

PV Ground Fault Detection for Growatt 10000/12000/18000/20000UE

PV plants with transformerless PV inverters are not galvanically isolated from the grid while feeding power. Therefore, the PV inverters should have a ground fault protection considering the safety of operators and compliance of standards.

For Growatt 10000/12000/18000/20000UE, PV isolation is measured before grid connection and residual current is measured after grid connection. Once fault occurs, PV inverter will disconnect the neutral from DC side by opening the output relay.

1. PV isolation measurement

Before each grid connection, the resistances between both the positive pole and negative pole of PV panel and earth are measured. Either measured value is lower than the limit, the PV inverter will not connect to grid, and show 'PV isolation low'. In this condition, the neutral is disconnected from the DC side as the output relay of the PV inverter is open. The limited value mentioned above is determined by the standards. The firmware setting of our PV inverters is 1Mohm at present.

The simplified principle of the isolation resistance measurement is described as Image1 and Image2.

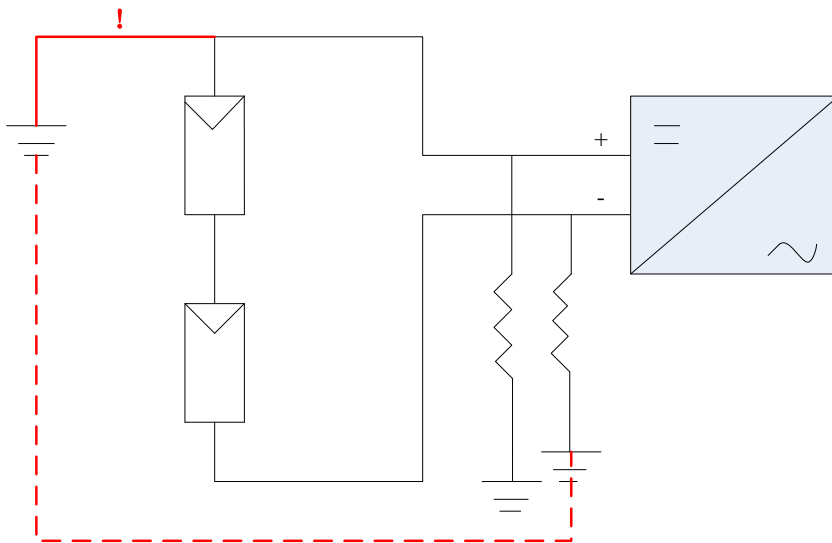


Image1

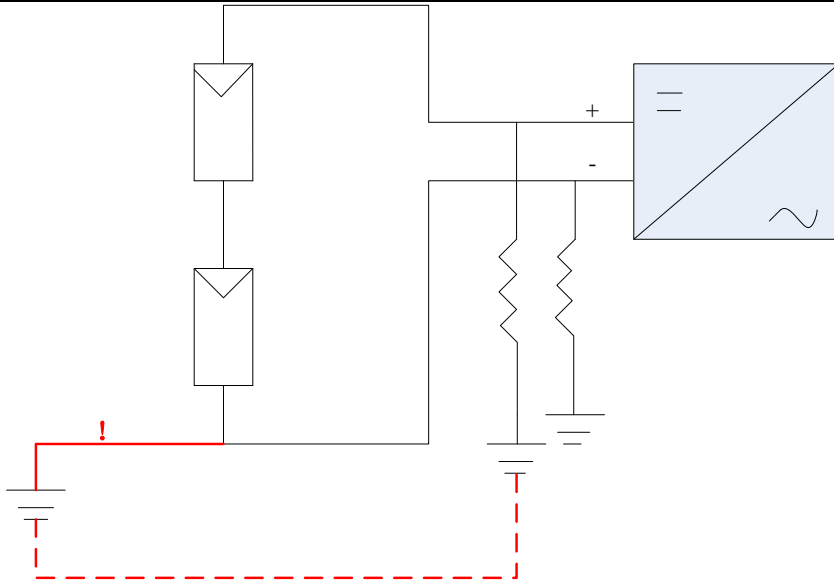


Image2

Image1 shows the current loop when the impedance of positive pole of DC side to earth is low, and Image2 shows which the negative to earth. Due to the exist of current loop, we can measure the impedance precisely.

2. Residual Current Monitoring Unit (RCMU)

Residual current is detected by the RCMU in feed-in state. Once the detected current reaches the following defined values, the inverter will turn off the relays in order to disconnect the neutral from DC side.

The RCMU protection below is defined by VDE0126-1-1 and IEC62109.

Residual current(sudden change)	Maximum disconnect time
30mA	300ms
60mA	150ms
150mA	60ms

The disconnection time in the event of leakage current larger than 300mA amounts to 300ms.

The PV inverter performs a self detection of RCMU every time before connecting to grid to make sure the RCMU can operation normally. Also the output relays are checked after RCMU self-detection.

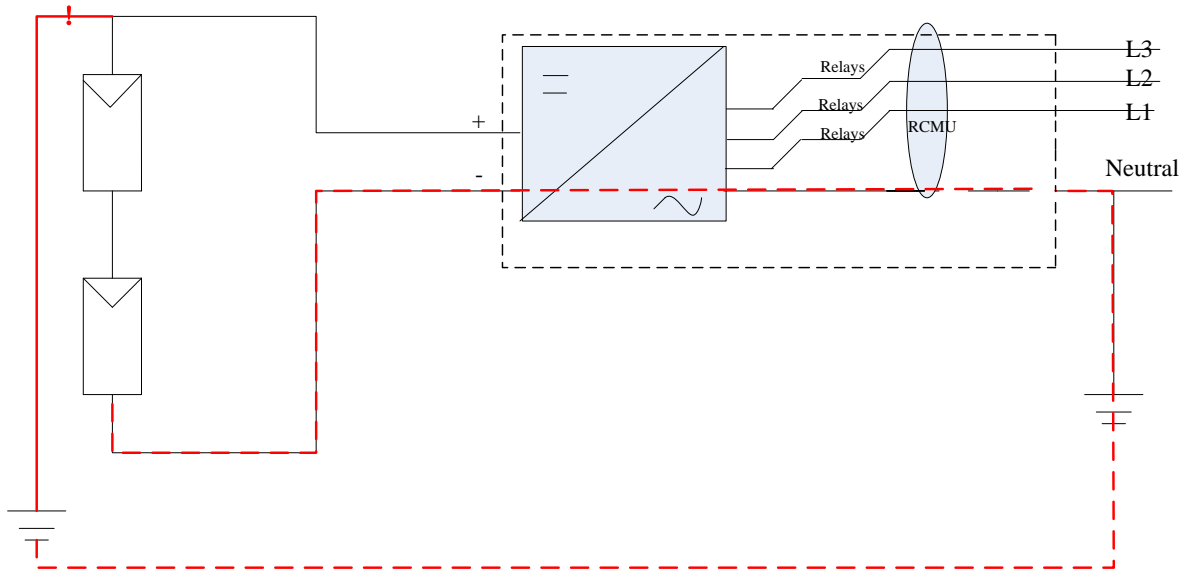


Image3

The above figure shows the situation when there is a residual current during feed-in operation.

In general, the Growatt 10000/12000/18000/20000UE has PV isolation measurement before grid connection and RCMU detection during grid connection to ensure it can disconnect from grid once PV ground fault occurs.

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