

## EREC G99 and Loss of Mains (LOM) Protection

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### EREC G99

Due to the huge increase in Distributed Generation (DG) in GB and across Europe, it has been recognised that DG needs to do more to provide support to power systems. This means that generation is required to support frequency, remains connected if possible and rides through faults, rather than tripping off, and potentially exacerbating any problems. In GB, G99 has been introduced to meet these demands.

G99 replaces G59 and generators connecting after 27 April 2019 must connect under G99.

Under G59, the protection relay (now called Interface Protection relay under G99) was the main piece of equipment that provided compliance. The “G59” relay is now only a very small part of the connection process.

### Interface Protection Relay

The protection relay is an electronic monitoring device which looks at the quality and stability of the grid connection. It is programmed to certain fixed parameters dictated by the DNO which includes voltage, frequency and Loss of Mains (LOM).

The voltage and frequency elements make sure that the voltage and frequency are within defined statutory limits. To reduce the occurrence of nuisance tripping, there are 2 stages before the relay operates. The intention is that a small excursion outside the limits is permitted for a relatively long period before tripping, but a large excursion will result in a rapid trip.

LOM is a general term associated with the automatic detection process which provides an ability to detect a change and so loss of the network/grid supply to which the generator is connected.

Should any of these areas go outside the programmed limits, then the relay will cause a protective device such as a circuit breaker to open, thereby instantly disconnecting the generator from the grid.

Without LOM protection, a fault on the on the DNO’s network may result in an embedded (or distributed generator) supplying a section of the Distribution Network. This is referred to as an “island” situation and may consist of anything from a few customers connected at low voltage (LV) to many customers connected to the high voltage (HV) network.

It is considered extremely dangerous for an island to be created and remain active. There are 2 issues:

1. The island powered by the embedded generator will almost immediately lose synchronous alignment with the Distribution Network and may cause damage to the generator when the grid is reconnected. This will especially occur on rural Distribution Networks where auto-reclosing schemes are used.
2. The generator will supply the Distribution Network without the knowledge of the DNO, causing danger to the DNO’s staff who expect the network to be dead. Also, there may be damage to customers’ equipment due to the unregulated supplies being outside statutory limits.

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There are 2 main methods for LOM detection. They are known as Rate of Change of Frequency (RoCoF) or Vector Shift (VS). These modules in the relay continuously monitor the AC waveform's sinusoidal pattern. If there is a sudden change and the change is outside the detectors pre-set limits, the relay will operate and cause a circuit breaker to open.

VS is susceptible to spurious operation during voltage disturbances caused by faults on the transmission network and is less effective at detecting islands on the Distribution Network.

In May 2016, WPD suffered a widespread loss of distributed generation in the south of England as a result of VS LOM protection. This was following a fault on the 400kv transmission network, probably caused by lightning. An investigation established that around 400MW of distributed generation was lost from the system. The evidence pointed to a wide spread operation of VS protection while RoCoF protection remained unaffected as the event did not cause a frequency change outside the G59 settings.

As a result, from February 2018, generators are not be permitted to implement VS as the form of LOM protection. (Some DNOs prohibited the use of VS LOM protection before this date.)

As distributed generation is now playing a larger role in supporting the frequency and stability of the wider power system, it is essential that the risk of inadvertent operation of protection is minimised.

Reducing nuisance tripping will also benefit generators by resulting in more generation.

Due to the replacement of traditional large steam turbine driven synchronous generators connected to the transmission system with smaller wind, hydro and solar generation predominately connected to the distribution system, it has been recognised that LOM protection needs to be updated further.

A Distribution Code Review Panel has recommended to Ofgem that the new LOM settings are applied to all generators. The Distribution Code has been modified requiring all qualifying generators to be compliant with the new settings by May 2022.

The work may involve re-programming the existing relay or replacing an existing VS relay or single function RoCoF relay, that can't be reprogrammed. The ENA estimate that there are 50,000 sites that require modification.

The current RoCoF setting is 0.125 Hz/s and the new setting is 1 Hz/s, an eight times increase. There is also a time delay of 0.5s before a trip can be initiated. These changes are to reduce the risk of nuisance tripping.

This recommendation will have a significant effect on many existing owners of generation in that to remain compliant with their Embedded Generation Connection Agreement (EGCA) and the Distribution Code, they will be compelled to make changes to their LOM protection in a short timescale. Assistance and funding are available and the ENA portal for applications will be open from mid-May. Approval for the first batch of applications will be by mid-August.