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Power Xpert C445 Motor Management Relay provides high-accuracy ground fault protection for motor and feeder loads

Power Xpert C445™ provides multiple unit-level ground fault detection methods for use on pulsed ground detection, solidly grounded, low resistance grounded, or high resistance grounded (HRG) systems. It offers the advanced features of a dedicated ground fault relay but built into the motor management relay—saving space, cost, time, and complexity.

Customer benefits

Providing internal ground fault detection and protection for residual, pulse, and zero sequence, the C445 allows the user to select the right protection level for their system while optimizing cost and footprint.

Motor applications: In addition to the standard overload and advanced current/voltage/power protections, the C445 offers a patented algorithm for detection and protection of residual, pulse, and zero-sequence ground faults.

Feeder applications: C445 offers a single easy-to-use compact product that can be used for ground fault protection and detection. The standard C445 can monitor feeder current and detect a pulse from a pulser on an HRG system. With the addition of the ground fault module and current transformer (CT), the system can be used as a compact, zero-sequence ground fault relay on both solid and high resistance grounded systems.

C445 ground fault methods summarized

Method	Levels	How it works	Ground type
Residual summation	0.12 A—50% Ext. CT primary (varies by size)	Sums three-phase currents from built-in CTs to detect ground fault.	Solidly grounded high resistance ground
Zero-sequence CT	0.03–10 A	Achieves higher sensitivity detection through use of a zero-sequence CT input.	Solidly grounded high resistance ground
Pulse detect	Compatible on systems down to 1 A	Uses a patented algorithm to locate ground faults on pulsed HRG systems without a zero-sequence CT.	High resistance ground with pulser system

Residual summation method

Summary: C445 uses three-phase current measurements from the embedded pass-through CTs to calculate ground fault current.

Application considerations: The residual method is a great built-in option that can be applied on any system. The C445's residual method is very accurate for this type of protection—with the ability to detect down to 3 A for systems up to 90 A.

Protection options: Users may set independent warning and trip levels and delays. A warning is only present when the threshold is met, and will auto-clear when it is not. A fault will cause a trip opening the contactor and requires reset. The user can configure the C445 so a trip can be set to auto-reset.

Modules required: Base system of **C445B_** base control module + **C445M_** measurement module. **C445UM** user interface is recommended for fault indication and diagnostics.

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Zero-sequence method

Summary: C445 achieves higher sensitivity ground fault detection with the addition of a small add-on module that accepts an input from a zero-sequence CT.

Application considerations: Higher level of accuracy, low level ground fault detection is used on both solidly grounded and high resistance ground systems. The zero-sequence module enables the C445 to accurately detect a low ground fault current. This allows the user to quickly locate the motor/feeder causing the ground fault. In many systems, this detection is only done at the switchgear level—requiring manual tracing of the downstream fault that can take hours or even days.

Protection options: The zero-sequence method provides options for: indication only, breaker shunt trip, or contactor trip.

- **Indication only:** Designed for HRG systems where the fault must be communicated, while leaving the system running. The event indication will latch until reset (can be set to auto-reset if desired). C445 will automatically notify via the C445UM fault LED and description window. Users may also view/record the fault over the network, or use a dedicated pilot device light.
- **Breaker shunt trip:** A selectable option that uses output Q3 on C445 to actuate a breaker shunt trip.
- **Contactor trip:** Same as standard C445 motor protections. If enabled, a protective event will open the contactor and require reset.

Modules required: The **C445XG-MOD** ground fault module that accepts an input from one of four sizes of zero-sequence CTs (**C445XG-CT2**, **C445XG-CT3**, **C445XG-CT4**, and **C445XG-CT7**.

C445B_ base control module—required.

C445M_ measurement module is needed for motor applications and feeder applications can be used as stand-alone ground fault relay mode.

C445UM user interface is recommended for automatic fault indication.

Pulse detect by Eaton method

Summary: C445 offers a patented pulse detect algorithm that can locate ground faults on pulsed HRG systems.

Application considerations: This feature is designed to be used specifically on pulsed HRG systems that generate a pulse on the ground fault current. In traditional systems, that pulse is only detected at the feeder level, so manual downstream tracing with an ammeter is still required (or the zero-sequence CT method may be used). C445 provides unit level detection down to 1 A on pulsed systems without use of a dedicated module/zero-sequence CT. Zero-sequence CTs are sized to allow all three motor phases to pass through and therefore add significant space in the motor control center (MCC) bucket. This feature therefore offers significant footprint and cost reduction, see **Figure 1**.

Protection options: The pulse detect method is a fault localization method rather than a protective event. In pulsed systems, when upstream equipment detects a ground fault, the user can then actuate the pulse to help in fault localization. C445 can detect this pulse so that the user does not need to manually trace the event.

Modules required: Requires a pulser (similar to Eaton **C-HRG** "Safe Ground" system), base system of **C445B_** base control module + **C445M_** measurement module. The zero-sequence CT and module are not required.

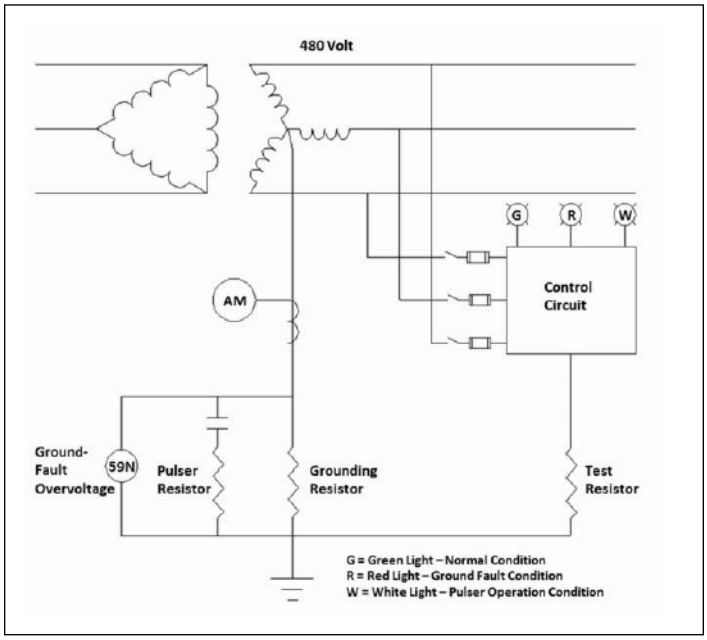

Figure 1. Pulse detect method schematic

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