solis seminars

Episode 50

How does the high power PV module adapt to the Inverter?

Background

With the rapid development of solar cell and photovoltaic module technology, the nominal power of PV modules now regularly breaks through from 400W+ to 500W+ and even to 600W+. The rapid development and increase in power of modules has put forward new requirements for inverter adaptation. So how do you choose the appropriate inverter for high power PV modules?

This Solis Seminar will give you detailed answers to ensure your inverters and modules are compatible.

PV Module Development Trends

Current PV technology is constantly updated and iterated, such as efficient PERC, black silicon, double glass, half chip, imbricated tile, etc.; In terms of silicon wafers, the size of silicon wafers also continues to increase, from 156mm to 182mm and 210mm, with the physical area of the wafers increasing by 37% and 83% respectively.

The PV module power of 182mm silicon wafers can exceed 540W, and the PV module power of 210mm silicon wafer exceeds 600W. Some module manufacturers have combined their new technologies to reach module power of 700W+.

Utilizing high power PV modules has many advantages. From the perspective of the overall system, high power PV module use has a positive impact on power generation efficiency, and can offer cost reduction across balance of

system items such as DC cables and will inevitably save on labor costs during installation.

For these reasons, high power PV modules are becoming the mainstream module of the industry.

How to Configure an Inverter with High-Power PV Modules

This high power development trend of PV modules has also had a significant impacton the technical development of inverters. The data in the following table comes from PV module data of 182mm silicon wafer and 210mm silicon wafer of a component manufacturer. The key parameters are as follows:

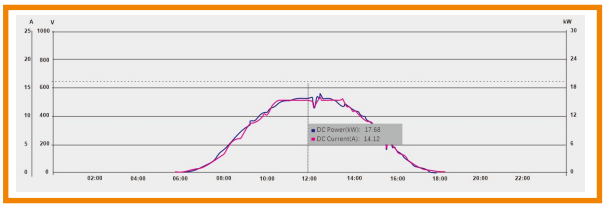
		PV module type & Wafer size			
		M10 (182mm)		G12 (210mm)	
STC Irrdiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5.)	Pmax[W]	535	550	600	670
	Voc[V]	49.35	49.80	41.44	46.1
	Isc[A]	13.78	13.88	18.41	18.62
	Vmp[V]	41.50	41.93	34.35	38.2
	Imp[A]	12.90	13.12	17.32	17.55

As you can see, the operating current and short-circuit current of the high-power PV module are both large. The current of the PV module corresponding to 210mm can reach more than 17A.

Therefore, any inverter being considered for use with high-power PV modules must meet the following requirements:

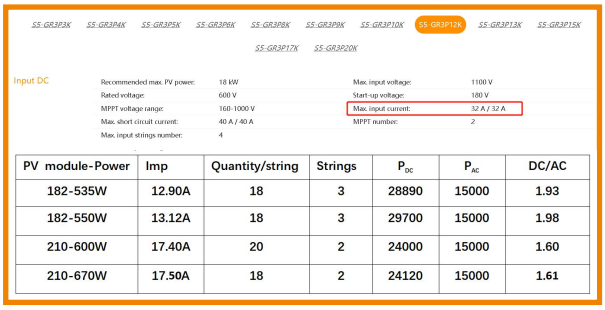
1. Higher String or MPPT Current

If the inverter MPPT current is lower than the specified modules, the input current will be limited during inverter operation, resulting in power generation loss. An inverter configured for use with high power PV modules must have a high enough string or MPPT input current capacity to maximise generation from the modules.



The maximum input current of Solis inverters reaches 18A and the maximum MPPT current reaches 36A. This allows for applications across Residential, C&I, and Utility scale systems. Customers can achieve a high DC ratio solution through accurate design ensuring compatibility with high current and high-power PV modules. The following are examples of solutions for residential, industrial and commercial projects.

Residential: Using a Solis three phase S5-GR3P15K as an example to configure the 182mm and 210mm PV modules.



PV module-Power	Imp	Quantity/string	Strings	P_{DC}	P_{AC}	DC/AC
182-535W	12.90A	18	3	28890	15000	1.93
182-550W	13.12A	18	3	29700	15000	1.98
210-600W	17.40A	20	2	24000	15000	1.60
210-670W	17.50A	18	2	24120	15000	1.61

We can see from this data that with proper design and configuration, Solis Residential products can adapt to the 182 and 210 PV modules and achieve a DC ratio of more than 1.6 times.

Commercial: Using Solis three phase S5-GC110K as an example. The 182 and 210 PV modules from the same manufacturer are used for configuration, and the maximum DC ratio can reach 1.8 times; shown below:

S5-GC100K S5-GC110K

Input DC

Max. input voltage:	1100 V	Rated voltage:	600 V
Start-up voltage:	195 V	MPPT voltage range:	180-1000 V
Max. input current:	10*32 A	Max. short circuit current:	10*40 A
MPPT number:	10	Max. input strings number:	20

PV module-Power	Imp	Quantity/string	Strings	P_{DC}	P_{AC}	DC/AC
182-535W	12.90A	18	20	192600	110000	1.75
182-550W	13.12A	18	20	198000	110000	1.80
210-600W	17.4A	24	10	144000	110000	1.31
210-670W	17.5A	22	10	147400	110000	1.34

Utility-scale: The 550W 182mm PV module in the table below is used for configuration with Solis-230K-EHV-5G-PLUS. The maximum DC ratio can reach 1.8 times:

Solis-215K-EHV-5G-PLUS Solis-255K-EHV-5G Solis-255K-EHV-5G-PLUS

Input DC

Max. input voltage:	1500 V	Rated voltage:	1080 V
Start-up voltage:	500 V	MPPT voltage range:	480-1500 V
Max. input current:	12*30 A	Max. short circuit current:	12*50 A
MPPT number:	12	Max. input strings number:	24

PV module-Power	Imp	Quantity/string	Strings	P_{DC}	P_{AC}	DC/AC
182-535W	12.90A	26	24	333840	230000	1.45
182-550W	13.12A	26	24	343200	230000	1.49

The PV module of 210mm can be configured with Solis-230K-EHV-5G, and the DC ratio can reach 1.24 times; shown below:

Solis-215K-EHV-5G-PLUS Solis-255K-EHV-5G Solis-255K-EHV-5G-PLUS

Input DC

Max. input voltage:	1500 V	Rated voltage:	1080 V
Start-up voltage:	500 V	MPPT voltage range:	480-1500 V
Max. input current:	14*26 A	Max. short circuit current:	14*40 A
MPPT number:	14	Max. input strings number:	28

PV module-Power	Imp	Quantity/string	Strings	P_{DC}	P_{AC}	DC/AC
210-600W	17.4A	34	14	285600	230000	1.24
210-670W	17.5A	30	14	281400	230000	1.22

2. The inverter must have long term load-bearing capacity

Solar PV module energy is transferred to the input end of the inverter through DC cables, and gradually transmitted and converted into AC output through electronic devices such as DC connectors, internal cables, PCB's, and power tubes. This sustained high current means that the overall hardware design of the inverter needs to be reevaluated and verified to meet the long-term and continuous bearing requirements.

DC connector | PCB design Improvement | Internal connection cable

Solis has always put product quality first, focusing on long service life and endurance of its inverters. Internal components such as DC connectors, power tubes and capacitors are only ever sourced from globally recognized brands , well known for their life expectancy and quality. For this reason Solis inverters are proven to have excellent DC bearing capacity.

3. Effective DC protection

The main challenge of high-power PV modules is that the working current increases greatly. According to the power consumption formula:

$$P = I^2 \times R$$

Power consumption is proportional to the square of the current, and high current leads to more serious DC heating under abnormal conditions. Therefore, adequate DC protection is the key to the safe and reliable operation of the solar system. It is even more important in the case of high-power PV module matching.

For example, Solis inverters have a variety of DC protection mechanisms, such as AFCI function, DC

breakers, anti-reverse connection protection, in line group string monitoring and I-V curve scanning.

Conclusion

Cost reduction and efficiency increases are the inevitable trend in the development of the solar industry as shown by high-power PV modules becoming the mainstream of the solar market. With the technological shift to high-power PV modules, inverters must also keep pace with this and match the performance of PV modules.
You can find out more about Solis inverters and how they could suit your next project here www.solisinverters.com