Application Note - Inverter Arc Detection in SolarEdge Systems (Europe & APAC)

Revision History

- Version 1.1 , Nov. 2017:
    - Error codes update according to new format released in inverter CPU v3.19xx
    - Auto reconnection time is the grid reconnection time according to the country setting
- Version 1.0, June 2016 - Initial release

Electric Arcs and Related Standards

An electric arc is an ongoing high-energy discharge, resulting from a current through a normally non-conductive material such as air.

When connecters or cables in a PV system are improperly connected or are damaged, the electric current may pass through the air, causing an electric arc. Arcs generate heat which can cause fires and they also pose an electrocution risk to those working near them. As PV systems age and connectors and cables degrade, the risk for electric arcs, while still low, increases.

In North America, UL/CSA safety requirements pertaining to arcs (UL1699B), requiring the ability to detect and terminate an arc through inverter shut down. The system has to remain shut down until an installer has checked the site and replaced any components if needed. Only then can the system be manually restarted.

In Europe and APAC, there are currently no standards for arc fault detection. In addition, there is no IEC or EN product standard available for arc fault detection (however there are recommendations in installation standards, e.g. IEC 62548). Since the risk of arcs in PV systems exists everywhere, arc fault detection is recommended and may be required in the future.

Arc Fault Detection in SolarEdge Systems

SolarEdge inverters installed in Europe & APAC with CPU version 3.19xx and higher comply with arc detection requirements, with two modes of inverter reconnection after an arc detection event:

- **Manual Reconnect** - The system must be manually restarted on site following inverter shut down.
- **Auto Reconnect** - Reconnects the system automatically after grid reconnection time according to the country setting. If the arc detection persists, the inverter disconnects and reconnects after the grid connection time until the event is resolved.

Enabling and Testing Arc Fault Detection

The arc fault circuit interruption (AFCI) option is disabled by default. Once it is enabled the default inverter reconnection mode is *Manual Reconnect*. In addition, when enabled, the inverter performs an automatic self-test for the arc fault detector each time the inverter "wakes-up" or is switched ON.

► **To enable/ disable arc detection:**

1. Enter Setup mode and scroll to the **Maintenance** menu.
2. Select **AFCI** ➔ **Enable** or **Disable**.

```
A F C I   < E n / D i s >
A F C I   M o d e   < M A N / A U T O >
```

► **To enable manual reconnect / auto connect:**

1. Enter Setup mode and scroll to the **Maintenance** menu.
2. Select **AFCI** ➔ **AFCI Mode** and choose the required mode: **Manual Reconnect** or **Auto Reconnect**.

```
M a n u a l   R e c o n n e c t
A u t o   R e c o n n e c t
```

► **To manually test the arc detection functionality:**

1. Make sure the inverter ON/OFF switch is turned ON.
2. Select **Maintenance ➔ Manual AFCI Test**.

    If the test is successful, the following message is displayed:

    ```
    Manual Test PASS
    ```

    The inverter production is then interrupted (as if a real arc detection has occurred), and the following error message is displayed (numbered either 18xC, 150 or 151):

    ```
    Error Code 18xC

    Arc Fault Detected
    ```

3. Perform manual restart to resume system operation: Turn the inverter ON/OFF switch to OFF and then to ON. The inverter performs an arc detection self-test and starts normal operation. If the test fails, contact SolarEdge support.

► **To troubleshoot arc-fault events:**

The inverter continuously performs arc detection while producing power. If an electric arc is detected, the inverter stops producing power. The following error message is displayed (numbered either 18xC, 150 or 151) ; if the inverter is connected to the SolarEdge monitoring platform, the error is displayed there as well):

```
Error Code 18xC

Arc Fault Detected
```

If this message is displayed:

1. Turn the inverter ON/OFF switch to OFF.
2. Check all PV strings for the correct open-circuit voltage:
    *   Inspect all connections and cables between the power optimizers in the strings: Verify they are connected properly by firmly pushing and pulling the plugs and verifying the connectors are locked.
    *   Inspect all connections and cables between the PV modules and the power optimizers: Verify they are connected properly by firmly pushing and pulling the plugs and verifying the connectors are locked.
    *   Verify that the strings are firmly attached to the DC Safety Unit (if applicable) terminal blocks.
    *   Verify all site-made connectors are firmly connected to their conductors by pulling from the conductor side of the connection.
3. If the system is set to manual reconnect, do the following:
    *   Turn the inverter ON/OFF switch to OFF.
    *   Turn the inverter ON/OFF switch to ON. The inverter performs an arc detection self-test and starts normal operation.

► **To troubleshoot self-test failures:**

If the self-test fails, the inverter displays an error message indicating that the arc detector hardware failed during wake-up tests (if the inverter is connected to the SolarEdge monitoring platform, the error is displayed there as well):

```
Error Code 18x8D
AFCI
self-test failed
```

The inverter continuously repeats the arc detection self-test until it is successful.

If the problem persists, contact SolarEdge support.