

Ground Fault Current Protection Devices Prevent Costly Production Shutdowns



Figure 1 Altech's three new series deliver multiple capabilities. In all three series, ground fault sensitivity levels range from 10 to 500 mA.

An unintentional electric path between a source of current and a grounded surface is referred to as a "ground fault." Ground faults occur when current is leaking somewhere. It is frequently the result of insulation breakdown or loss when age or other environmental factors degrade the conductor insulation, causing an inadvertent contact between a live conductor and ground. Most short circuits initially manifest as ground faults; if undetected, they can cause serious and costly damage to electrical systems and equipment, crippling production and disrupting supply chains.

Ground fault protection of equipment (GFPE) can prevent these faults in automated processes and reduce or eliminate costly plant downtimes. Ground fault protection is essential in commercial, industrial, and institutional facilities such as (but not limited to):

- Chemical Plants,
- Refineries,
- Waste water treatment plants,
- Semiconductor facilities,
- Pharmaceutical plants, and
- Other plants near water (especially salt water).

Ground fault protection of equipment (GFPE) is defined in Article 100 of the National Electrical Code (NEC) as "a system intended to provide protection of equipment from damaging line-to-ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit." The focus of the NEC, which is a code developed by the National Fire Protection Association (NFPA), is primarily fire prevention. Circuit protection is required to prevent fires from occurring due to overcurrent faults or short-circuits.

GFPE devices work by quickly and automatically disconnecting a circuit when it detects that the electric current is not balanced between the energized (line) conductor(s) and the return (neutral) conductor. Apart from saving production equipment from unnecessary downtime (and potential injury to personnel) these devices also can help with:

- Motor winding failure detection,
- “Surveillance” on wire insulation, and
- Detecting potential short circuits before they occur.

Altech offers a wide variety of solutions to help prevent production shutdowns due to AC and DC pulsating ground faults, as well as overloads and short circuits. This article will look at its newest technology lineup — including an industry “first” — consisting of three series of devices; in all three series, ground fault sensitivity levels range from 10 mA – 500 mA.

Three New Series

Altech’s GFL series is the industry’s first combination of a UL 489 Branch Circuit Protector with a Ground Fault Equipment Protector. By way of review, a branch circuit is the wiring portion of a system extending beyond the final overcurrent device protecting the circuit. A Ground Fault Equipment Protector which is intended to protect equipment from damage should not be confused with five mA ground fault circuit interrupters (GFCIs), which provide personnel protection from electrical shock.

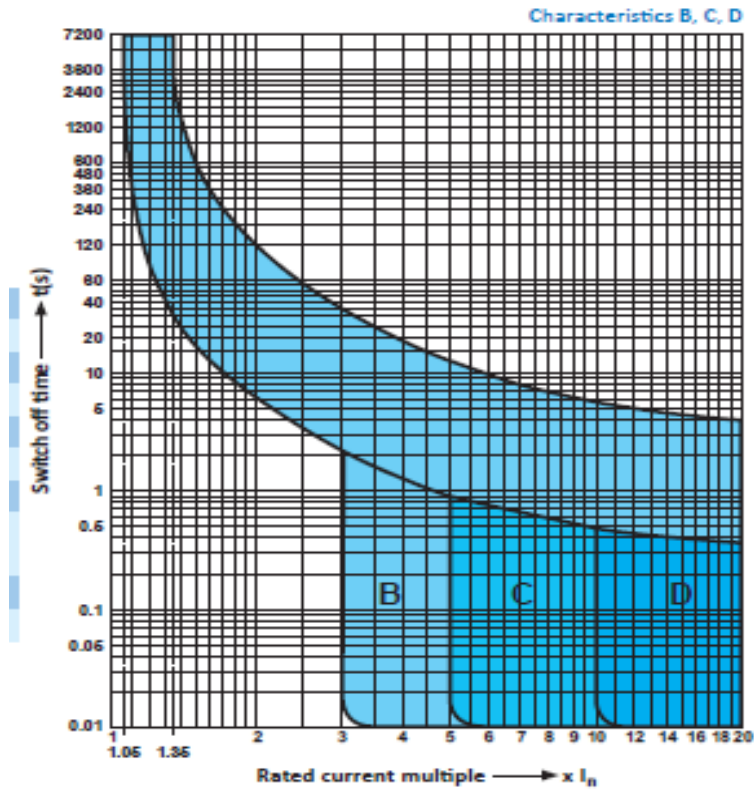
GLF series devices are designed to provide protection against short circuits, overloads, AC ground faults (residual current faults), and pulsating DC ground faults. Eliminating the need for upstream circuit protection, GFL devices are available in one pole+N, two pole, and two pole+N switching — live and neutral disconnect — at 120/240 V AC and 240 V AC.

The number of poles represents the number of conductors that are interrupted when a fault condition occurs. A single-pole device interrupts only the energized conductor, while a double-pole device interrupts both the energized and return conductors. The +N terms signify that the return, or neutral conductor is an isolating pole only.

Ground fault sensitivity levels for the GLF series range from 10 mA–500 mA. Rated current is 5 A–40 A and rated Short Circuit Interrupt Capacity is 10 kA.

UL 489, “Standard for Molded-Case Circuit Breakers and Circuit Breaker Enclosures,” published by Underwriters Laboratories, Inc. spells out requirements for overcurrent protection devices in a branch circuit. For approval, UL 489 requires the device pass a series of calibration, overload, endurance, and short-circuit tests. Minimum short-circuit tests are performed at 5000 A. Overload tests are performed at six times the current rating of the device, or 150 A minimum. Devices rated up to 600 V and 6,000 A are covered in this standard. The device must survive short-circuit testing and continue to provide future overload protection.

GFL Series RCBO Overload Trip Curves



GFL Series RCBO Ground Fault Trip Curve

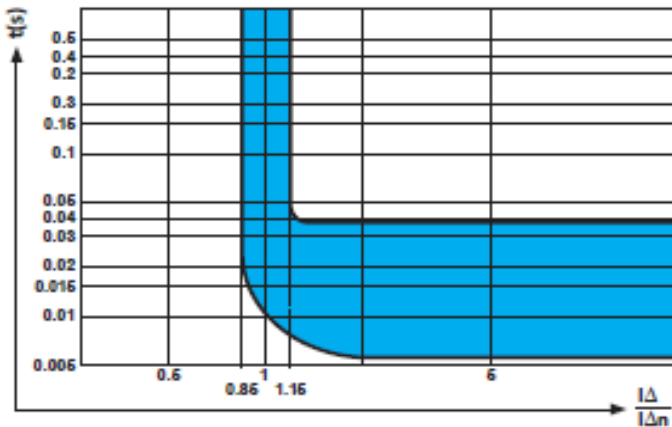


Figure 2. GFL series RCBO overload (top) and ground fault (bottom) trip curves.

Circuit breaker operating characteristics are graphically presented on time/current characteristic curves, commonly called trip curves, that plot tripping time versus current level. The curve (Fig. 2 top) shows the amount of time required for a circuit breaker to trip at a given overcurrent level.

For GLF devices, for instance, three overload trip curves (B, C, and D) can be specified. The Type B characteristic is designed for European residential circuit protection. This characteristic can also be used for protection of computers and electronic equipment. The Type C characteristic is for general device protection in control circuits, and the Type D characteristic is designed for high inrush loads. These curves are developed using predefined specifications such as operation at an ambient temperature of 40° C. For different ambient temperatures, the current values of the tripping operation can change by approximately 5% per 10° K temperature difference.

The Ground fault Characteristic Curve for the GFL series is shown in Fig. 2 (bottom). The ground fault function consists of a pickup and delay setting. The pickup portion determines at what point the circuit breaker will begin detecting a ground fault. The delay adjustment determines how long the circuit breaker will delay tripping after a ground fault has been detected.

UL standard 1077 covers supplementary protectors used in equipment. A supplemental protector is defined as an overcurrent device for protection of the end circuit; it may be added to a circuit to provide an extra level of protection for a specific component. These devices require the use of an upstream protective device so, generally, these protectors have lower short-circuit protection, as it's assumed that there's branch circuit protection upstream. Where UL 489 devices are tasked with conductor protection, protection of the load is the primary purpose of selecting a UL 1077 device.

When your application requires supplemental protection for control circuits and on the load side of branch circuit protectors, Altech's UL1077 solution is the GFR series. GFR devices can be supplied with two and four poles at 277 V AC and 480 Y/277 V AC and with a rated current of 5 A–40 A. Rated Short Circuit Withstand Capacity is 10 kA.

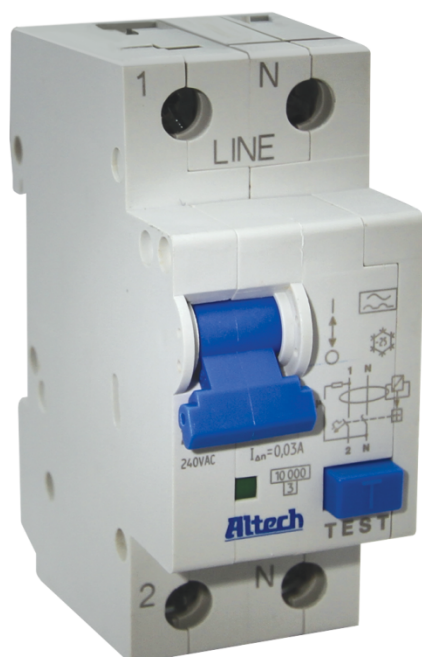


Figure.3 Altech's two pole GFR series combines a Ground Fault Relay and a supplementary protector

The GFR series (Fig. 3) is a space-saving design as it serves as a combined equipment Ground Fault Relay and Supplementary Protector (RCBO or residual-current circuit breaker with overcurrent protection). The GFR series features dual pole switching (live and neutral) and is designed to provide protection against overloads and AC ground faults (residual current faults) as well as pulsating DC ground faults. A ground fault relay detects all phase-to-ground faults within its defined zone of protection under conditions which produce minimum fault current. Ground fault relays are used to sense low magnitude ground faults. When the ground fault current magnitude and time reach the ground fault relay pick up setting, the control scheme signals the circuit disconnect to open.

Similar to UL 489, UL 1077 supplementary protectors must pass a series of calibration, overload, endurance, and short-circuit tests. A supplementary protector can be overload tested at 1.5 times its rating for general use or six times its rating for motor starting. It may trip at less than 125% of its rating or greater than 135%. Unlike UL 489, UL1077 devices do not necessarily need to survive the test.

The GF Series of UL 1053 Ground Fault Sensing and relaying devices provides residual current protection for circuits with loads up to 63 A in one to three poles at 480 Y/277 V AC with a 10 kA short circuit withstand rating. Three trip curves (B, C, and D) are offered. Designed with two and four poles, the series offers rated current of 25 A, 40 A, and 63 A, and is rated a Short Circuit Withstand Capacity of 10 kA. It represents a retrofit GFEP, where standard overload and short circuit protection is already being provided (or will be provided) by other means.

UL1053 requirements cover equipment intended for use in circuits that are solidly grounded. They do not cover ground fault circuit-interrupters, nor equipment intended to be powered from single-phase circuits operating at more than 600 V or three-phase circuits operating at more than 600 V phase-to-phase.

The Altech Advantage

The three series mentioned above are the latest additions to Altech's UL listed product range. Designed to meet the most demanding conditions, these competitively priced, technically correct circuit protection devices cover most applications where meeting UL and NEC requirements is essential. Altech further provides comprehensive product support and the capability to develop customized solutions to meet particular requirements.

For more information go to ([URL here](#))