SG3400HV-30 and SG3125HV-30 Series

Grid Support

SUNGROW

Version 1.0

1. Introduction

This document describes the grid support of SG3125HV-30, SG3125HV-MV-30, SG3400HV-30 ,SG3400HV-MV-30 and series.

2. SG3125HV-30 & SG3400HV-30 Series Grid Support

This product meets the requirements of IEC standard.

Using reactive power control, we can able to achieve Pf (Fixed Power Factor), Q(t) (Fixed Reactive Power Ratio), Q(U) (Voltage and Reactive Power Regulation), Q(P)(Q is related with P).

Using active power control, we can able to achieve power grid dispatching function and active power response time regulation function.

In FRT state, the inverter can quickly respond to the changes of the power grid and support the power grid.

3. Active & Reactive & FRT Power Control

3.1. Reactive Power Control

3.1.1. Pf Mode

Pf mode: the power factor is fixed and reactive power setpoint is calculated according to the current power.The adjustable range of the power factor is -0.8~+0.8, and the adjustment curve in the Pf mode is shown in the fig.1 below. The shaded area in the figure shows the P-Q capability of the inverter in Pf mode.

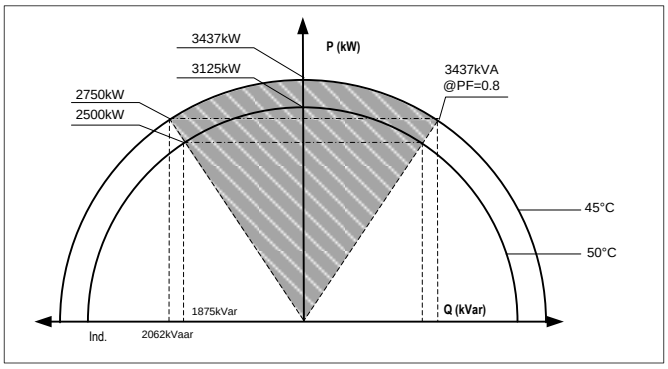

Fig.1. The P-Q Capability (Pf mode)

The Pmax=3437kW, Smax=3437kVA. The Max. Q is +/-2062 kVar, when the power factor is +/-0.8,at 45℃;

The Q is +/-1498 kVar, when the power factor is +/-0.9,at 45℃.

3.1.2. Q(t) Mode

In the Q(t) mode, system rated reactive power is fixed, and the system outputs reactive power according to the delivered reactive power ratio.

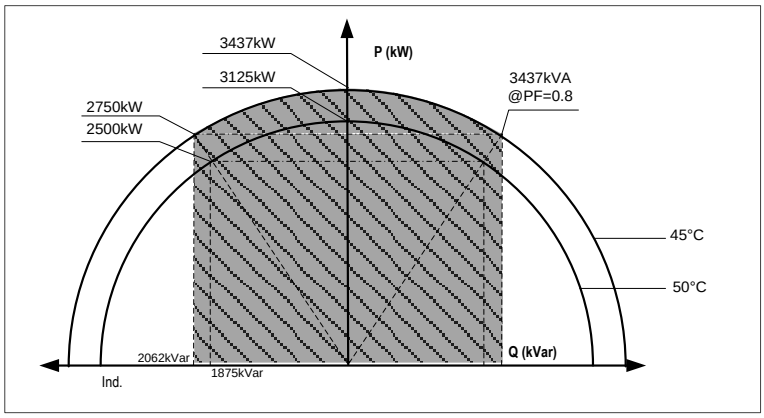

Fig.2. The P-Q Capability [Q(t) mode]

The Pmax=3437kW, Smax=3437kVA. The Max. Q is +/-2062 kVar, when the power factor is +/-0.8,at 45℃;

The Q is +/-1498 kVar, when the power factor is +/-0.9,at 45℃.

3.1.3. Q(U) Mode

Parameter	Definition/Setting description	Range	Default value
QU enable power(%)	In QU mode, the QU function will be enabled when the actual output active power percentage is greater than the set value	0-100	0
QU operation mode	In QU reactive power mode, the method to set the reactive power value	Var PCT adj/ TanPhi adj/ CosPhi.adj	Var PCT adj
QU input type	QU function input voltage type; the max./min value of the real time grid voltage or during grid voltage change	RT volt/Record volt	RT volt
QU PF Start	The lower limits of compensation power factor caused by grid voltage change; setting is available when the QU operation mode is TanPhiadj or CosPhiadj	0.8~1	Country-specific
QU PF End	The Upper limits of compensation power factor caused by grid voltage change; setting is available when the QU operation mode is TanPhiadj or CosPhiadj	0.8~1	Country-specific
QU volt rise start (%)	Refer to U1i in "fig.3 Q(U) Mode Curve"	100~110	Country-specific
QU volt rise end (%)	Refer to U2i in "fig.3 Q(U) Mode Curve"	100~110	Country-specific
QU volt drop start(%)	Refer to U1s in "fig.3 Q(U) Mode Curve"	90~100	Country-specific
QU volt drop end(%)	Refer to U2s in "fig.3 Q(U) Mode Curve"	90~100	Country-specific

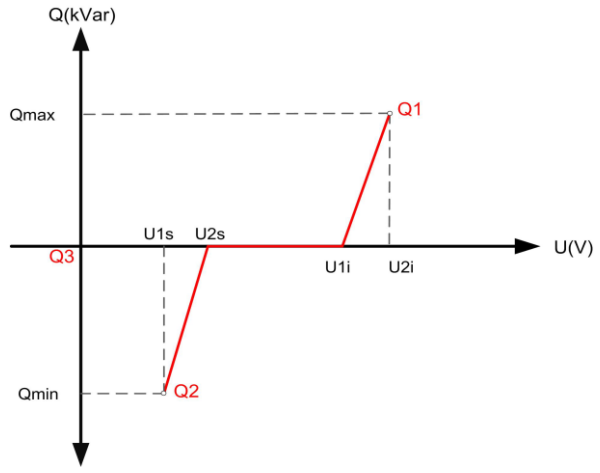

Fig.3. Q(U) Mode Curve

3.1.4. Q(P) Mode

Parameter	Definition/Setting description	Range	Default value
Q(P) upper PF	Power factor of point P1 in "fig.4 Q(P) mode curve "	0.9~1	1
Q(P) lower PF	Power factor of point P2 in "fig 4 Q(P) mode curve "	0.9~1	0.9
Q(P) upper power(%)	Output power of point P2 in "fig 4 Q(P) mode curve "	50~100	100
Q(P) lower power(%)	Output power of point P1 "fig 4 Q(P) mode curve "	0~50	50

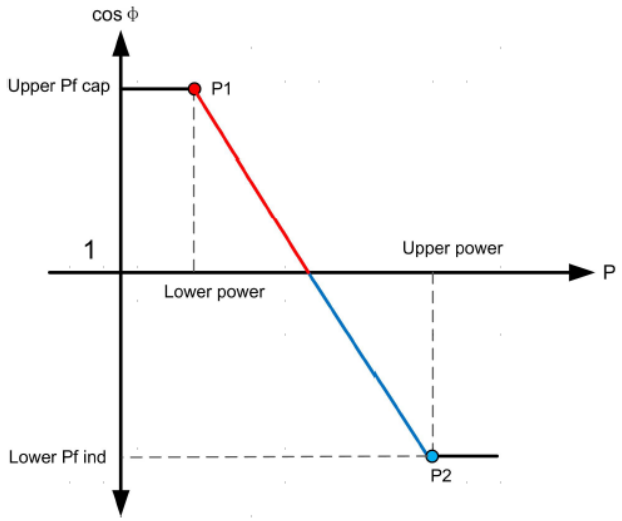

Fig.4. Q(P) Mode Curve

3.2. Active Power Control

3.2.1. Active Power Regulation

The active power ramp rate can be set to control how the inverter increases or deceases its output power when the PV power is increased due to irradiation rise or decreased due to power limitation.

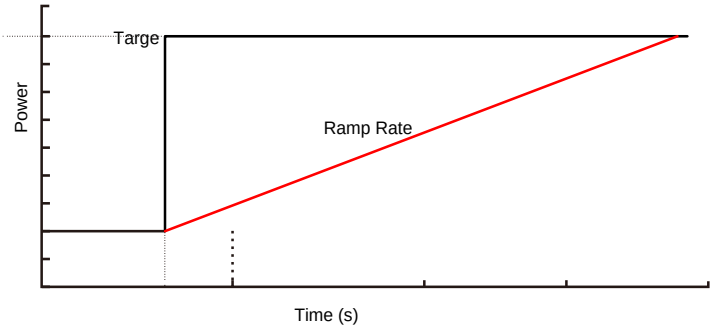

Fig.5. Ramp Rate Control

Parameter	Definition/Setting description	Range	Default value
T-start-wait (s)	Time interval between the moment at which the AC/DC parameters meet the grid-connection requirements and the moment at which the inverter begins to generate power.	0~600	60
T-stop-delay (s)	Time interval between the moment at which the stop command is sent via the LCD display or the PC and the moment at which the inverter executes the stop command.	0~600	0

Parameter	Definition/Setting description	Range	Default value
Stop slope (%/s)	Active power decline rate over the time from the moment at which the Turnkey Station executes stop command to the moment at which the inverter stops.	0.1~500	100
Start slope (%/s)	Active power rise rate over the time from the moment at which the inverter executes the start command to the moment at which the Turnkey Station starts.	0.01~100	10
P-rise rate (%/s)	Rate of rise of the active power Percentage that the active power rise per second accounted for the nominal power (%/s).	0.01~500	Country-specific
P-decline rate (%/s)	Rate of decline of the active power.	0.01~500	Country-specific
Limit Power (%)	Percentage of the active power output to the nominal output power (%).	0~110	110

*Parameter that can be set by professional personnel.

3.2.2. Frequency Derating Function

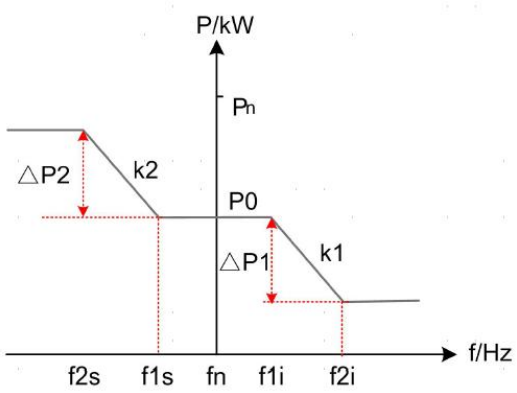

Fig.6. The relation curve between the active power and the frequency

Parameters	Range	Default	Descriptions
FW func enable	Enable/Disable	Disable	To enable/Disable the FW function
FW output change base	Rated-P/Pre-derate-P	Country-specific	The standard of active power change caused by frequency change
OF decrease start(Hz)	50~55 / 60~65	Country-specific	Refer to f1i in Fig.6The relation curve between the active power and the frequency
OF decrease end(Hz)	50~55 / 60~65	Country-specific	Refer to f2i in Fig.6The relation curve between the active power and the frequency
OF decrease slope	0~2	Country-specific	Refer to K1 in Fig.6The relation curve between the active power and the frequency
OF decrease limit (%)	0~110	Country-specific	Refer toΔP1 in Fig.6The relation curve between the active power and the frequency
FW input type	RT-freq/Record-freq	Country-specific	The input frequency type of the FW function. The max./min value of the real-time

			frequency or during frequency change
FW enable power(%)	0~115	0	After the FW function is enabled, the FW function is started when the percentage of the actual output active power is bigger than the set value
UF increase start(Hz)	45~50 / 55~60	Country-specific	Refer to f1s in Fig.6The relation curve between the active power and the frequency
UF increase end(Hz)	45~50 / 55~60	Country-specific	Refer to f2s in Fig.6The relation curve between the active power and the frequency
UF increase slope	0~2	Country-specific	Refer to K2 in Fig.6The relation curve between the active power and the frequency
UF increase limit(%)	0~110	Country-specific	Refer to ΔP2 in Fig.6The relation curve between the active power and the frequency

3.3. FRT Power Control

The inverter can detect the abnormal frequency and respond quickly. Users can set the frequency protection range through the LCD screen to comply with local national grid standards.

Parameters	Range	Default	Descriptions
Ⅰ_Fgrid-max(Hz)	50~55/60~65	Country-specific	The grid over-frequency protection I value. Protection is activated when frequency exceeds this value
Ⅱ_Fgrid-max(Hz)	50~55/60~65	Country-specific	The grid over-frequency protection II value. Protection is activated when frequency exceeds this value
Ⅲ_Fgrid-max(Hz)	50~55/60~65	Country-specific	The grid over-frequency protectionⅢvalue. Protection is activated when frequency exceeds this value
Ⅳ_Fgrid-max(Hz)	50~55/60~65	Country-specific	The grid over-frequency protectionⅣvalue. Protection is activated when frequency exceeds this value
Ⅴ_Fgrid-max(Hz)	50~55/60~65	Country-specific	The grid over-frequency protection Ⅴvalue. Protection is activated when frequency exceeds this value
Recover_Fgrid-max(Hz)	50~55/60~65	Country-specific	The inverter recovers normal operation when grid frequency is below this value
Ⅰ_T-Fhigh trip(ms)	40~36000000	Country-specific	The grid over-frequency I tripping time
Ⅱ_T-Fhigh trip (ms)	40~36000000	Country-specific	The grid over-frequency II tripping time
Ⅲ_T-Fhigh trip(ms)	40~36000000	Country-specific	The grid over-frequency Ⅲ tripping time
Ⅳ_T-Fhigh trip (ms)	40~36000000	Country-specific	The grid over-frequency Ⅳ tripping time
Ⅴ_T-Fhigh trip(ms)	40~36000000	Country-specific	The grid over-frequency Ⅴ tripping time
Ⅰ_Fgrid-min(Hz)	45~50/55~60	Country-specific	The grid under-frequency protection I value. Protection is activated when frequency exceeds this value
Ⅱ_Fgrid-min(Hz)	45~50/55~60	Country-	The grid under-frequency protection II value.

		specific	Protection is activated when frequency exceeds this value
Ⅲ_Fgrid-min(Hz)	45~50/55~60	Country-specific	The grid under-frequency protection Ⅲ value. Protection is activated when frequency exceeds this value
Ⅳ_Fgrid-min(Hz)	45~50/55~60	Country-specific	The grid under-frequency protection Ⅳ value. Protection is activated when frequency exceeds this value
Ⅴ_Fgrid-min(Hz)	45~50/55~60	Country-specific	The grid under-frequency protection Ⅴ value. Protection is activated when frequency exceeds this value
Recover_Fgrid-min(Hz)	45~50/55~60	Country-specific	The inverter recovers normal operation when grid frequency is above this value
Ⅰ_T-Flow trip(ms)	40~36000000	Country-specific	The grid under-frequency I tripping time
Ⅱ_T-Flow trip (ms)	40~36000000	Country-specific	The grid under-frequency II tripping time
Ⅲ_T-Flow trip(ms)	40~36000000	Country-specific	The grid under-frequency Ⅲ tripping time
Ⅳ_T-Flow trip (ms)	40~36000000	Country-specific	The grid under-frequency Ⅳ tripping time
Ⅴ_T-Flow trip (ms)	40~36000000	Country-specific	The grid under-frequency Ⅴtripping time

3.3.1. Low Voltage Ride Through (LVRT)

LVRT requires the PV plant to stay in operation within certain voltage drop range due to the grid failure or disturbance; meanwhile, PV plant should provide the dynamic support by feeding the reactive power to the grid in response to grid voltage dip level.

Note: T1, T2, U1 and U2 are all settable parameters.

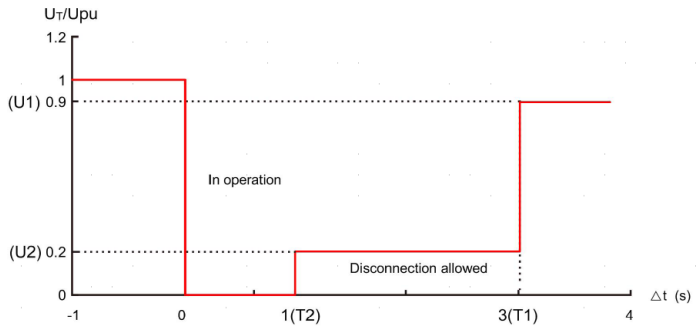

Fig.7. Lower Voltage Ride Through

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

Parameters	Range	Default	Descriptions
LVRT switch	Enable/Disable	Country-specific	Enable or disable the LVRT switch
LVRT T1(ms)	40~36000000	Country-specific	Parameters related to the LVRT

LVRT T2(ms)	40~36000000	Country-specific	Parameters related to the LVRT
LVRT T3(ms)	40~36000000	Country-specific	Parameters related to the LVRT
LVRT T4(ms)	40~36000000	Country-specific	Parameters related to the LVRT
LVRT T5(ms)	40~36000000	Country-specific	Parameters related to the LVRT
LVRT voltage1(%)	5~90	Country-specific	Parameters related to the LVRT
LVRT voltage2(%)	5~90	Country-specific	Parameters related to the LVRT
LVRT voltage3(%)	5~90	Country-specific	Parameters related to the LVRT
LVRT voltage4(%)	5~90	Country-specific	Parameters related to the LVRT
LVRT voltage5(%)	5~90	Country-specific	Parameters related to the LVRT
LVRT dynamic Var Kf factor	0~10	Country-specific	Ratio of reactive power compensation and voltage dip depth during LVRT

3.3.2. High Voltage Ride Through (HVRT)

The HVRT requires the PV plant to stay in operation within a certain voltage rise range due to the grid disturbance.

Note: T1, T2, U1 and U2 are all settable parameters.

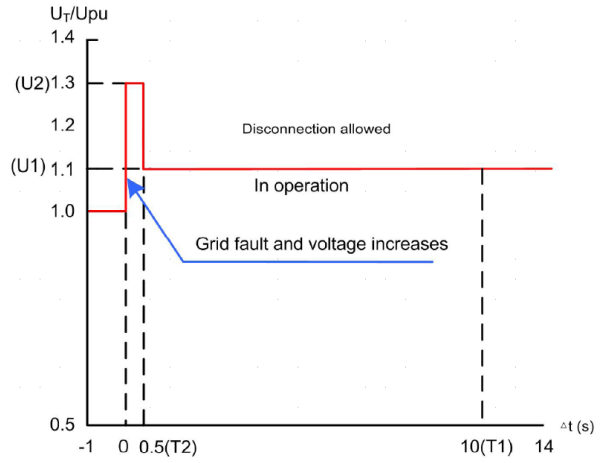

Fig.8. High Voltage Ride Through

Parameters	Range	Default	Descriptions
HVRT switch	Enable/Disable	Enable	Enable or disable the HVRT switch
HVRT T1(ms)	40~36000000	Country-specific	Parameters related to the HVRT
HVRT T2(ms)	40~36000000	Country-specific	Parameters related to the HVRT
HVRT T3(ms)	40~36000000	Country-specific	Parameters related to the HVRT

HVRT T4(ms)	40~36000000	Country-specific	Parameters related to the HVRT
HVRT T5(ms)	40~36000000	Country-specific	Parameters related to the HVRT
HVRT voltage1(%)	110~140	110	Parameters related to the HVRT
HVRT voltage2(%)	110~140	Country-specific	Parameters related to the HVRT
HVRT voltage3(%)	110~140	130	Parameters related to the HVRT
HVRT voltage4(%)	110~140	130	Parameters related to the HVRT
HVRT voltage5(%)	110~140	130	Parameters related to the HVRT
HVRT dynamic Var Kf factor	0~10	Country-specific	Ratio of reactive power compensation and voltage dip depth during HVRT