Grid-Connected Photovoltaic Inverter

SIEL Product Specification

Model :

SOLEIL 1F-TL 2K
SOLEIL 1F-TL 3K
SOLEIL 1F-TL 4K
SOLEIL 1F-TL 6K

Table of contents

1. Introduction

This specification is regarding to a series of Photovoltaic Inverters (PV Inverter) developed by SIEL S.p.A.. The inverter is used to convert DC power from solar array[1] to AC power fed to grid in distributed power applications.

1 The inverter is only suitable for silicon module. Thin film is not permitted.

2. Features

1. Transformerless design
2. Maximum efficiency range for different model：96.5 ~ 97.5%
3. Euro efficiency range for different model： 95.8 ~ 97.0%
4. MPPT efficiency >99%
5. Optional DC Switch
6. Lead-free, RoHS complied

3. Electrical specification

3.1 Marketing definition

Model	SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K SOLEIL 1F-TL6K	SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K SOLEIL 1F-TL6K	SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K SOLEIL 1F-TL6K	SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K SOLEIL 1F-TL6K
Market	Germany	Italy	Spain	England
Display model name	SV XXXXs DE	SV XXXXs IT	SV XXXXs ES	SV XXXXs UK
Grid interface regulation	VDE-AR-N 4105 / VDE0126-1-1/A1	CEI 0-21	RD1699	G83/1-1 / G59 Issue 2

3.2 Input (DC)

Model	SOLEIL 1F-TL2K	SOLEIL 1F-TL3K	SOLEIL 1F-TL4K	SOLEIL 1F-TL6K
Max. PV open voltage	550V	600V	600V	600V
Nominal DC voltage	360V			
Max. DC power	2300W	3450W	4600W	6300W
System start-up voltage	150 V			
Initial feeding voltage	150 V			
Shutdown voltage	Typical 80V			
Working voltage range	100 ~ 550V	100 ~ 500 V		
MPPT voltage range (full rating range)	200 ~ 500 V	200 ~ 500 V	225 ~ 500 V	200 ~ 500 V
MPPT efficiency	> 99%			
Max. DC current	11A	17.5A	20A	2 x 20A
Number of MPP tracker(s)	1	1	1	2[2]
DC insulation resistance[3]	2K ~ 4K : VDE0126-1-1/A1 : Riso >1MΩ, Others : Riso > 200KΩ 6K : VDE0126-1-1/A1 : Riso >1.5MΩ, Others : Riso > 200KΩ			

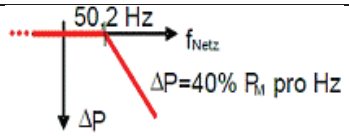
3.3 Output (AC)

3.3.1 Common Specification

Model	SOLEIL 1F-TL2K	SOLEIL 1F-TL3K	SOLEIL 1F-TL4K	SOLEIL 1F-TL6K
Nominal AC power	2000W	3000W	4000W	6000W
Max. AC power[4] (in 10 minutes)	2200W	3300W	4400W	6000W
Nominal voltage	230V			
Nominal frequency	50Hz			
AC wiring system	Single phase			
Nominal AC current	8.7 A	13 A	17.4A	26 A
Max. AC current	9.6 A	14.4A	19.2A	28.8 A
O/P current distortion (THD i)	< 3%			
Power Factor	0.99 (±0.9 on demand)			

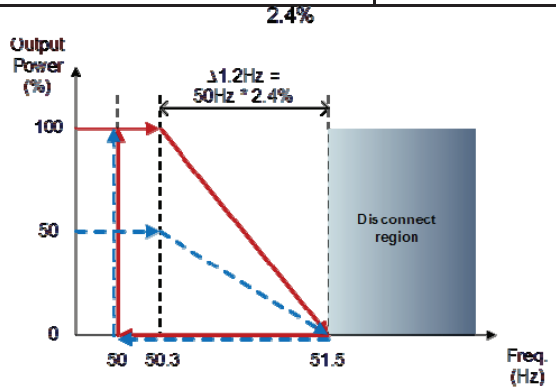
2. The max. operation voltage for two trackers to independent usage is 500V., and the max. power for one tracker is 4000W.
3. DC insulation resistance is the impedance of PV+ or PV- of DC input to the ground.
4. For the VDE-AR-N 4105 :
(1) The maximum power is 4600W. This means the SV 4600s doesn't have 110% over load ability.
(2) The maximum Q is equal to its normal AC power.
And the max power for RD1699 is 5000W.

3.3.2 Grid monitoring

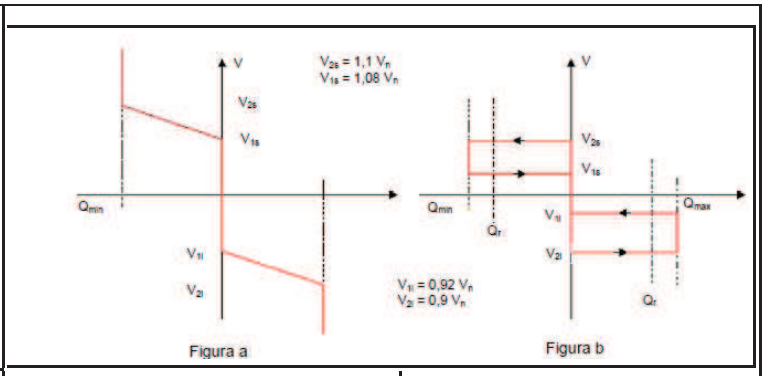
Model	SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K			SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K SOLEIL 1F-TL6K		
Grid Monitoring	VDE-AR-N 4105			VDE0126-1-1/A1		
limit of single phase	N/A			N/A		
Operational voltage range	230V, -20%+15%			230V, -20%+15%		
Disconnection time of excess operational voltage range[5]	-20%,+15%		+10%	-20%,+15%		+10%
	<0.1 seconds		<0.1 seconds	≤0.2 seconds		≤0.2 seconds
Voltage value setting in the firmware[6]	184V	264.5V	253V	187V	262V	250V
Power factor	0.9 lagging/leading			0.99		
Voltage tolerance	better than 1%			N/A		
Frequency tolerance	better than 0.1%			N/A		
Operational frequency range	 1. 47.5~51.5Hz , Disconnection within 0.2second, 2. Back frequency point: the same as the red curve(Before disconnection)					
Frequency value setting in the firmware	47.5 Hz		51.5Hz	47.55 Hz		51.45Hz
Reconnection time	**60s** @ 85% ~ 110% voltage &47.5Hz ~ 50.05Hz with **10% Power/min** increment					
Reconnection time(FW setting)						
Disconnection time of excess DC current injection (sec.)	< 0.1			< 0.2		
DC-Injection	1A			1A		

5. For the +10% definition, after calculating of the mean value of 10 minutes then it just can trip
6. If only an integrated NS protection is used for power generation systems of up to 30 kVA, then the value of the rise-in-voltage protection U of 1.1 Un shall not be changed.

Model	SOLEIL 1F-TL2K SOLEIL 1F-TL3K SOLEIL 1F-TL4K		
Grid Monitoring	RD1699		
limit of single phase	5KW		
Operational voltage range	230V, -15%+10%		
Disconnection time of excess operational voltage range	-15%	+10%	+15%
	<1.5s	<1.5s	<0.2s
Voltage value setting in the firmware	198V	250V	262V
Operational frequency range	48 ~ 50.5 Hz		
	48Hz	50.5Hz	
	<3s	<0.5s	
	Reconnection @50Hz if over frequency		
Frequency value setting in the firmware	48.05Hz	50.45 Hz	
Reconnection time	NA		
Reconnection time(FW setting)	180s		
Disconnection time of excess DC current injection (sec.)	< 0.2		
DC-Injection	0.5 % of Nominal AC current		
Note : The power factor of the energy supplied to the corporate network distribution should be as close as possible to the unit and, if anything, superior to 0.98 when the installation work to powers greater than 25 percent of its rated power			

Model		
Grid Monitoring	**CEI 0-21** *(1)	
limit of single phase	6kW	
Operational voltage range	**230V**	
Power factor range	**0.9 over excited or under excitred**	
S1 Voltage *(2) range	46 ~230V(20%-100%)	230 ~276.0V (100%-120%)
FW default setting	195.5V	253V
S1 V Disconnection Time range	0.05~5.00S	0.05~5.00S
FW default setting	0.5s	3s
S1 Frequency range	47.0 ~50.0Hz	50.0 ~52.0Hz
FW default setting	49.5Hz	50.5Hz
S1 F Disconnection Time	0.05~5.00S	0.05~5.00S
FW default setting	0.1s	0.1s
S2 Voltage	0 ~230V(0-100%)	230 ~299.0V(100%-130%)
FW default setting	92V	264.5V
S2 V Disconnection Time	0.05~5.00S	0.05~1.00S
FW default setting	0.3s	0.2s
S2 Frequency	47.0 ~50.0Hz	50.0 ~52.0Hz
FW default setting	47.5Hz	51.5Hz
S2 F Disconnection Time	0.05~5.00S	0.05~5.00S
FW default setting	0.1s	0.1s
Limitation curves of active power via frequency (2~5%Adjustable, 2.4% as Default)		
Reconnection time (FW Setting)	wait 300 sec with frequency inside "Value of frequency to reset the derating condition"	

Slow-Start after derating condition P(f)	20% per min to frozen load	
Reconnection voltage	195,5 V - 253 V	
Reconnection frequency range	settable from 49Hz to 51Hz by steps of 0,05Hz	
FW default setting	49,90 - 50,10 Hz	
Reconnection time	0s to 900s by steps 5s	
FW default setting	300s	
Slow-Start after disconnection	20% per min to minimal power	
FW default setting	20% per min to minimal power	
Disconnection time of excess	0.5% 1s	
DC current injection (sec.)	1A 0.2s	
DC-Injection	0.5% of Nominal AC current	
Reactive Power Control		
1.Const. Q		
2kVA	Cosfi = 1 P=2KW Q = 0 VAR	Cosfi = 0.9 P = 1,8KW Q= (-)872 Var ~ (+)872 Var (48.43% P)
3kVA	Cosfi = 1 P=3KW Q = 0 VAR	Cosfi = 0.9 P = 2,7KW Q= (-)1308 Var ~ (+)1308 Var (48.43% P)
4kVA	Cosfi = 1 P=4KW Q = 0 VAR	Cosfi = 0.9 P = 3,6KW Q= (-)1744 Var ~ (+)1744 Var (48.43% P)
6kVA	Cosfi = 1 P=6KW Q = 0 VAR	Cosfi = 0.9 P = 5,4KW Q= (-)2615 Var ~ (+)2615 Var (48.43% P)
2. Const PF	(-)0.90 ~(+)0.90 pf	

3. Curve Q(U)with type A&B		
	P Lock-in: 20% Pn	P Lock-out: 5% Pn
Node1:	*90%*	*(+)43.6% Q/S*
Node2:	*92%*	*(+) 0% Q/S*
Node3:	*108%*	*(+) 0% Q/S*
Node4:	*110%*	*(-)43.6% Q/S*
4.Curve PF(P) Type A	V Lock-in: 241.5 V	V Lock-out:230.0 V
Node1:	*20%*	*(+) 1.00pf*
Node2:	*40%*	*(+) 1.00pf*
Node3:	*50% (*note 3)*	*(+) 1.00pf*
Node4:	*90%*	*(-) 0.90pf*
Curve PF(P) Type B		
Node1:	*0%*	*(+) 1.00pf*
Node2:	*5%*	*(+) 1.00pf*
Node3:	*5%*	*(-)0.90pf*
Node4:	*90%*	*(-) 0.90pf*

(1) CEI 0-21 LV (S1=S2) LV & MV has the same default setting :
V↑ = 276V 0,5s, V↓ = 184V 1s, F↓ = 47Hz 4s, F↑ = 52Hz 1s, Slope:2.4%

(2) In CEI 0-21, Voltage & Frequency operation range & disconnection time setting are adjustable.
S1 Voltage average value of the voltage measured on a time window of 10 min mode moving average

(3) The inverter must start in any case when the F & V are allocated in 49.9~50.1hz & 195.5 ~253V, (included the first start)

4. General Specification

Model	SOLEIL 1F-TL2K	SOLEIL 1F-TL3K	SOLEIL 1F-TL4K	SOLEIL 1F-TL6K
Max. conversion efficiency	96.8%	97.2%	97.5%	97.5%
European efficiency	95.8%	96.5%	97%	97%
Topology	transformerless			
Power consumption: standby / night	< 7W / < 0.1W	< 7W / < 0.1W	< 7W / < 0.1W	< 10W / < 0.2W
Protection degree	IP43	IP65	IP65	Chassis: IP65 Fan: IP55
Heat dissipation	Convection	Convection	Convection	Force Air cooling (Fan easy replacement)
Front Bezel	- LCM display: Character 16 words, 2 lines			
LED indicator	Green (ON): Normal status Red (ON): Fault status. Inverter is unable to connect with grid.			
Communication (standard)	Extension Slot : RS485 Modbus			
	USB Type B receptacle			
Protocol				
Protection Device DC Switch	standard			
Hazard substance restriction	Lead free, complied with RoHS GP2			
Acoustic noise	< 35dB	< 35dB	< 35dB	< 45dB
Operating temperature range	-20 ~ +60℃			
Max. operating Temp. without derating for nominal voltage	40℃			
Humidity	0 to 95%, non-condensing	100%, condensing		
Altitude	Up to 2000m without power derating			
Grid interface regulation (according to setting)	VDE-AR-N 4105 / VDE0126-1-1/A1 CEI 0-21 RD1699 G83/1-1 / G59 Issue 2			
Safety	EN 62109-1 (2010) EN62109-2:2011 (IEC 62109-1; IEC 62109-2)			
EMC : EMS / EMI	EN 61000-6-2: 2005 / EN 61000-6-3: 2007+A1: 2011			
CE	LVD: 2006/95/EC EMC: 2004/108/EC			

Mechanical requirements

4.1 Dimension & Weight

Model	SOLEIL 1F-TL2K	SOLEIL 1F-TL3K	SOLEIL 1F-TL4K	SOLEIL 1F-TL6K
Dimension W×D×H (mm)	355*365*151	427*451*154	427*451*154	434*597*205
Net weight (Kg)	12.9	15	16.5	33.6
Gross weight (Kg)	15.8	18.7	20.1	39.4

4.2 Installation method

Model	SOLEIL 1F-TL2K	SOLEIL 1F-TL3K	SOLEIL 1F-TL4K	SOLEIL 1F-TL6K
Wall mounted	Yes			
Mounting Bracket	SIEL Standard wall bracket			

4.3 Connection of wires

Model	SOLEIL 1F-TL2K	SOLEIL 1F-TL3K	SOLEIL 1F-TL4K	SOLEIL 1F-TL6K
DC side pair(s) (+,-) MC connectors	1	2	2	1x2
DC connection	MC4 or Wieland/PST40i1			
DC wire diameter	14AWG	12AWG	12AWG	12AWG
AC TB	Dinkle connector or Phoenix connector			
AC wire diameter	14AWG	12AWG	12AWG	10AWG