solis inverters by Ginlong Technologies (Stock Code: 300763.SZ) Service

I-Leak-Pro or Leakage current

Background

Leakage current failure: faults and possible causes as well as ways to prevent the issue. We will look at a real-life installation example to demonstrate the ways this common fault can be prevented.

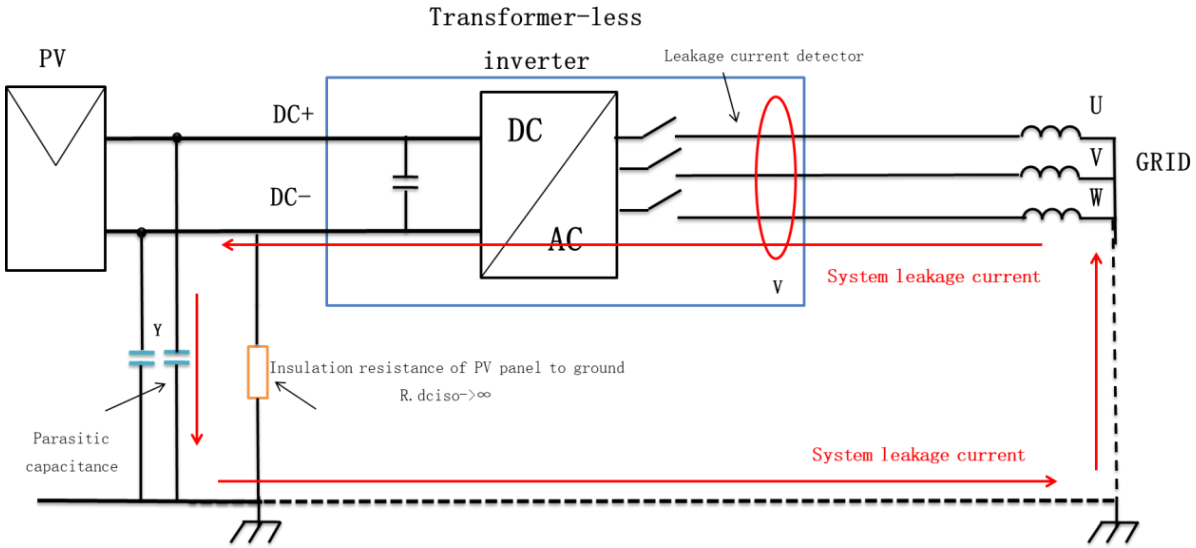
Failure Occurrence and Cause

In wet weather, "leakage current faults" are more likely to occur than "PV insulation faults", and leakage current protection equipment is more commonly triggered which will cause the inverter to shut down.
A likely cause is that the inverter is disconnected from the grid, entering the protection mode with the inverter screen displaying the error message of "ILeak-PRO 01/02/03/04". This could then trigger the leakage protection device if the system has such a device installed.

NOTE：

1) Alarm code“ILeak-PRO 01”, indicates a sudden leakage current of the system exceeding 30mA
2) Alarm code“ILeak-PRO 02”, indicates a sudden leakage current of the system exceeding 60mA
3) Alarm code“ILeak-PRO 03”, indicates a sudden leakage current of the system exceeding 150mA
4) Alarm code“ILeak-PRO 04”, indicates the system has a continuous leakage current

Likely Reason: This fault indicates that the inverter and the leakage current protector have detected leakage current from the PV system to the ground.



In such cases, the safety regulations require that the inverter must stop generating and enter the protection mode to protect the safety of people and equipment.

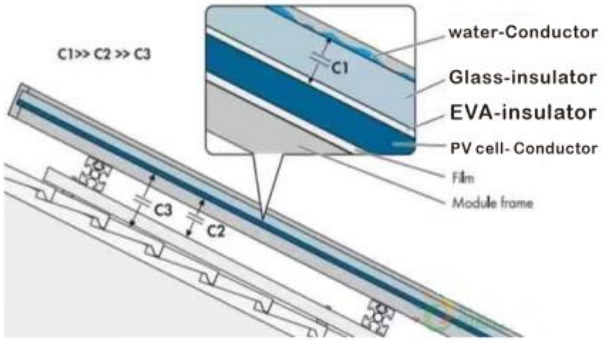
Probable cause: Leakage current faults are generally divided into three categories:

- External environmental factors (increased environmental humidity)
- System factors (poor system ground insulation)
- Inverter factors (leakage current detection protection threshold is too small)

Failure Analysis

1. Environmental factors

The environment can have a significant influence on this issue, especially in solar PV systems with a large capacity, and have vast areas of PV panels that form strong capacitive characteristics.
Due to application scenarios and installation location, it is easy for the system to be affected by environmental humidity, resulting in system capacitive leakage, especially on rainy days or damp mornings, and evenings.



$$I = \frac{f\varepsilon SU}{2kd} \begin{cases} \propto S \\ \propto \frac{1}{d} \end{cases}$$

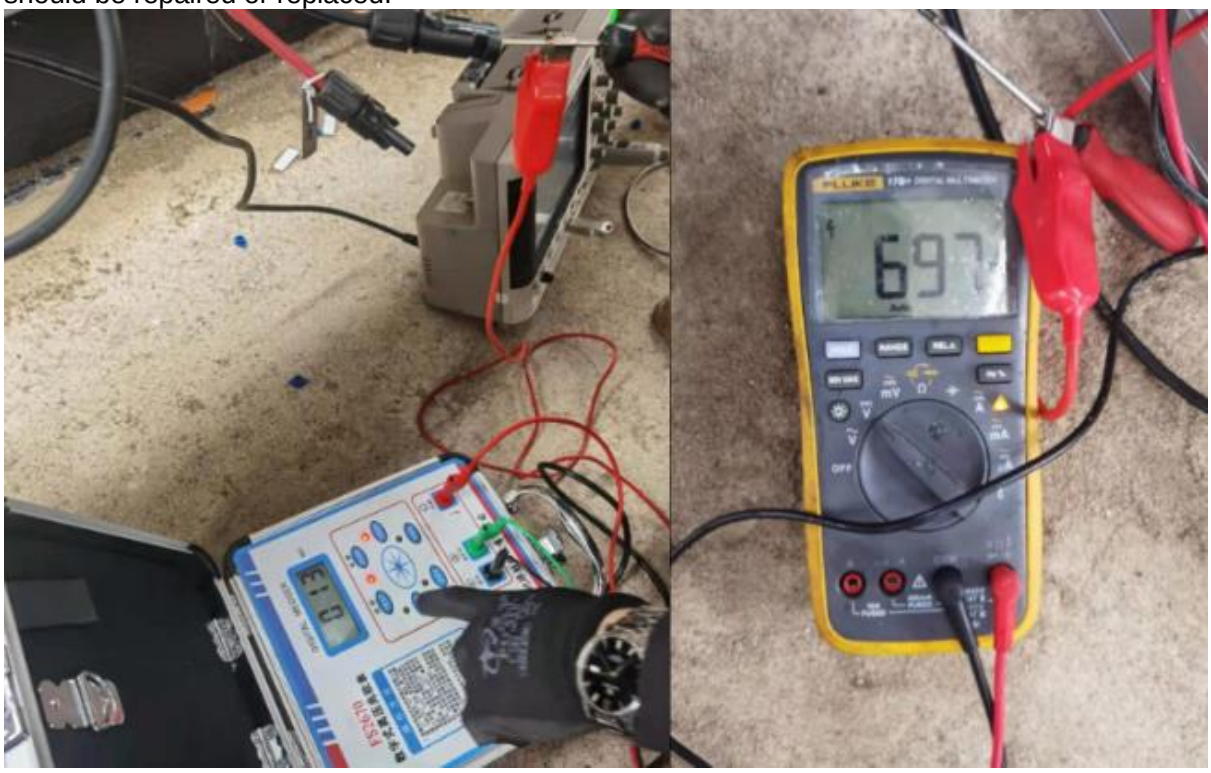
It is also known through field tests that the air humidity (medium ε) has a great influence on the stray capacitance of the system. It is easy to tell from the formula for leakage current (shown above) that the larger the PV panel area(S) , the higher the conductivity(ε) of air , and the shorter the distance(d) between the PV panel and ground or roof , the higher the leakage current will be. This is the reason why commercial solar PV projects, especially when the solar panels are "carpet" installed on galvanized steel roofs, it tends to trigger the current leakage alarm.

Testing of stray capacitance of PV strings to ground under different humidity		
Project type	2.2MW factory galvanized steel roof project	
Testing method	Bridge test method	
Result	Sunny day: The capacitance value of PV string to ground is 5~8nF	Rainy day: The capacitance value of PV panel to ground is 15~20nF

As shown in the table, the stray capacitance on rainy days is about 3 times that of sunny days. Considering the influence of the tiled area of the PV panel, the leakage current value will be larger.
Understanding the Fault: Note the alarm time. If it occurs in the morning, evening or on a rainy day, and goes into automatic recovery, then it is a normal phenomenon. If the alarm occurs frequently, it is necessary to investigate and adjust leakage protection thresholds according to the on-site working conditions;

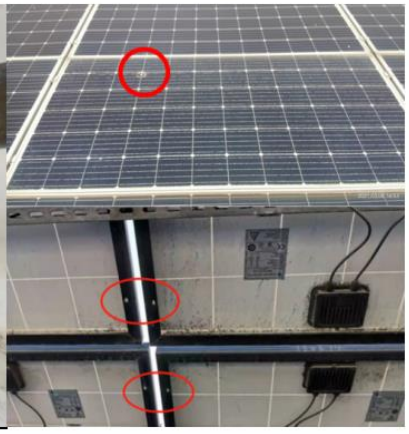
2. System factors

① Cable: If the cable sheath is damaged, it is easy to leak electricity when the air humidity is high.
Troubleshooting: Use a multi-meter or a meg-ohmmeter. If a cable with poor insulation is found, it should be repaired or replaced.



② Poor cable installation: Cable is directly installed on a roof without PVC pipe protection. When water accumulates on the roof, it is prone to short-circuit or current leakage. See images below.

③Poor grounding: Good grounding has two functions. The first is to effectively release the capacitive leakage current of the system to avoid excessive accumulation; the second is to ensure the safety of the system. If the grounding is sufficient and a leakage incident occurs, the leakage current will be sent to earth and will not cause an electric shock.



Damaged PV panel

PV panel is not grounded

Poor inverter grounding **Poor system grounding**

④ Other potential causes: The DC or AC line may not be firmly connected or the connector is damaged, which will cause current leakage. In addition, if the combiner box has poor airtightness, it will leak electricity after encountering water.

3. Inverter factors

After the necessary inspection and repair, if the system is in good and safe working order, the leak current protection value can be revised according to the local site conditions. Change the settings as follows:

Advanced settings→special settings→IgZero_COPM.Set→Setting ILeak.-L value

NOTE：The specific value depends on the working conditions on site. Please consult your local Solis support engineer or after-sales service team for additional guidance.

www.solisinverters.com/aftersales.html

Conclusion

On rainy or damp days, a solar PV system can be subjected to system faults which should not be overlooked. For some of the system's frequent failures, system owners should be aware of the possible cause, investigate accordingly and resolve the issue in good time. To fully protect the safety of equipment, surrounding buildings and personnel the PV plant should be kept in good operating conditions at all times.
Solis is one of the world's leading string inverter manufacturers and provides world class technical support and after sales service. If you have any technical and product questions about solar PV systems, please visit us at: www.solisinverters.com.

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