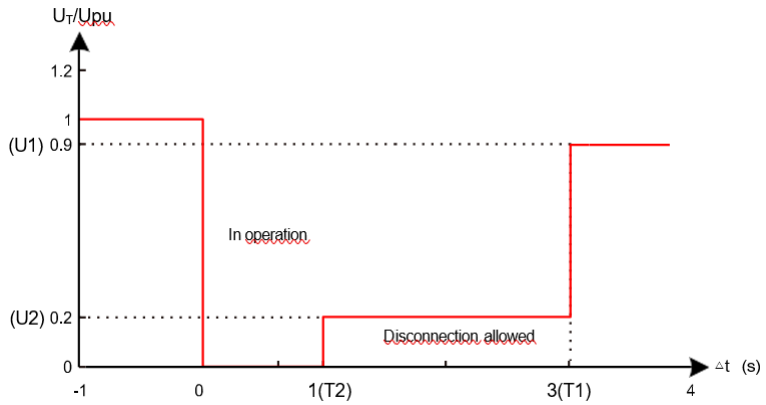

Figure 2 Low voltage withstand requirements

Note: T1, T2, U1, and U2 are all settable parameters. For the specific range and default value, refer to Protection parameter range and default value

The LVRT parameters can be set to meet the different requirements of different grid codes

Parameters	Range	Setting	Descriptions
LVRT switch	Enable/Disable	Enable	Enable or disable the HVRT switch
LVRT T1(ms)	40~36000000	20000	Setting for starting time for LVRT stage 1
LVRT T2(ms)	40~36000000	1500	Setting for starting time for LVRT stage 2

LVRT T3(ms)	40~36000000	500	Setting for starting time for LVRT stage 3
LVRT T4(ms)	40~36000000	500	Setting for starting time for LVRT stage 4
LVRT T5(ms)	40~36000000	500	Setting for starting time for LVRT stage 5
LVRT voltage1(%)	0~90	90	Setting for starting LVRT stage 1. The setting should meet the local grid standard.
LVRT voltage2(%)	0~90	85	Setting for starting LVRT stage 2. The setting should meet the local grid standard.
LVRT voltage3(%)	0~90	10	Setting for starting LVRT stage 3. The setting should meet the local grid standard.
LVRT voltage4(%)	0~90	10	Setting for starting LVRT stage 4. The setting should meet the local grid standard.
LVRT voltage5(%)	0~90	10	Setting for starting LVRT stage 5. The setting should meet the local grid standard.
LVRT dynamic Var Kf factor	0~10	2	Ratio of reactive power compensation and voltage dip depth during LVRT

High Voltage Ride Through (HVRT)

Technical Requirements for Connecting Photovoltaic Power Station to Power System requires that the PV plant can operate as required within certain voltage range.

Grid-connection point voltage	Requirements
$1.1U_{pu}<U_T<1.2U_{pu}$	Operate for at least 10s
$1.2U_{pu}\leq U_T\leq 1.3U_{pu}$	Operate for at least 0.5s

Note: UT is the grid-connection point voltage; Upu is the grid-connection point nominal voltage.

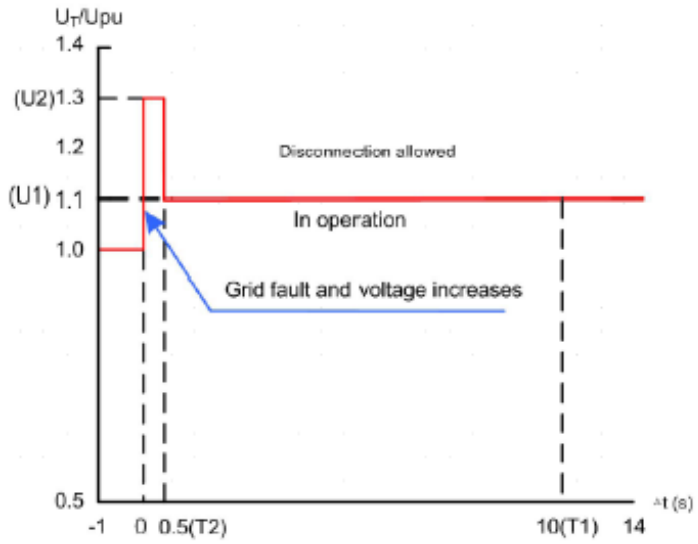

Figure 3 High voltage withstand requirements

Parameters	Range	Setting	Descriptions
HVRT switch	Enable/Disable	Enable	Enable or disable the HVRT switch
HVRT T1(ms)	40~36000000	2000	Setting for starting time for HVRT stage 1
HVRT T2(ms)	40~36000000	2000	Setting for starting time for HVRT stage 2
HVRT T3(ms)	40~36000000	2000	Setting for starting time for HVRT stage 3
HVRT T4(ms)	40~36000000	2000	Setting for starting time for HVRT stage 4
HVRT T5(ms)	40~36000000	2000	Setting for starting time for HVRT stage 5
HVRT voltage1(%)	110~140	110	Setting for starting HVRT stage 1. The setting should meet the local grid standard.
HVRT voltage2(%)	110~140	110	Setting for starting HVRT stage 2. The setting should meet the local grid standard.
HVRT voltage3(%)	110~140	110	Setting for starting HVRT stage 3. The setting should meet the local grid standard.
HVRT voltage4(%)	110~140	110	Setting for starting HVRT stage 4. The setting should meet the local grid standard.
HVRT voltage5(%)	110~140	110	Setting for starting HVRT stage 5. The setting should meet the local grid standard.
HVRT dynamic Var Kf factor	0~10	2	Ratio of reactive power compensation and voltage dip depth during HVRT

Dead band settings

The reactive current activation threshold is determined by the setting configured for the voltage dead band. Below are the voltage dead band settings:

LVRT		HVRT	
Range	**Setting**	**Range**	**Setting**
0 - 100%	90%	100-140%	110%
0 - 600 V	540 V	600 - 840 V	660 V

Reactive current injection is determined by the LVRT Dynamic Var Kf factor and HVRT Dynamic Var Kf factor. See LVRT and HVRT settings for details.