

Commercial Fault Current Limiter for Distribution & Transmission Networks

- Protects the Grid by Suppressing Fault Currents
- Instantaneous Response to Network Faults
- Immediate Recovery when Fault Clears
- Standard Transformer Technology (no Cryogenics)
- Scalable up to Extra High Voltage Ratings
- Cuts Capital and Operating Costs of the Grid
- Prolongs Useful Life of Network Plant
- Enables Capacity Increase
- Facilitates Interconnectivity & Smart Networks
- Enables Renewable Generation Connection

The ever-increasing network complexity, competitive power markets, rapidly growing intermittent renewable supply and aging infrastructure conspire to challenge system operators daily. GridON is offering operators and network designers commercially available fault current limiter (FCL) to enable grid inter-connectivity and capacity increase, and to facilitate connection of additional power generation and renewable energy sources. They are an essential element in improving grid resilience and reliability, can significantly lower capital expenditures and operating costs, and extend the useful life of substations and grid infrastructure.

The design is based on combining industry-standard, proven transformer technology with GridON's unique and proprietary concept of magnetic flux alteration to saturate an iron core. GridON's device offers performance benefits including instant, self-triggering response to a fault, immediate recovery following clearance of the fault without network interruption, and suppression of multiple consecutive faults. It is the first such fully tested, commercially viable pre-saturated fault current limiter.

Removing the fault level constraints without costly network upgrades enables the installation of more low carbon and other electricity generation directly onto the distribution system, with shorter connection times and reduced connection costs. It also enables smart distribution networks with increased network efficiency, flexibility, reliability and resilience. The breakthrough in design removes the need for superconducting components which results in a simple, reliable and low maintenance solution. Unlike previous FCL technologies which have not reached commercial viability, GridON's solution is fully scalable for use at all voltage levels on both distribution and transmission systems.

GridON has partnered with Australian based Wilson Transformer Company – a shareholder and engineering and manufacturing partner - to bring this innovative state-of-the-art portfolio of FCL products to the market.

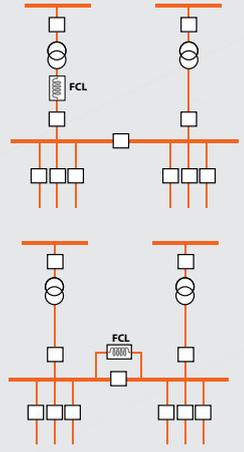
The Energy Technologies Institute has procured and funded a US\$7m development and demonstration project, aiming to drive the technology development to a point at which network operators could deploy this product which is now commercially available. Following comprehensive testing by Testing & Certification Australia, the FCL is now in service at a UK Power Networks main substation in East Sussex, UK. E.ON New Build & Technology provided technical assurance and network modeling support throughout the project.

GridON has recently won the 2013 UK Energy Innovation Award for the Best Energy Network Improvement. Topping thousands of other innovative technologies, GridON was also the proud recipient of the 2011 GE ecomagination "Powering the Grid" award and the 2012 European ACES Smart Grid award.



GridFeed FCL in a transformer feeder location

Placing a GridFeed FCL in a transformer feeder location offers great flexibility in reducing substation fault levels to accommodate switchgear ratings. One or more FCLs may be installed, depending on the fault reduction required, with minimal changes to existing protection settings. The FCL may be included in the transformer protection zone, with no additional relays or CTs required. The FCL may also be used to improve load-balancing between feeder transformers with different impedances and/or rated powers. GridFeed FCLs enable capacity increase on existing grids.



GridConnect FCL in a bus-tie location

Placing a GridConnect FCL in a bus-tie location offers significant advantages in paralleling bus sections upon loss of one or more transformers in the substation. It also enables paralleling of bus sections in previously split substations, allowing interconnectivity, more flexible running arrangements and increased power quality. One or more FCLs may be installed, depending on the bus-bar topology and fault reduction required, with minimal changes to existing protection settings. The FCL may be paralleled with existing bus-tie circuit breakers, with no additional relays or CTs required.

The FCL utilizes copper windings wound onto a DC biased, pre-saturated iron core, enabling it to present very low impedance during normal operation.

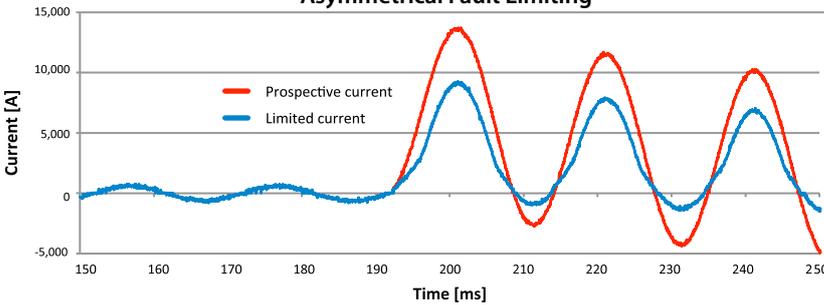
When fault conditions occur, the iron core is self-driven instantaneously out of saturation, presenting much higher impedance to the grid, thereby limiting the fault current. Upon fault clearing, the FCL immediately (<1ms) resumes its low impedance normal condition, ready to protect against any subsequent network faults.

GridON's FCLs currently support all transmission and distribution voltage levels and offer fault current reduction flexibility to suit the specific application and customer requirements.

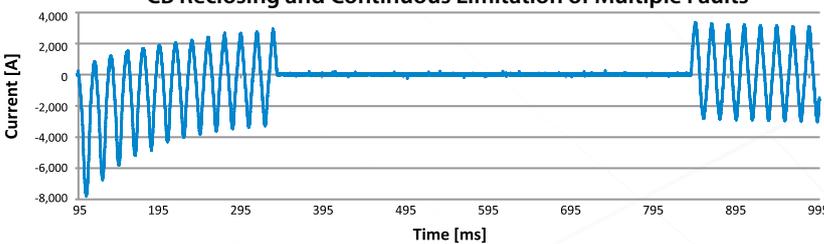
10MVA GridFeed FCL for UK Power Networks

Prior to installation, the FC was fully tested under extreme network conditions by Testing & Certification Australia, a certified high power laboratory. Performance and withstand to fault current events have been demonstrated over 50 fault tests. Immunity to loss of DC bias has been verified both in nominal load and fault conditions. The device has been tested under circuit breaker reclosing and fault recovery conditions, demonstrating full fault limiting capability for repeated faults. Instantaneous recovery from fault back to nominal impedance has been demonstrated.

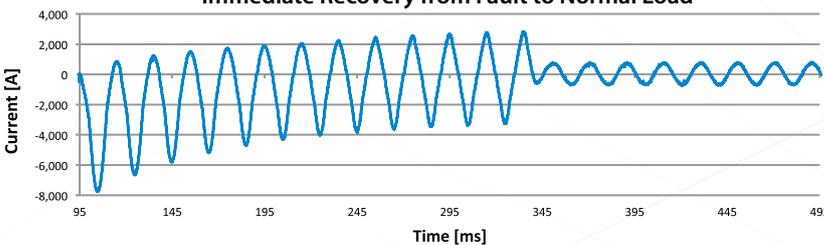
Asymmetrical Fault Limiting



CB Reclosing and Continuous Limitation of Multiple Faults



Immediate Recovery from Fault to Normal Load



10MVA Key Parameters

| Parameter | Value |
|--------------------------------------|--|
| Line Voltage | 11kV, 50Hz, 3-ph |
| Nominal load current (power through) | 525Arms (10MVA) |
| Prospective fault current | 5.34kA rms, 13.6kA peak |
| Limited fault current | 2.22kA rms, 9.13kA peak |
| Fault current reduction (clipping) | 58% of steady state rms (33% of first peak) |
| Tested fault withstand duration | 3 seconds |
| Recovery from fault to normal load | Instantaneous (less than 1msec) |
| CB reclosing | Fully tested with 500msec dead zone between faults |
| Voltage drop during normal operation | 0.8-2% |
| Power frequency voltage withstand | 28kV |
| Lightning impulse withstand | 75kV |

A comprehensive monitoring and control system is provided with the FCL to enable seamless integration with existing protection schemes and to provide a real-time view of the FCL operational parameters. GridON offers the DR-FCL monitoring system from Dynamic Ratings as part of its solution.