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TRANSTECH

The Littelfuse Protection Relay Range

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ARC FLASH DETECTION

EARTH LEAKAGE/GROUND FAULT

FEEDER PROTECTION

MOTOR PROTECTION

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TRAILING CABLE PROTECTION

ARC-FLASHRELAY COMPARISON GUIDE

Reliable Operation with Built-In Redundancies

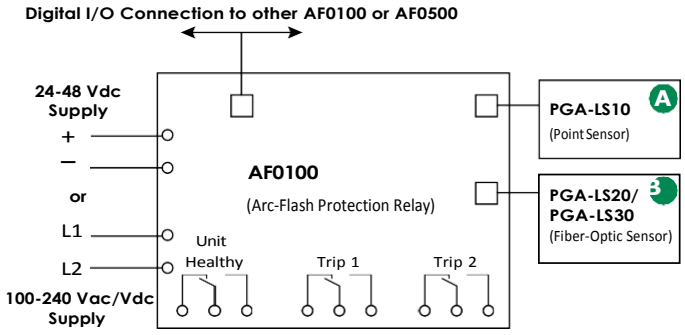
When you are entrusting a safety device to protect equipment from catastrophic damage, it is important to know that it will operate as expected. Littelfuse Arc-Flash Relays do this by having built-in redundancies and health monitors, making maintenance and installation tasks faster, more efficient and helping to minimize downtime.

	AF0100	AF0500	PGR-8800
Redundant Internal Trip Path ▪ Two internal trip paths for added reliability—if the microprocessor trip path fails, the backup analog trip path will seamlessly take over, sending an alarm notification to operators ▪ Backup analog trip path initializes very quickly upon power up, ensuring protection is enabled while energizing the system when hazard risk is higher	✓	✓	✓
Health Monitoring ▪ Continuously monitors connection to trip coil to ensure path is intact ▪ LED indication of sensors' "Ready" or "Tripped" status on sensor and relay ▪ Sensors are durable enough to withstand a detected arc-flash event	✓	✓	✓
Reliable Light Detection ▪ Two types of light sensors (point and fiber-optic) for different applications ▪ Adjustable light-level and wide-angle detection add flexibility ▪ Durable and flexible sensor design eliminates breakage and re-work	✓	✓	✓
High-Speed (<1 ms) Trip ▪ Rapidly initiate the removal of power to reduce the incident energy of the arc flash		✓	✓
Upstream Tripping ▪ Ability to trip upstream device if the local breaker fails to clear the fault		✓	✓
Data Logging ▪ Quickly assess the factors that led to a trip in order to get back online quickly		✓	✓
Optional Current Detection for Fault Verification ▪ Avoid nuisance tripping with current-supervised arc-flash trips ▪ Phase Current Transformers for overcurrent detection ▪ Two user-defined definite-time overcurrent protection levels and times			✓
Tie Breaker Tripping ▪ Ability to trip both incoming feeder and tie breaker when arc is detected in one section of a switchboard ▪ Affected part of the switchboard is isolated from the non-affected part		✓	
Zone Tripping ▪ Ability to trip 2 separate zones with 1 relay ▪ Sensor zone assignment through simple PC configuration and/or digital inputs and outputs		✓	

AF0100 SERIES

Arc-Flash Relay

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	DESCRIPTION
AF0100-00	Arc-Flash Relay, Universal Supply
AF0100-10	Arc-Flash Relay, 24-48 VDC

Specifications

Input Voltage	
AF0100-00	100-240 VAC/VDC, 24-48 VDC
AF0100-10	24-48 VDC
Dimensions	**H** 90 mm (3.5"); **W** 128 mm (5.0"); **D** 60 mm (2.4")
Trip, Error Relays	Form C, 250 VAC/30 VDC, 6 A resistive
Trip Time	5 ms (typical)
Sensitivity	10-25 klux programmable
Mounting	Surface, DIN rail
Operating Temperature	-40°C to +70°C (-40°F to 158°F)
Shipping Weight	1.0 kg (2.2 lb)
Certifications	UL Listed (UL 508), CE, RCM, FCC
Warranty	2 years

Description

The AF0100 Series arc-flash relay is a cost-effective solution that reduces arc-fault damage by detecting the light from an arc flash and rapidly tripping. Two remote light sensors can be connected to one relay and multiple AF0100 and/or AF0500 relays can be connected to monitor additional sensors, providing complete coverage for a wide range of applications. The compact, DIN-rail or surface-mountable body makes this an ideal solution for equipment manufacturers.

Two isolated Form-C contacts are provided for applications with multiple devices that must be tripped. This is especially useful for generator applications where the generator and breaker need to be tripped in case of an arc flash.

The AF0100 accepts PGA-LS10 point sensors and PGA-LS20/ PGA-LS30 fiber-optic sensors in any combination. Sensor health is continuously monitored to ensure fail-safe operation. A solid-state redundant trip circuit provides an internal fail-safe mechanism and fast arc-flash response during power up.

Front-panel and sensor LEDs indicate sensor health and fault location.

Features & Benefits

FEATURES	BENEFITS
Compact	Fits into a wide range of arc-flash applications
Two optical sensor types	Point sensors or fiber-optic sensors can be used in any combination for coverage flexibility
Dual sensor inputs	One relay can monitor two arc-flash sensors
Adjustable light sensitivity	Allows for operation in bright environments and maximum sensitivity in dark environments
Discrete wire networking	Multiple AF0100 or AF0500 units can be interconnected to form a system
Fail-safe system	Continuous monitoring of optical sensors and inputs ensures protection
USB interface	Configuration software is easy to use with no drivers or software installation
Unit health	Ensures continuous protection with self diagnostic and remote unit-healthy indication
LED Indication	Trip and sensor status indication both on relay and sensors

Accessories

A 

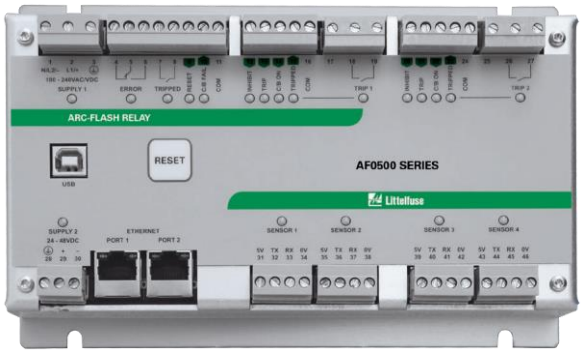
PGA-LS10 Point Sensor
Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Includes sensor health and trip indication.

B 

PGA-LS20/PGA-LS30 Fiber-Optic Sensor
360° light sensor to run along bus bars. Includes sensor health and trip indication.

AF0500 SERIES

Arc-Flash Relay



Features & Benefits

FEATURES	BENEFITS
4 arc sensor inputs	Supports both point and fiber sensors
Arc-Flash trip time <1ms	Limits arc-flash damage and risk of injury
2 IGBT high speed trip outputs	Supports applications such as upstream breaker tripping or tie breaker tripping
Universal Power Supply	100-240 Vac, 24-48 Vdc, or 110-250 Vdc supply
Fail-safe system	Continuous monitoring of optical sensors and inputs ensures protection
LED indication (on unit and each sensor)	Trip and sensor status indicated both on relay and sensors
Discrete wire networking	Multiple AF0500 units can be interconnected to form a system
USB interface	Data logging and configuration software uses a USB interface with no drivers or software installation
Data logging	On-board event recorder for system diagnostics (2048 log lines)
Ethernet interface	Modbus® TCP communication

Ordering Information

ORDERING NUMBER	DESCRIPTION
AF0500-00	Arc-Flash Relay
AF0500-00-CC	Arc-Flash Relay, Conformally Coated

ACCESSORIES	REQUIREMENT
PGA-LS10	Required*
PGA-LS20, PGA-LS30	Required*
PGA-1100	Optional

Description

The AF0500 is a microprocessor-based arc-flash relay that limits arc-fault damage by detecting the light from an arc flash and rapidly tripping the feeder breaker. The unit is well suited for switchgear, transformer and power converter applications.

Sensors, inputs, and connections are health monitored to ensure fail-safe operation. A secondary solid-state trip circuit provides a redundant trip path. A USB port is used for configuration and access to event logs.

AF0500 includes an Ethernet interface and supports Modbus® TCP communication. Zone tripping, upstream breaker tripping and tie breaker tripping applications can be easily configured.

A number of control inputs allows interconnection of multiple AF0500 units to form a system.

Optical Sensors

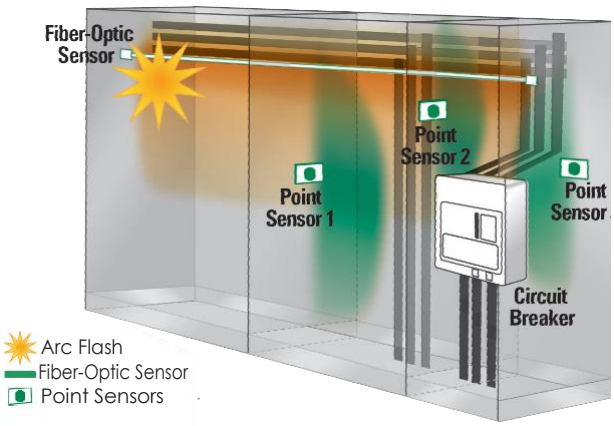
The AF0500 accepts both PGA-LS10 point sensors and PGA-LS20/PGA-LS30 fiber-optical sensors. Thus, any combination of fiber or point sensors is supported.

For fast fault location, front-panel and sensor LEDs indicate sensor health and which sensor detected an arc fault.

Sensor Placement

The AF0500 Arc-Flash Relay and sensors are easily installed in retrofit projects and new switchgear with little or no re-configuration. Simple applications work straight out of the box with no need of PC configuration. More complex systems with multiple power sources are configured using the relay's built-in USB interface software.

Generally, it is recommended to mount 1 or 2 sensors per cubicle to cover all horizontal and vertical bus bars, breaker compartments, drawers, and anywhere that there is a risk for an arc fault. Threading a fiber-optic sensor through the cabinets and in areas where point-sensor coverage is uncertain results in complete coverage and an added level of redundancy. Even if policy is to only work on de-energized systems, all maintenance areas should be monitored to prevent potential damage and additional cost.

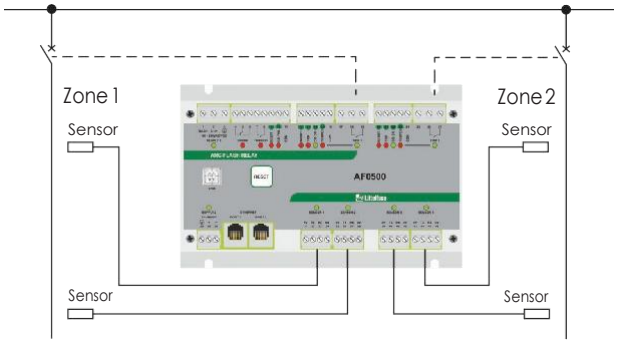


AF0500 SERIES

Applications

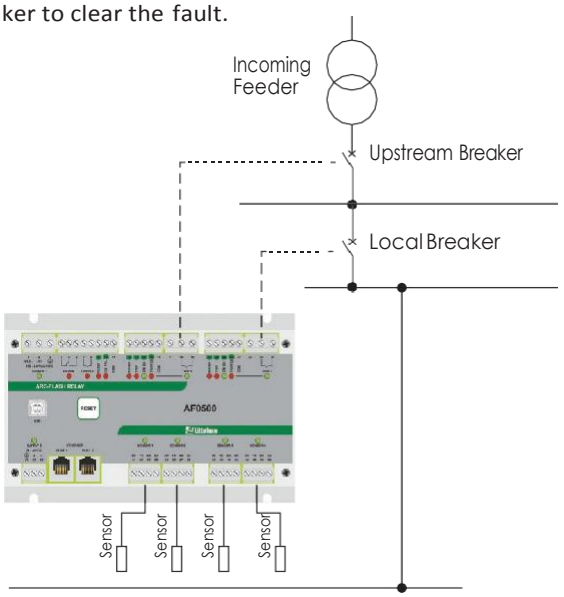
Zone Tripping

AF0500 can trip 2 separate zones. Sensors can be assigned to the zones individually through PC configuration.



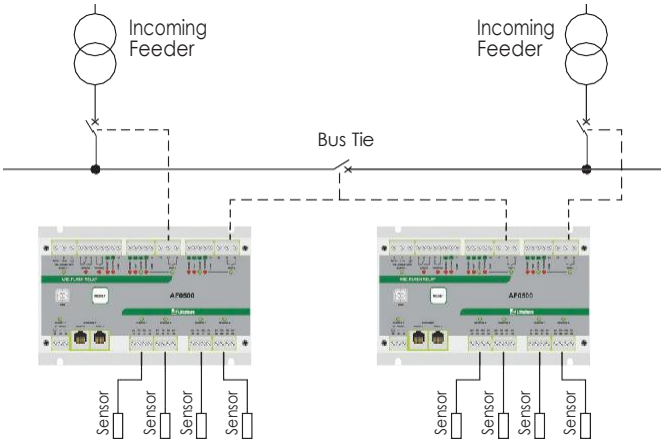
Upstream Breaker Tripping

In case of failure of the local circuit breaker to open, another trip command is sent after a short delay to an upstream breaker to clear the fault.



Tie Breaker Tripping

In case of an arc in one section of the switchboard, the AF0500 can trip both the incoming feeder and the tie breaker simultaneously. Thus the affected part of the switchboard is isolated from the non-affected part.



Accessories

PGA-LS10 Point Sensor
Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Includes Sensor health and trip indication.

PGA-LS20/PGA-LS30 Fiber-Optic Sensor
360° light sensor to run along bus bars. Sensor health and trip indication.

PGA-1100 Diode Logic Unit
This module allows multiple arc-flash relays to trip a common breaker, for example a tie-breaker.

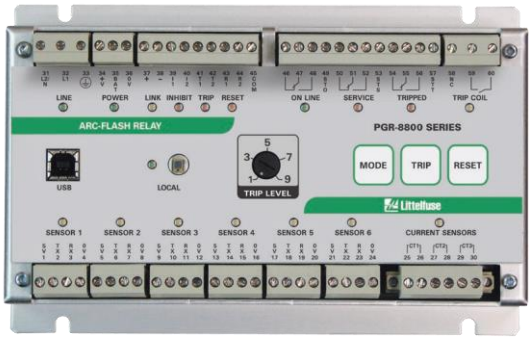
Specifications

Power Supply	
Universal	100 to 240 Vac (+10%, -15%) 50/60 Hz, 20 VA, 110 to 250 Vdc (+10%, -20%) 8 W
Low Voltage	24 to 48 Vdc (+10%, -20%), 4 W
Sensor Inputs	4 light sensor inputs for PGA-LS10, PGA-LS20 and PGA-LS30 sensors
Trip Outputs	2 IGBT switches
UL Rating	120/240 Vac, 1800 VA, 0.75 A maximum continuous, 125/250 Vdc, 138 VA, 0.75 A maximum continuous
Supplemental Rating	
Make/Carry	30 A for 0.2s
Voltage Rating	24 to 300 Vac, 24 to 300 Vdc
Current Rating	20 A for 2 s, 10 A for 5 s

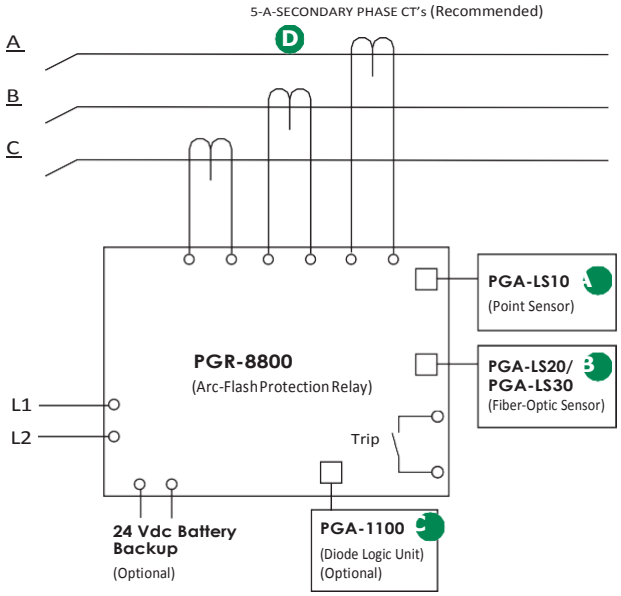
Communication	Ethernet, 2 ports with internal Ethernet switch, Modbus® TCP
Dimensions	**H** 130 mm (5.1"); **W** 200 mm (7.9"); **D** 54 mm (2.1")
Shipping Weight	0.9 kg (2 lb)
Operating Temp.	–40°C to +70°C (–40°F to 158°F)
Approvals	UL Listed (UL508), CE, RCM, FCC, CSA
Warranty	5 years
Mounting	Surface, DIN (with optional D0050 adapter clips)

PGR-8800 SERIES

Arc-Flash Relay



Simplified Circuit Diagram



For detailed wiring diagram, see adjacent page.

Ordering Information

ORDERING NUMBER	DESCRIPTION
PGR-8800-00 (UL, CE, CSA, RCM)	Arc-Flash Relay
PGR-8800-00-CC (UL, CE, CSA, RCM)	Arc-Flash Relay, Conformally Coated

ACCESSORIES	REQUIREMENT
PGA-LS10	Required*
PGA-LS20, PGA-LS30	Required*
PGA-1100	Optional
Current Transformer	Recommended

*At least one sensor is required. However, the exact number of sensors for proper coverage depends on the application.

Description

The PGR-8800 is a microprocessor-based relay that limits arc-fault damage by detecting the light from an arc flash and rapidly tripping. Phase-current-transformer inputs are provided for current-constrained arc-flash protection and, when so equipped, a programmable definite-time overcurrent function can be enabled. An optical sensor on the PGR-8800 and adjustable trip level reduce the chance of nuisance tripping by setting a threshold for ambient light. Sensors, inputs, and connections are monitored to ensure fail-safe operation. A secondary solid-state trip circuit provides a redundant trip path. A USB port is used for configuration and access to event logs and graphs.

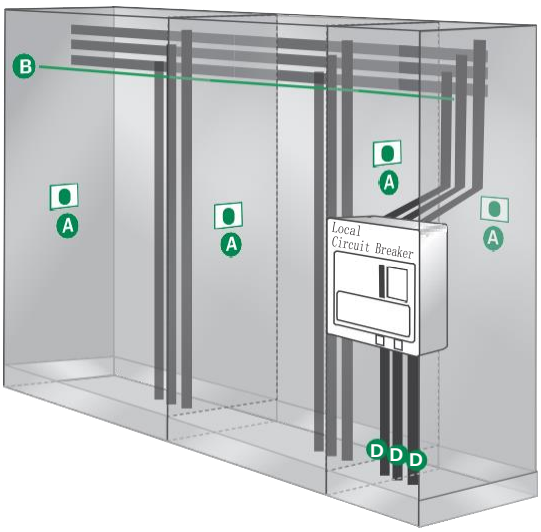
Optical Sensors

The PGR-8800 accepts both PGA-LS10 and PGA-LS20/ PGA-LS30 optical sensors, designed to collect light over a wide angle and with high sensitivity. For fast fault location, front-panel and sensor LED's indicate sensor health and which sensor detected an arc fault.

Sensor Placement

The PGR-8800 Arc-Flash Relay and sensors are easily installed in retrofit projects and new switchgear with little or no re-configuration. Even elaborate systems with multiple power sources take minutes to configure using the relay's built-in USB interface software.

Generally, it is recommended to mount 1 or 2 sensors per cubicle to cover all horizontal and vertical bus bars, breaker compartments, drawers, and anywhere that there is potential for an arc-fault. Threading a fiber-optic sensor through the cabinets and in areas where point-sensor coverage is uncertain results in complete coverage and an added level of redundancy. Even if policy is to only work on de-energized systems, all maintenance areas should be monitored to prevent potential damage and additional cost. At least one sensor should have visibility of an arc fault if a person blocks the other sensor(s).



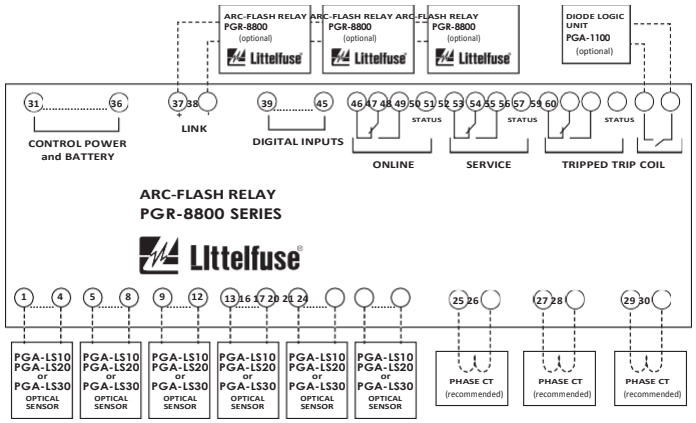
Rev: 4-I-050516
Based on Manual Rev 3-C-040816

PGR-8800 SERIES

Features & Benefits

FEATURES	BENEFITS
Arc-Flash trip time <1 ms	Limits arc-flash damage and risk of injury
Multiple sensors (up to 24)	Single module can monitor 6 sensors. Up to 4 PGR-8800 units can be linked into one system
Fail-safe system	Continuous monitoring of optical sensors and inputs ensures protection
Redundant trip circuit	Solid-state backup arc-detection circuit adds a second layer of safety
Adjustable light sensitivity	Allows for operation in bright environments and maximum sensitivity in dark environments
LED indication (on unit and each sensor)	18 LEDs provide at-a glance status for module and I/O state
Current detection	Phase-CT inputs provide overcurrent protection and prevent nuisance trips
Optical detection	Point and fiber-optic sensors provide wide detection area with sensor health trip indication
Digital inputs (6)	Two each: remote trip, inhibit, and reset inputs
Service mode	Allows for system test without tripping
Trip coil contact	Solid-state 24-300 Vdc/24-300 Vac IGBT
Indication contacts	Form C and status outputs
USB interface	Data logging and configuration software uses a USB interface with no drivers or software installation
Built-in sensor	Can be used in single-sensor systems, as a seventh sensor, and for calibration
Universal power supply/Battery backup	100-240 Vac, 14-48 Vdc, or 110-250 Vdc supply accepted. Ability to charge and run off an external, user-supplied 24 Vdc battery.
Data logging	On-board event recorder helps with system diagnostics
Modbus	Remotely view measured values, event records & reset trips
Upstream Tripping	Ability to trip upstream device if the local breaker fails to clear the fault

Wiring Diagram



Accessories

A 

PGA-LS10 Point Sensor
Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Sensor health and trip indication. Dimensions: See PGR-8800 Manual

B 

PGA-LS20/PGA-LS30 Fiber-Optic Sensor
360° light sensor for tricky installations with many shadows or to run along bus bars. Sensor health and trip indication. Dimensions: See PGR-8800 Manual

C 

PGA-1100 Diode Logic Unit
This module allows multiple PGR-8800 relays to trip the same breaker, for example an upstream or a tie-breaker. Dimensions: **H** 80mm (3.15") **W** 20mm(0.79") **D** 70mm(2.76")

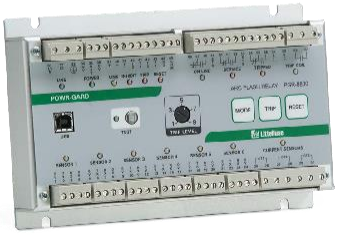
D 

Current Transformers
Eliminate nuisance arc-flash trips and use for overcurrent protection.

Specifications

IEEE Device Numbers	Overcurrent (50), Arc Flash (AFD)
Input Voltage	100-240 Vac, 14-48 Vdc, and 110-250 Vdc
Dimensions	**H** 130 mm (5.1"); **W** 200 mm (7.9"); **D** 54 mm (2.1")
Optical Trip Settings	9-25 klux, 800 µs-20 s
Current Trip Setting (A)	Programmable
Indication Contact Mode	Fail-safe
Trip Coil Voltage[1]	24-300 Vdc, 24-300 Vac
Trip Coil Contact Mode	Selectable fail-safe or non-fail-safe
Redundant Trip Circuit	Standard feature
Input Monitoring	Standard feature
USB Interface	Standard feature
Trip, Reset, Service Buttons	Standard feature
Expandable System	Link up to 4 PGR-8800 units
Warranty	5 years
Mounting	Surface, DIN (with D0050 adapter clips)
Approvals	UL, CE, CSA, RCM, FCC, DNV type approval, ABS type approval

NOTE (1) - Contact Littelfuse for trip coil VOLTAGES higher than 300 Vdc/Vac.



General Arc-Flash Questions

How much energy is in a typical arc-flash incident?

A phase-to-phase fault on a 480-V system with 20,000 amperes of fault current provides 9,600,000 watts of power. Imagine that there is no arc protection and the fault lasts for 200 milliseconds before the overcurrent protection clears it. The released energy would be 2 MJ, which corresponds roughly to a stick of dynamite.

The energy formula is as follows:

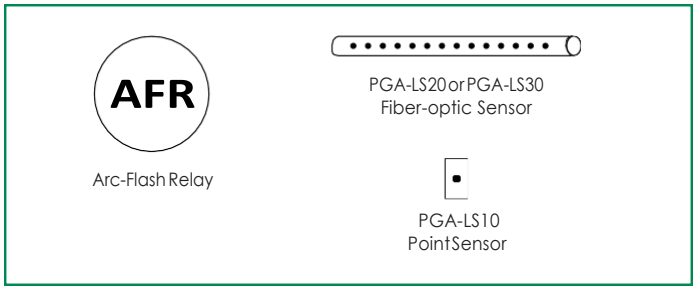
Energy = voltage x current x time = 480 V x 20,000 A x 0.2 s = 1,920,000 J

For a given system voltage, two factors can be adjusted to reduce arc-flash energy: time and current

Time can be reduced by using a device such as the PGR-8800 or AF0500 to rapidly detect an arc flash, thus cause the connected circuit breaker to trip at its instantaneous speed, overriding any inverse-time delay. Current can be reduced by using current-limiting fuses or, in case of phase-to-ground faults, by using high-resistance grounding.

What is the electrical symbol of an arc-flash relay?

Although there is no formal symbol, Littelfuse is currently using the following:



How long has Littelfuse had an arc-flash relay in service?

Littelfuse acquired arc-flash technology from Selco, which had been manufacturing arc-flash relays for almost 20 years. The product was launched in North America in August of 2011. Littelfuse has numerous installations throughout the world and an estimated 18,000 arc-flash relays are installed world-wide.

Do you have a list of references of companies using the Littelfuse Arc-Flash Relays?

Yes, please contact your Littelfuse Sales Rep for a list of available references.

Do you have an example of a Littelfuse Arc-Flash Relay protecting a facility in the event of an arc flash?

Please view our arc-flash case study at Littelfuse.com/ArcFlash for an installation success story where the PGR-8800 saved a plant from catastrophic damage.

What are the key considerations when choosing an arc-flash relay?

We have written a white paper on considerations for choosing an arc-flash relay that examines advantages and drawbacks. It is available to download on our website at Littelfuse.com/ArcFlash.

Is nuisance tripping a problem?

Normal in-house lighting will not cause the arc-flash relays to trip. Flashlights, direct sunlight or strong, focused light at short distances may produce enough light to cause tripping.

If there are concerns about that, the best way to avoid nuisance tripping is by using the optical sensors in conjunction with current supervision. This function is available with PGR-8800. In this scenario, the relay looks at the optical sensors for a fault and if there is a high amount of light, then looks at the CT inputs to see if the current is above the nominal setting you configured, and if both conditions are true, then it will trip the relay. This prevents tripping in cases where there is significant light from an outside source (such as a welder, camera flash or direct sunlight).

Does thermal imaging trip the Littelfuse Arc-Flash Relays?

Assuming the thermal imaging device is passively detecting heat in the switchgear by using the infrared light emitted, there will be no interference with the arc-flash relay or sensors.

Would a camera-flash trigger the Littelfuse Arc-Flash Relays?

When the PGR-8800, AF0500 or AF0100 is set to maximum sensitivity and the amount of time light is required to be present on the sensor is set to a minimum, it is possible that a small point-and-shoot camera close to the sensor could be sufficient to trip the relay. Typically, a compact camera's flash does not present enough intensity to cause a trip, except at VERY close proximity to the sensor. More advanced cameras and larger flashes can trip the Littelfuse Arc-Flash Relays from a greater distance. In applications where this is a concern, it is recommended to use the PGR-8800 with optional CTs so that non-arc-flash light with no corresponding increase in current above normal operating conditions does not cause a trip. Where current supervision is used, both high current and intense light are required to have an arc-flash trip. The PGR-8800 relay can also be toggled into service mode to disable the trip-coil while a camera flash is used. It is imperative to restore the relay to normal operation once the flash photography is completed.

Do the Littelfuse Arc-Flash Relays relay detect ultra-violet light?

The typical spectrum of light from an arc-flash is spread across the visible spectrum and so this is what the PGR-8800, AF0500 and AF0100 relays are detecting. Ultraviolet light is mostly used to detect corona which can be present before an arc flash but is also present in higher voltage systems where no arc flash is imminent. Using ultraviolet light alone could lead to nuisance trips and the relay would only be looking at a small section of the total light from the arc. The point sensor has been designed to work with a wide spectrum of visible light. This is due to the fact that there are no distinct peaks in the spectrum of an arc; the peak depends on the material involved. An arc will typically peak on the visible spectrum and fade out toward the infrared area. Below is a graph depicting the PGA-LS10's spectral sensitivity. The fiber sensor spectral sensitivity is nearly identical. The only difference is the lower part of the spectrum, below ~400 nm, will be cut off.

Do the Littelfuse Arc-Flash Relays provide fault location identification?

Yes, each sensor has an on-board LED as well as a sensor LED on the arc flash relay that provides feedback identifying which sensor caused the trip.

Do the Littelfuse Arc-Flash Relays provide zone tripping?

AF0500 has two high speed IGBT outputs for tripping of circuit breakers. Each sensor input can be assigned individually to any or both of the trip outputs. Thus AF0500 can trip up to 2 independent zones.

Can you compare a service-mode instantaneous setting to an arc-flash relay?

You would need to look at an actual application to do a true comparison. There are cases when lowering the instantaneous setting would serve the same benefit as the arc-flash relay in lowering incident energy. There may be some added complexity to making sure the maintenance mode is entered and also set back to operational mode. You do not want to have mis-coordination or tripping during starting of a motor if you start to exceed the instantaneous level. That being said our motor and feeder relays do have this mode of operation so they are useful. There are cases where the bus may be very large and not loaded (during commissioning for example). An arcing fault is high resistance and may not get near the instantaneous operating range of the breaker. That would be the worst case scenario for the instantaneous setting and show the most difference between it and the light detection method.

Do the different modes of the arc-flash relay have different response times?

It is possible for the arc-flash relay to send a trip signal within 1 ms of detecting light above the threshold settings or within 1 ms of detecting light AND current. It is also possible to configure the relay to have additional delay as needed.

What is the life of the Littelfuse Arc-Flash Relays? What maintenance is required and how often?

The PGR-8800, AF0500 and AF0100 relays have a 5 year warranty but depending on the environment it will last much longer than that. Maintenance required will depend on your application and principally focuses on removing dust collection on light sensors. We recommend checking the light sensors periodically (with a period relevant for the amount of dust) with an external light source to verify that the sensors are not obscured by dust build-up and using compressed air to blow dust off the sensors during regularly scheduled maintenance. It is good practice to periodically check that the IGBT trip output is tripping the breaker. Breaker maintenance is also critical to provide reliable and fast clearing time.

Does the built-in software consider the mechanical delay of all devices in the circuit and allow for changes to faster reacting main breakers?

In reference to the coordination programs such as EDSA, ETAP and SKM. They all allow specific information to be entered on the circuit interrupter chosen in their extensive libraries. This can show changes of using faster main breakers fairly easily. Note if the equipment is older Littelfuse recommends testing the actual operating time of the breakers to make sure they are able to interrupt in the time that is allotted.

How do arc-flash relays compare to Zone Selective Interlocking Protection (ZSIP) and Bus Differential?

These are different technologies that detect and quickly clear faults. ZSIP will detect a fault and block an upstream protective device from operating until the local protective device has a chance to clear the fault. If not, the upstream device attempts to clear it. This takes valuable time (100 ms for detection only) and may be difficult to retrofit.

Bus Differential measures the difference of current going into and out of a device, such as switchgear. If the current supplied by the source travels through the switchgear to the load, all is well. If a fault occurs within the switchgear, the current going in does not equal the current going to the load. This detection method is much quicker (33 ms for detection only) and may be more difficult and/or expensive to retrofit, depending on the number of CTs.

Electrical Design Software

What is SKM software and where can I find more information?

SKM Software (www.skm.com) is one brand of power system analysis software that allows users to define the electrical parameters of their system and model its behavior. It is often used for coordination studies and arc-flash hazard analysis. Other software brands are ETAP, Easy Power and EDSA.

How do you enter resistance-grounding or arc-flash relays into the SKM software for calculating arc flash?

Resistance grounding presently shows no advantage in power system modeling software. The analysis of arc-flash energy is based on three-phase faults. High resistance grounding does eliminate the potential hazard from a single phase-to-ground fault. Different sources show 80 to 90% of faults in a plant start as a single phase-to-ground fault. Arc-flash relays can be entered as a definite time trip (at 1 ms for PGR-8800 and AF0500) which is then added to the breaker clearing time. The advantage of arc-flash detection is that the breaker is no longer waiting for coordination of downstream devices. Another method often used to lower incident energy is to switch the relay or breaker settings to maintenance mode or a second setpoint group. These are lower settings with quicker operating times, often ignoring coordination of downstream devices with knowledge that a person is in the area. When the person leaves the area, the settings are returned to normal.

How do you model your optical devices in SKM and ETAP, since the relay is detecting light?

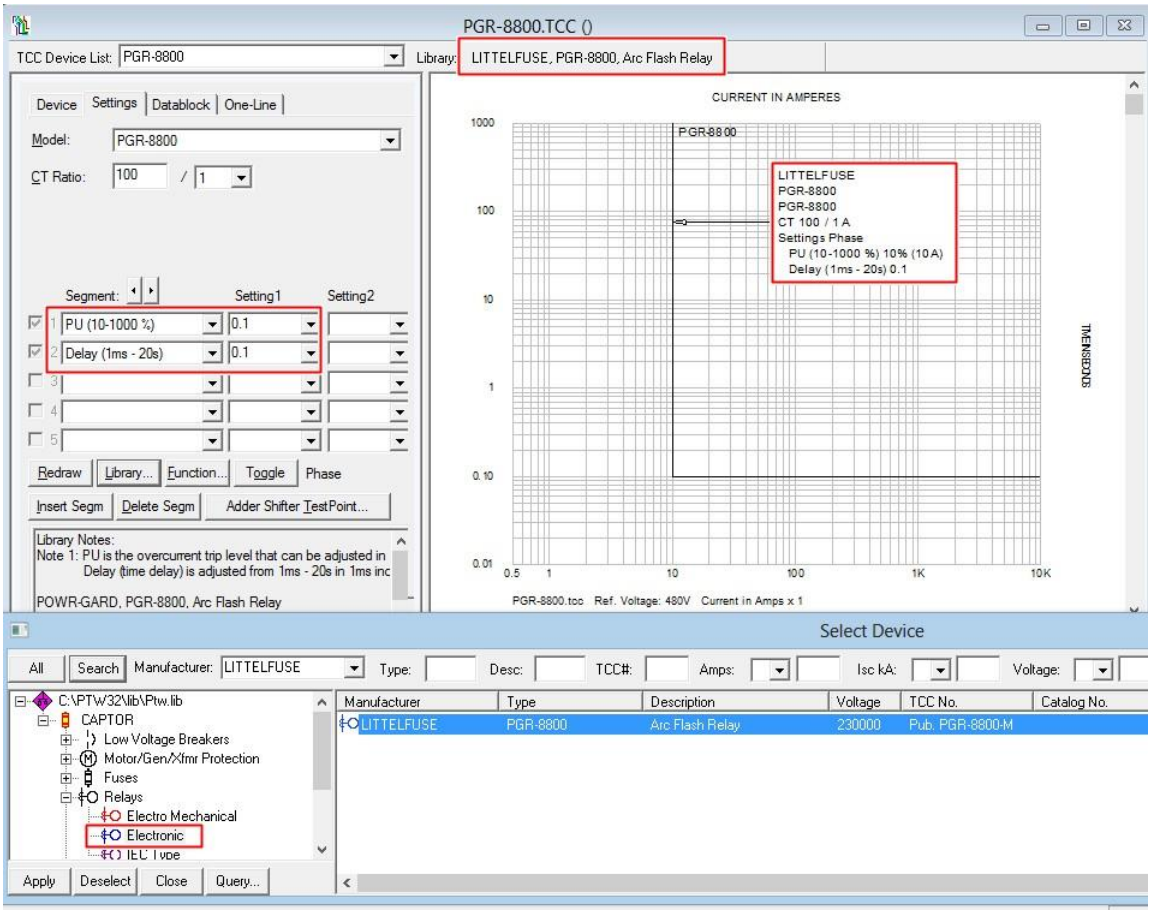
You must add the arc-flash relay trip time to the breaker shunt-trip operating or clearing time. The result will be a vertical line (definite-time) that shows the same response time regardless of the current. This demonstrates the advantage of using light for arc-flash detection.

How does power system analysis software, such as SKM, EasyPower, and ETAP, recognize arc-flash relays?

SKM software list the PGR-8800 relay in the library and other companies are currently adding the relay. The figure below shows the PGR-8800 Arc-Flash relay modeled in SKM:

The PGR-8800 has two (2) settings for overcurrent protection:

- Pickup is adjustable from 10 to 1000% of the secondary CT rating (any CT with a 5A secondary can be used)
- Time delay from 1 ms to 2 seconds



DISCLAIMER: PLEASE VISIT FOR INSTRUCTIONS ON HOW TO INSTALL THE SKM FILE.

For arc-flash protection, the PGR-8800, AF0500 and AF0100 must see light of sufficient intensity to initiate the tripping sequence. If current inhibit is enabled, the PGR-8800 will not send a trip signal unless there is also sufficient current. Both light and current trip levels can be adjusted.

Currently, no power system analysis software package can model the light detection. They only model the overcurrent setting. To avoid the nuisance tripping with standard overcurrent protection, the user typically increases the pickup value or time delay. This leads to arcing faults going unnoticed until it is too late. With the Littelfuse Arc-Flash Relays, this is not an issue as the light is used to prevent nuisance tripping on electrical noise or momentary overload conditions while still allowing for very fast tripping. Thus, the reaction time is reduced to that of the AF0500 or PGR-8800 (less than 1 ms unless configured otherwise), or AF0100 plus the circuit-breaker operating time, independent of the current.

Bolted Pressure Switches can also be used, but many of these devices have limitations in terms of interrupting and clearing time rating, so the user must check the ratings first. With either a CB or BPS, the opening time or clearing time can be modeled in SKM. The opening time or clearing time must include all devices in the sequence, which includes the shunt trip or undervoltage times as well as circuit breaker times. It is recommended to regularly maintain and test operation of circuit breakers. A qualified testing company could verify and provide the most accurate information on breaker clearing time.

On AF0500 / AF0100 applications and PGR-8800 applications where only light detection is utilized, this clearing time value can be used in the software as a user-defined trip time. For the PGR-8800 applications using current, an alternative is to use the PGR-8800 library model with the current set to a low value to reproduce the current-independent characteristic of optical detection. When current and light are both required then the current-inhibit level setting in the PGR-8800 should be used for the model.

Applications and Installations

What are the typical application / system voltages?

The PGR-8800, AF0500 and AF0100 can be used on electrical systems operating at any voltage (AC or DC) since it does not directly connect to the system. The system is monitored with light sensors and optional current transformers (for AC systems, PGR-8800 only) that can be selected for any current / voltage rating. The small size of these Arc-Flash Relays allows for installation in any switchgear cubicle, transformer compartment, or motor control center bucket.

What is the maximum recommended length from the Littelfuse Arc-Flash Relays to the breaker?

Application specific data is needed to determine the maximum distance of the relay from the circuit breaker. Please refer to the installation manual or call technical support for assistance.

Can the Littelfuse Arc-Flash Relays be used in low-voltage systems and will a low-voltage breaker's closing or opening cause a trip?

When a low-voltage breaker is closing there is often a large inrush current that, depending on the configuration of the PGR-8800, AF0500 or AF0100, could be sufficient to allow a high-intensity light source other than an arc-flash to cause a trip. While low-voltage breakers often produce an arc when they are opening, closing the breaker does not normally produce an arc, so the PGR-8800, AF0500 and AF0100 should not operate unintentionally. When opening the breaker, an arc is typically present as part of normal operation of the breaker. If light sensors are placed such that the breaker arcing is visible then it is recommended to also use current-supervision. The breaker arcing during normal opening will cause a reduction in current because of the increased impedance and if using the PGR-8800, the current-supervision will not operate.

Is internal arc classification of switchgear enclosures enough to eliminate an arc hazard?

No, although it reduces the hazard. The arc-flash relay may help prevent damage to the equipment and provide additional protection in the event that the doors are not properly closed. Depending on the impedance of the arc fault, the arc may persist for a long time in the switchgear and could exceed the rating of the gear.

When working on an energized transformer, we use instantaneous settings at the feeder breaker relay. Can the Littelfuse Arc-Flash Relays bring any benefit?

According to IEEE 1584, the arcing current can be as low as 38% of the available bolted fault current. If the instantaneous trip setting of the circuit breaker is greater than the arcing current, the breaker could take seconds or minutes to open, thus creating a potentially DANGEROUS arc flash condition. The PGR-8800, AF0500 and AF0100 can react in milliseconds regardless of the fault current, and initiate the tripping signal to open the breaker lowering the incident energy to a minimum.

Is there a specific relay to protect all of a switchgear bus section against arc flash?

The PGR-8800, AF0500 and AF0100 are all ideal for protecting switchgear bus sections. The PGA-LS20 or PGA-LS30 fiber sensors are often used for those applications, depending on the bus arrangement.

Are there control systems available that truly eliminate or control arc flash?

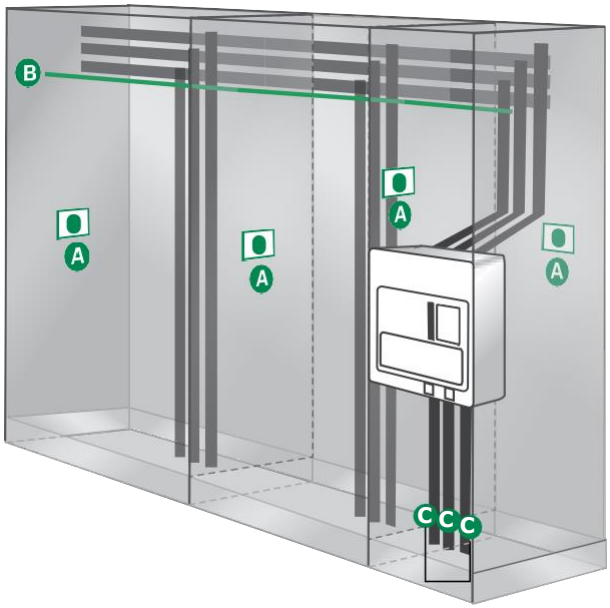
If the equipment is energized there is not a single system that does that.

Light Sensors and Current Transformers

What are the installation guidelines for the sensors?

The PGR-8800 and AF0500 Arc-Flash Relay and sensors are easily installed in retrofit projects and new switchgear with little or no re-configuration. Even elaborate systems with multiple power sources take minutes to configure using the relay's built-in USB interface software.

Generally, it is recommended to mount 1 or 2 sensors per cubicle to cover all horizontal and vertical bus bars, breaker compartments, drawers, and anywhere that there is potential for an arc-fault. Threading a fiber-optic sensor through the cabinets and in areas where point-sensor coverage is uncertain results in complete coverage and an added level of redundancy. Even if policy is to only work on de-energized systems, all maintenance area should be monitored to prevent potential damage and additional cost. At least once sensor should have visibility of an arc fault if a person blocks the other sensor(s).



PGA-LS10 Point Sensor
Line-of-sight light sensor with a built-in LED to indicate sensor health or trip state. Comes standard with a 10 m (32 ft.) cable.

PGA-LS20, PGA-LS30 Fiber-Optic Sensor
A 360° fiber-optic sensor detects light along the active length of the cable and has a built-in LED to indicate sensor health or trip state. Recommended installation is along bus bars as well as in challenging spaces that have many compartments. Comes standard with two 10 m (32 ft.) cables.

Phase Current Transformers
(Optional, PGR-8800 only)
Phase Current Transformers (CTs) are required to detect phase currents. When retrofitting systems, existing CTs with a 5 A secondary can be used.

Below are some additional guidelines:

- First determine sensor placements, then consider zones.
- Ensure sensors and cables are not blocked by objects, either fixed or movable.
- Do not place sensors or fiber cable on live or energized components.
- Chose a location that will minimize collection of foreign debris and easy access for maintenance, if needed.
- Use care when handling, pulling, and securing cables.
- Avoid sharp bends (< 5 cm) and high temperature (>80°C).
- Consider placements around air-magnetic circuit breakers.
- Consider movable parts and area accessible to personnel for commissioning, testing, inspecting, etc.
- Even though the sensors and cables have no exposed live parts are fully insulated, the placement and routing must comply with industry standard requirements on over-surface (creep) and through-air (clearance).

What is a typical light sensitivity radius for a fiber-optic sensor?

This is a difficult metric to provide because the distance an arc can be detected by the fiber-optic sensor is dependent on many variables. However, the PGA-LS20 and PGA-LS30 fiber-optic sensors are factory calibrated so that it will have the same detection range as the PGA-LS10 when 60 cm (a standard section width) is exposed to the arc flash. In other words, a 3 kA arc can be detected from a distance of 2 m from the fiber assuming that the light is incident on 60 cm of fiber. However, the PGA-LS20 and PGA-LS30 also has an adjustment screw that allows the user to calibrate the fiber-optic sensor to be more sensitive (for smaller sections) or less sensitive (for larger ones) so that the characteristic matches that PGA-LS10 point sensors. We recommend a minimum of 20 cm of fiber exposed per section.

The sensor is calibrated at the factory for 60 cm of fiber in each monitored compartment. When using the fiber-optic sensor in compartments with less than 60 cm of fiber, the sensitivity may have to be adjusted. The sensor is unable to differentiate between 10,000 lux hitting 60 cm of fiber and 30,000 lux hitting 20 cm of fiber– the same amount of light is transmitted through the fiber to the receiver. To achieve the desired sensitivity, the receiver (with the black thumb nut) must be adjusted.

Is there a maintenance schedule for the sensors?

Each sensor has an internal health LED. Its purpose is to verify the continuity of the sensor cabling and the internal sensor circuitry. This 'health check' circuit will not detect dust buildup on the sensor. There are several ways to mitigate dust buildup. A sensor mounted at the top of an enclosure looking down is optimal. This configuration will not collect much dust in most cabinet installations, due to intensity of an arc combined with the reflections off the metal walls (even a dirty sensor will collect a great deal of light).

Sensors must be cleaned in order to maintain consistent sensitivity. Sensor cleaning should be part of regular maintenance and should be performed via compressed air or dry wipe down. A maintenance routine can be implemented to clean sensors at a set interval that is aligned with industry standard recommendations, such as NFPA 70B, Recommended Practice for Equipment Maintenance.

A more proactive approach could also be used by putting the relay into Service Mode and shining a bright light on each sensor. A trip will be indicated if the sensor is able to detect the light but the breaker will not be tripped. If the relay light isn't indicating a trip then cleaning is necessary.

At what intensity of light will the Littelfuse Arc-Flash Relays indicate or trip?

The PGR-8800, AF0500 and AF0100 can be configured to trip between 10 klux and 25 klux. The relay's sensor LEDs can be configured to indicate at various levels below the trip level to warn that light intensity is approaching the trip level.

The fiber-optic sensor has an adjustable sensitivity (in addition to the relay sensitivity dial) that could be used to increase the sensitivity for a given length of fiber to levels below and above the relay setpoint.

How would the fiber-optic sensors be installed in switchgear that is shipped in groups? Do these sensors come in various lengths or with repeaters?

The fiber-optic sensors have two parts, an electrical cable connection to the relay and the light-sensitive fiber-optic cable. Splitting a fiber is a challenge because a bad splice can result in decreased or increased sensitivity and failure to operate or nuisance tripping. Shipping splits should be wired so that the fiber-optic sensor cable does not traverse multiple sections. The electrical part of the sensor, connecting the sensor to the relay, can be up to 50 m long and is much easier to connect at the final installation as well as much more durable than optical fiber. It is important to remember that a light-collecting fiber-optic cable behaves quite differently from a transmission-only shielded fiber-optic cable.

The latter case is more frequently used, especially in telecommunications industries and can have very large lengths, but in that case light is fed directly into the tube at a low angle of incidence and losses along the cable are very low. For the PGA-LS20 and PGA-LS30 fiber-optic sensors, the entire fiber-optic cable is designed to absorb light incident on the surface, bend the light to trap it in the cable, and then keep it in the cable. However, light is lost along the length of the cable and the longer the light must travel along the cable, the more light is lost. The active lengths of the PGA-LS20 and PGA-LS30 are 8 m and 18 m respectively. Repeaters are not available as the cost may be too high compared to installing a second fiber-optic sensor. Repeaters may cause timing issues for the sensor-check signal.

How do you test the sensors? Are they fail-safe?

A sensor-check circuit in every Littelfuse Arc-Flash Relays tests the sensor once per second to verify that the sensor assembly is functioning correctly and that it is connected. The signal is sent from the relay along the cable to the sensor which activates an internal LED. A failure in the sensor circuitry or cable would result in a loss of check signal. The PGR-8800, AF0500 and AF0100 recognize this signal loss as a missing sensor and will indicate an error condition on the sensor, relay faceplate and the online or error output will change state. The user can decide what to do with this relay output and whether it will trip the system or simply signal an alarm. The fiber-optic sensor works the same way except that the signal travels through the length of the fiber-optic cable so a break or crimp in that cable is also detected.

For the PGR-8800, sensors can be tested individually by putting the relay into Service mode and shining a bright light source on the sensor. A trip will be indicated if the sensor is able to detect the light but a trip signal will not be sent to the breaker. A high-power flashlight can serve to verify the sensors are properly detecting light. The power required on the flashlight is difficult to quantify because of the way the light is spread and focused, but a 3 million candela flashlight has proven more than sufficient for use on point sensors.

What is the purpose of the Current Transformers (CTs) and are they required?

The purpose of the CTs is to validate an arcing condition, although CTs are not required for operation. The PGR-8800, AF0500 and AF0100 relays can detect light only to send a trip signal. If the CTs are used with the PGR-8800, the relay will only send a trip signal if both light and overcurrent conditions are detected. In applications where high-intensity light is a possible, overcurrent detection can be used to prevent nuisance tripping.

Resistance Grounding

Would a ground fault on the main switchgear act as an arc-flash relay?

HRG systems eliminate arc-flash hazards associated with ground-faults per IEEE Std 141-1993. Even though tests have shown that HRG systems also reduce the arc-flash energy with phase-to-phase arcing faults, it can not be used to reduce PPE. Arc-Flash Relays can be used to identify these arcing conditions and significantly reduce arc-flash hazards. In many applications, both are used to increase uptime and protection.

Can we have more than 5A L-G fault available in HRG in any circumstances?

The maximum ground-fault current is physically limited to the value of the resistor, assuming no resistance in the fault and return path. For example, on a 480V system, for a ground-fault current of 5A, the resistor value is 277V / 5A = 55.4 ohms. The 55.4 ohm resistor sets a maximum ground-fault current of 5A. However, it is typically lower due to either fault resistance and/or resistance in return path. In some older facilities where the return path is weak, a lower resistance value is used to allow for a higher ground-fault current.

Is there protection (resistance grounding) for delta circuits?

HRG systems are only used on 3-wire systems, either wye with floating neutral or delta. If used on wye systems, the resistor is simply directly connected to the neutral bushing. If it is a delta system, typically a zig-zag transformer is used to create a neutral point (or three single-phase transformers are used). In any case, a neutral point, which is used to connect the resistor.

The code only allows HRG if you didn't have neutral to ground loads (i.e. 277 V). Would this only be applied on 3-wire systems?

Correct, the NEC prohibits using HRG systems on systems with line-to-neutral loads. The reason is that the elevated neutral voltage, which occurs during a ground fault, may back-feed a circuit causing a dangerous condition. However, CEC allows HRG systems on these systems if the entire system is tripped offline during a ground fault.

How do you address the system-leakage capacitance on HRGs, especially at medium-voltage levels?

You are correct that at medium-voltage, the system leakage capacitive current increases, which is a function of voltage. Fortunately, this has been well documented over the years and tables are used to estimate the leakage current. Depending on this value, the ground-fault on a HRG system may not be recommended to remain on system.

Is it possible to apply HRG to a distribution transformer in order to minimize the arc-flash hazard when working on the secondary of the transformer?

High-Resistance Grounding (HRG) has some limitations. For example, it is difficult to implement on systems with line-to-neutral loads. Another limitation is the amount of current flow during a ground-fault. HRG limits the current to typically 10A or less, which may not be enough to detect on your distribution system. If these are not issues, consider using HRG systems. However, perform a detailed engineering study to ensure other limitations (such as voltage shift) are acceptable.

If you have a neutral-grounding resistor, is an arc-flash relay also recommended?

Yes, because the NGR only reduces or eliminates arcing ground faults. For the other type of arcing faults, phase faults, a Littelfuse Arc-Flash Relay can be used to provide maximum protection. Typically 95% of all faults are ground faults, so the NGR reduces or eliminates most of the risk and the Littelfuse Arc-Flash Relays provides the 5% protection in the switchgear.

Safety Regulations

Do arc-flash relays lower the Personal Protective Equipment (PPE) required?

In order to lower the amount of PPE required, the incident energy must be reduced. There are two ways to lower the incident energy of an arc-flash event, reducing the fault current or the clearing time and reducing the available energy. Reducing the available energy can be achieved by using current-limiting fuses and, for single-phase faults, resistance grounding.

Reducing the clearing time typically is not possible when using overcurrent protection due to system coordination requirements. Current-based protection must have sufficient delay to prevent unnecessary tripping on momentary overload or current spikes, thus losing valuable reaction time.

Arc Flash relays resolve this issue by detecting light ,which allows for a fast reaction time. The PGR-8800 and AF0500 relays can detect an arcing condition and send a trip signal to the circuit breaker within 1 ms. The AF0100 can send a trip signal in as low as 3 ms. This detection time is much faster than standard protection and circuit breakers, which means using a Littelfuse Arc Flash relay in combination with a circuit breaker will lower the incident energy. This results in an increase in worker safety, less fault damage, and improved uptime. Since the arc-flash hazard has decreased, the associated PPE may also be lowered. The exact amount will depend on user setpoints, so it must be modeled in the system to determine the new incident energy and PPE.

Can the Littelfuse Arc-Flash Relays eliminate the need for PPE 3 or 4 clothing?

Please use our reduction workbook to learn more about incident energy reduction at Littelfuse.com/ArcFlash.

Can the Littelfuse Arc-Flash Relays reduce PPE required if only walking in front of the equipment, or opening the cabinet to read a nameplate?

If the worker is within the flash protection boundary of the exposed (line of sight) energized part, then the PPE category on the label must be used. If the door is closed or cover is on, check NFPA 70E Table 130.7(C)(15)(a) or (b) for a reduction in PPE category.

What are the regulatory agencies' opinion on arc-flash relays on life safety and critical circuits?

Hospitals and health care facilities are not exempted from OSHA safety requirements. They rely on the experience and reputation of the Professional Engineer's assessment.

When designing a safety protocol, should low-fault current / long clearing-time hazard and a high-fault current / short clearing-time hazard with the same incident energy be treated differently?

If the incident energy is the same, No. However, if the incident energy is more or less, NFPA 70E requires the worker to use arc rated clothing equal to or greater than the possible maximum incident energy.

Is there a recommendation as to how often you need to update the arc-flash label?

NFPA 70E Article 130.5 requires the arc-flash analysis to be updated when major modifications occur and reviewed every 5 years, whichever occurs first.

Our facility completed an arc-flash assessment and there are areas with an incident energy of 40 cal / cm². Will the Littelfuse Arc-Flash Relays reduce those levels and will that allow us to work on energized equipment and reduce the amount of PPE required?

It is possible, but this must be evaluated on a case-by-case basis to determine the resulting reduction in arc-flash energy. We recommend you contact the engineer or engineering firm that performed the assessment and request them to re-run the study at that equipment using the PGR-8800, AF0500 or AF0100 relay to lower the energy and use our Arc-Flash Energy Reduction Workbook, which can be found on Littelfuse.com/ArcFlash.

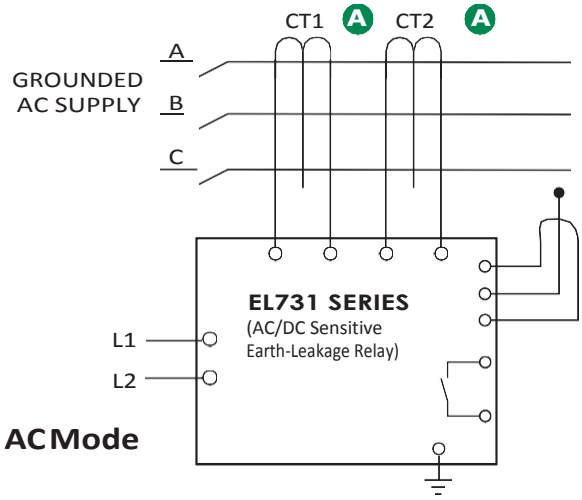
If using this arc-flash relay as the only method to protect personnel from arc flash, should the arc-flash relay be tested and have a Safety Integrity Level? (SIL)

We don't recommend that the PGR-8800, AF0500 or AF0100 be used as the only method to protect personnel from arc flash. Adequate PPE should be worn based on the results of an arc-flash study. Resistance grounding is highly recommended to eliminate single phase-to-ground arc flashes. Current-limiting fuses and relays such as our Littelfuse Feeder and Motor Protection Relays with maintenance mode settings or dual set-point groups are also highly recommended.

EL731 SERIES

AC/DC Sensitive Earth-Leakage Relay

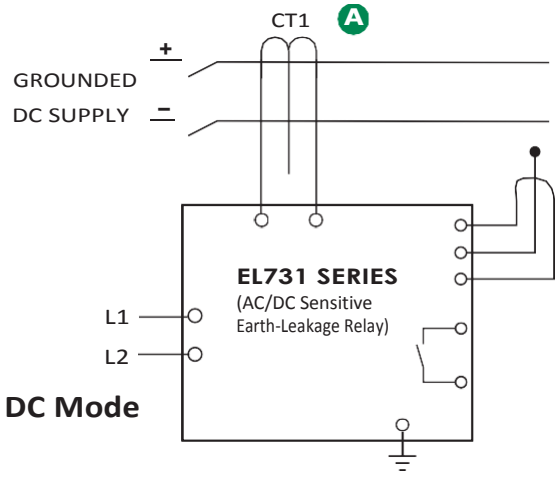
Simplified Circuit Diagram



For detailed wiring diagram, see adjacent page.

Description

The EL731 is a microprocessor-based AC/DC Sensitive Earth-Leakage Relay that offers complete coverage for all frequencies from 0 to 6,000 Hz. Two CTs are required for the entire frequency range, or one CT can be used for only low- or high-frequency detection. An RTD/PTC sensor input allows over-temperature protection for a motor or drive. The EL731 offers metering, password-protected alarm and trip settings and optional network communications. It is primarily used to add low-level ground-fault protection to variable-speed drives, and to dc circuits.



Ordering Information

ORDERING NUMBER	CONTROL POWER	COMMUNICATIONS
EL731-00-X0	120/240 Vac/Vdc	None
EL731-01-X0	120/240 Vac/Vdc	DeviceNet™
EL731-02-X0	120/240 Vac/Vdc	Profibus®
EL731-03-X0	120/240 Vac/Vdc	EtherNet/IP™
EL731-04-X0	120/240 Vac/Vdc	Modbus® TCP
EL731-10-X0	48 Vdc & 24 Vac	None
EL731-11-X0	48 Vdc & 24 Vac	DeviceNet™
EL731-12-X0	48 Vdc & 24 Vac	Profibus®
EL731-13-X0	48 Vdc & 24 Vac	EtherNet/IP™
EL731-14-X0	48 Vdc & 24 Vac	Modbus® TCP
EL731-20-X0	24 Vdc	None
EL731-21-X0	24 Vdc	DeviceNet™
EL731-22-X0	24 Vdc	Profibus®
EL731-23-X0	24 Vdc	EtherNet/IP™
EL731-24-X0	24 Vdc	Modbus® TCP

Accessories

A 

EFCT Series Earth-Fault Current Transformer
Required zero-sequence current transformer specifically designed for low level detection.

AC700-CUA Series Communication Adapter
Optional network-interface and firmware-upgrade communications adapters field-install in EL731.

AC700-SMK DIN-rail & Surface-mount Adapter
EL731 plugs into adapter for back-plane mounting.

ACCESSORIES	REQUIREMENT
EFCT Series CT	One Required
AC700-CUA Series Com. Unit	Optional
AC700-SMK Surface-Mount Kit	Optional
AC700-CVR-00 Watertight Cover (IP66) for Panel-Mount Applications	Optional
PGA-0520 Analog Meter	Optional

Note: When building a part number, replace the "X" with "1" for AS/NZS 2081:2011 Compliant product, "0" otherwise.

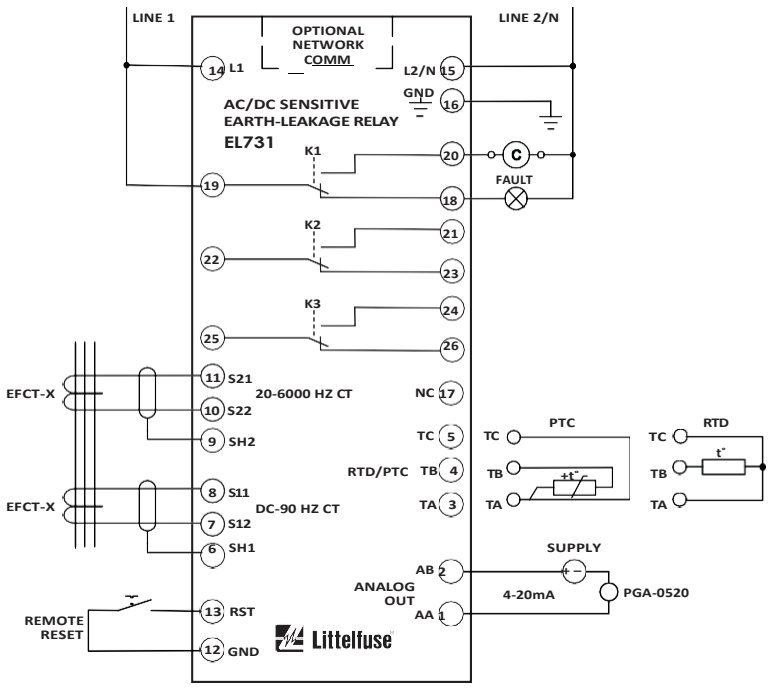
EL731 SERIES

AC/DC Sensitive Earth-Leakage Relay

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (30-5,000 mA)	Adjustable trip setting provides a wide range of low-level protection and system coordination
Frequency range (0-90 Hz, 20-6,000 Hz)	Operate in either AC or DC mode or both. Use single or combined ranges. Separate metering
32-char OLED display	Earth-leakage metering, setup and programming
Local LED indication	Visual Trip, Alarm, CT connection indication
CT-Loop monitoring	Alarms when CT is not connected
Analog output (4-20 mA)	Connect to DCS. Allows connection to an optional meter (PGA-0520) or control system
Adjustable time delay	Adjustable trip delay for quick protection and system coordination
Alarm and trip settings	Detect a deteriorating condition before damage occurs
Temperature-sensor input	Drive or motor temperature protection
Output contacts	3 programmable: Operate 2 alarm and 1 trip circuit
Network communication	Optional connection to plant network
Harmonic filtering	Eliminates nuisance tripping due to harmonic noise
Microprocessor based	No required calibration saves maintenance cost
Universal power supply	Provides flexibility for numerous applications

Wiring Diagram



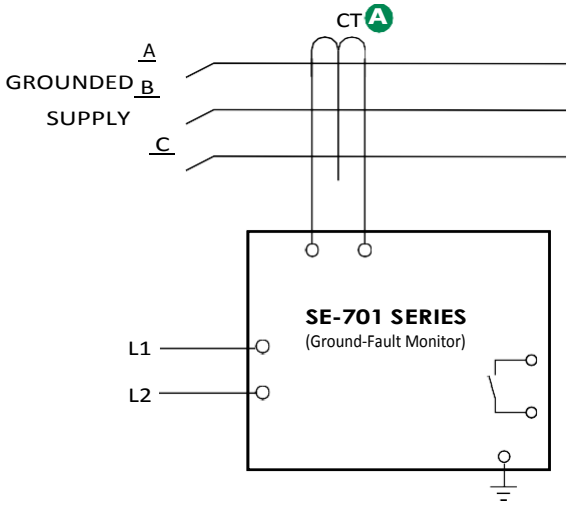
Specifications

IEEE Device Numbers	AC ground fault (50G/N, 51G/N), DC ground fault (79G), PTC overtemperature (49), RTD temperature (38, 49)
Supply Voltage	120/240 Vac/Vdc, 24 Vdc, 48 Vdc/24 Vac
Trip Level Settings	30-5,000 mA AC and DC
Alarm Level Settings	30-5,000 mA AC and DC
Trip Delay	0.05-2 s
Output Contacts	3 Form C (programmable)
Contact Operating Mode	Fail-safe & non-fail-safe
Reset	Front panel and remote
Freq. Response, CT1	0-90 Hz
Freq. Response, CT2	20-6,000, 190-6,000, 20-90, 20-3,000 Hz; selectable
Current Transformer	EFCT-x series
CT Detection	Open & short detection
Terminals	Plug-in, wire clamping, 24 to 12 AWG (0.2-2.5 mm^2)
Communications	EtherNet/IP™, DeviceNet™, Profibus®, Modbus® TCP (optional)
Analog Output	4-20 mA (selectable 0-5 A or 0-100% trip-level setting)
Conformal Coating	Standard feature
Dimensions	**H** 48 mm (1.9”); **W** 96 mm (3.8”); **D** 129 mm (5.0”)
Approvals	UL Listed (E340889), CSA, RCM (Australia), CE
Warranty	5 years
Mounting	Panel; Surface and DIN (with optional AC700-SMK)

SE-701 SERIES

Ground-Fault Monitor

Simplified Circuit Diagram



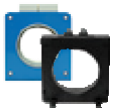
Description

The SE-701 is a microprocessor-based ground-fault relay for resistance- and solidly-grounded systems. In addition to common systems, it is uniquely suited for use on systems with significant harmonic content. The SE-701 can provide main-plant protection, feeder-level protection, or individual-load protection. Proper current transformer selection provides the desired pickup range. The output contacts can be connected for use in protective tripping circuits or in alarm indication circuits. The analog output can be used with a PLC or a meter.

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (1-99%)	Tripsetting based on input CT primary, allows use with any CT. Minimum 50 mA with EFCT Series.
Adjustable time delay (50 ms - 2.5 s)	Adjustable trip delay allows quick protection and system coordination
Output contacts	Form A and Form B ground-fault output contacts for operation of separate annunciation and trip circuits
Analog output (0 - 5 V)	Allows for connecting an optional meter (PGA-0500) or a control system
CT-Loop monitoring	Alarms when CT is not connected
Selectable DFT or peak detection filtering	Compatible with variable-speed drives
Harmonic filtering	Eliminates nuisance tripping
Non-volatile trip memory	Retains trip state while de-energized to simplify troubleshooting
Microprocessor based	No calibration required, saves on maintenance cost
Universal power supply	Allows operation in application where one side of PT is faulted, provides flexibility for numerous applications

Accessories

A 

Ground-Fault Current Transformer
Required current transformer model depends on application. We offer a variety of sensitive CTs with 5- and 30-A primaries.

B 

PGA-0500 Analog % Current Meter
Optional panel-mounted analog meter displays ground-fault current as a percentage of the CT primary rating.

Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-701-OU	120/240 Vac/Vdc
SE-701-OD	12/24 Vdc
SE-701-OT	48 Vdc
SE-701-O3	24 Vac

ACCESSORIES	REQUIREMENT
Current Transformer	Required
PGA-0500	Optional
PMA-55, PMA-60	Optional
SE-EFVC Voltage Clamp	Optional

Note: For optional conformal coating please consult factory.

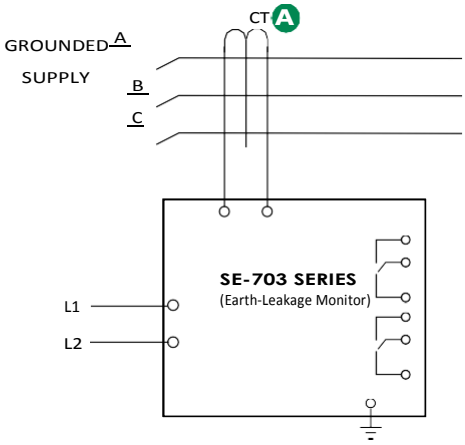
Specifications

IEEE Device Numbers	Ground fault (50G/N, 51G/N)
Input Voltage	See ordering information
Dimensions	**H** 75 mm (3.0"); **W** 55 mm (2.2"); **D** 115 mm (4.5")
Trip Level Settings	1-99% CT-Primary Rating
Trip Time Settings	0.05-2.5 s
Contact Operating Mode	Selectable fail-safe or non-fail-safe
Harmonic Filtering	Standard feature
Test Button	Standard feature
Reset Button	Standard feature
CT-Loop Monitoring	Standard feature
Output Contacts	Isolated Form A and Form B
Approvals	CSA certified, UL Listed (E340889), CE (European Union), C-Tick (Australian)
Analog Output	0-5 V
Conformally coated	Consult factory
Warranty	5 years
Mounting	DIN, Surface (standard) Panel (with PMA-55 or PMA-60 adapter)

SE-703 SERIES

Earth-Leakage Monitor

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-703-0U-0x	120/240 Vac/Vdc
SE-703-0D-0x	12/24 Vdc
SE-703-0T-0x	48 Vdc
SE-703-03-0x	24 Vac

Note: x=0 for AS/NZS 2081:2011 compliance (fail-safe output contacts)
x=2 for AS/NZS 2081:2002 compliance (selectable fail-safe or non-fail-safe output contacts

ACCESSORIES	REQUIREMENT
EFCT Series	Required
PGA-0500	Optional
PMA-55	Optional
PMA-60	Optional
SE-EFVC Voltage Clamp	Optional

Description

The SE-703 is a microprocessor-based earth-fault relay for resistance- and solidly earthed systems. It offers sensitive earth-fault detection as low as 25 mA and can be used on systems with significant harmonic content. The SE-703 provides feeder-level protection or individual-load protection. The output contacts can be connected for use in protective tripping circuits or in alarm indication circuits. The analog output can be used with a PLC or a meter. The SE-703 is specifically designed to be AS/NZS 2081 compliant to either 2011 or 2002 (see ordering options).

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (25 - 500 mA)	Adjustable trip setting provides a wide range of low-level protection and system coordination
Adjustable time delay (INST-500 ms)	Adjustable trip delay allows quick protection and system coordination
Output contacts	2 Form C ground-fault output contacts for operation of separate annunciation and trip circuits
Analog output (0- 5 V)	Allows for connecting an optional meter (PGA-0500) or control system
CT-Loop monitoring	Alarms when CT is not connected
Contact operating mode	Fail-safe operating mode for undervoltage applications, optional non-fail-safe mode available
Harmonic filtering	Eliminates nuisance tripping
Non-volatile trip memory	Retains trip state while de-energized to simplify troubleshooting
Microprocessor based	No calibration required, saves maintenance cost
Universal power supply	Allows operation in application where one side of PT is faulted, provides flexibility for numerous applications
Global certifications	Compliant with US, Canadian, European, and Australian standards for applications in almost any country

Accessories

EFCT Series Ground-Fault Current Transformer
Required zero-sequence current transformer specifically designed for low-level detection.

PGA-0500 Analog % Current Meter
Optional panel-mounted analog meter displays ground-fault current as a percentage of the set-point or 5 A.

PMA-60 Series – Mounting Adapter
Required when panel mounting for AS/NZS 2081:2011 compliance

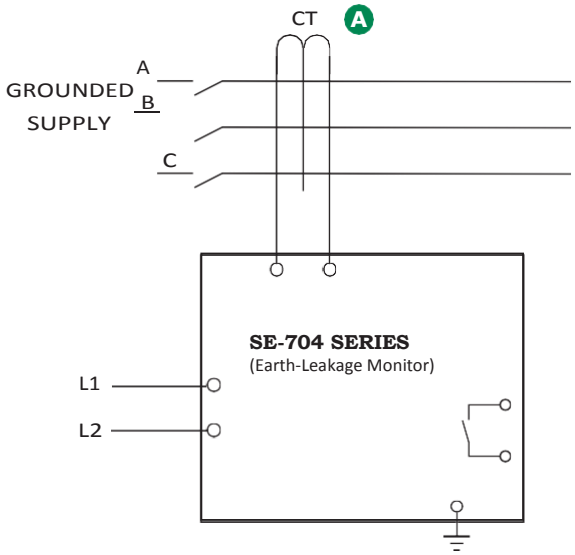
Specifications

IEEE Device Numbers Ground fault (50G/N, 51G/N)
Input Voltage See ordering information
Dimensions **H** 75 mm (3.0"); **W** 55 mm (2.2"); **D** 115 mm (4.5")
Trip Level Settings 25-500 mA
Trip Time Settings INST-500 ms
Contact Operating Mode Fail-safe (x=0 models) or selectable (x=2 models)
Harmonic Filtering Standard feature
Test Button Standard feature
Reset Button Standard feature
CT-Loop Monitoring Standard feature
Output Contacts Two isolated Form C contacts
Approvals CSA certified, UL Listed (E340889), CE (European Union), RCM (Australian)
Compliance AS/NZS 2081:2011 (x=0 models) or AS/NZS 2081: 2002 (x=2 models)
Analog Output 0-5 V
Conformally coated Yes
Warranty 5 years
Mounting DIN, Surface (standard) Panel (with PMA-55 or PMA-60 adapter)

SE-704 SERIES

Earth-Leakage Monitor

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-704-0U	120/240 Vac/Vdc
SE-704-0D	12/24 Vdc
SE-704-0T	48 Vdc
SE-704-03	24 Vac

ACCESSORIES	REQUIREMENT
SE-CS30 Series	Required
PGA-0500	Optional
PMA-55, PMA-60	Optional

Note: For optional conformal coating please consult factory.

Description

The SE-704 is a microprocessor-based ground-fault relay for resistance- and solidly-grounded systems. It offers very sensitive ground-fault detection as low as 10 mA and can be used on systems with significant harmonic content. The SE-704 provides feeder-level protection or individual-load protection. The output contacts can be connected for use in protective tripping circuits or in alarm indication circuits. The analog output can be used with a PLC or a meter.

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (10 mA- 5 A)	Adjustable trip setting provides a wide range of low-level protection and system coordination
Adjustable time delay (30 ms- 2.0 s)	Adjustable trip delay allows quick protection and system coordination
Output contacts	Form A and Form B ground-fault output contacts for operation of separate annunciation and trip circuits
Analog output (0-5 V & 0-1 mA)	Allows for connecting an optional meter (PGA-0500) or control system
CT-Loop monitoring	Alarms when CT is not connected
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil
Harmonic filtering	Eliminates nuisance tripping
Non-volatile trip memory	Retains trip state when de-energized to simplify troubleshooting
Microprocessor based	No calibration required saves maintenance cost
Universal power supply	Allows operation in application where one side of PT is faulted, provides flexibility for numerous applications

Accessories

A 

SE-CS30 Series Ground-Fault Transformer
Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.

B 

PGA-0500 Analog % Current Meter
Optional panel-mounted analog meter displays ground-fault current as a percentage of the set-point or 5 A.

Specifications

IEEE Device Numbers Ground fault (50G/N, 51G/N)
Input Voltage See ordering information
Dimensions **H** 75 mm (3.0"); **W** 55 mm (2.2"); **D** 115 mm (4.5")
Trip Level Settings 10 mA-5.0 A
Trip Time Settings 30-2000 ms
Contact Operating Mode Selectable fail-safe or non-fail-safe
Harmonic Filtering Standard feature
Test Button Standard feature
Reset Button Standard feature
CT-Loop Monitoring Standard feature
Output Contacts Isolated Form A and Form B
Approvals UL Listed (E340889), CSA, CE (European Union)
C-Tick (Australian)
Analog Output 0-5 V & 0-1 mA
Conformally coated Optional
Warranty 5 years
Mounting DIN, Surface (standard)
Panel (with PMA-55 or PMA-60 adapter)

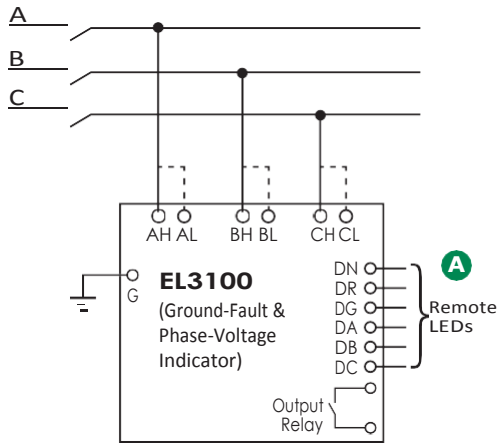
EL3100 SERIES

Ground-Fault & Phase-Voltage Indicator

Description

The EL3100 is a self-powered ground-fault and phase-voltage indication system for 3-phase systems. The EL3100 meets the National Electrical Code (NEC) and the Canadian Electrical Code (CEC) requirements for ground detectors for ungrounded alternating-current systems. Voltage connections are provided on the EL3100 for 208, 240, 480, and 600-V systems. Three green LED's on the EL3100 indicate the presence of phase-to-ground voltage and one red LED indicates a ground fault. The EL3100 can operate stand-alone or with up to five remote LED indicators. A solid-state relay output provides indication of a ground fault. The output relay is closed when the 3-phase neutral voltage shifts as the result of ground leakage.

Simplified Circuit Diagram



Features & Benefits

FEATURES	BENEFITS
NEC® and CEC Code compliant	Meets National Electrical Code (NEC®) Article 250.21 and Canadian Electrical Code Part 1, Section 10-106 (2) requirements for ungrounded systems
Low-voltage remote LEDs	System voltage is not present at the remote LED location
Phase-voltage indication	Indicates the presence of voltage on both grounded and ungrounded systems
Output relay	Allows for remote ground-fault indication

Ordering Information

ORDERING NUMBER	MOUNTING
EL3100-00	DIN, Surface

ACCESSORIES	REQUIREMENT
RK-310X-0Y	Optional

Note: X=R for red LED and G for green LED
Y=0 for no label and 1 for a ground-fault label

Accessories

A

Remote LEDs
High-intensity 16-mm IP67 LED lamps available in red and green colors.

Specifications

Input Voltage	Input L: 208/240 Vac Input H: 480/600 Vac
Dimensions	**H** 87.0 mm (3.43") **W** 112.5 mm (4.43") **D** 56.0 mm (2.2")
Approvals	CSA certified, UL Listed (E340889) No RCM Labelling
Conformally Coated	Standard feature
Warranty	5 years
Mounting	DIN, Surface

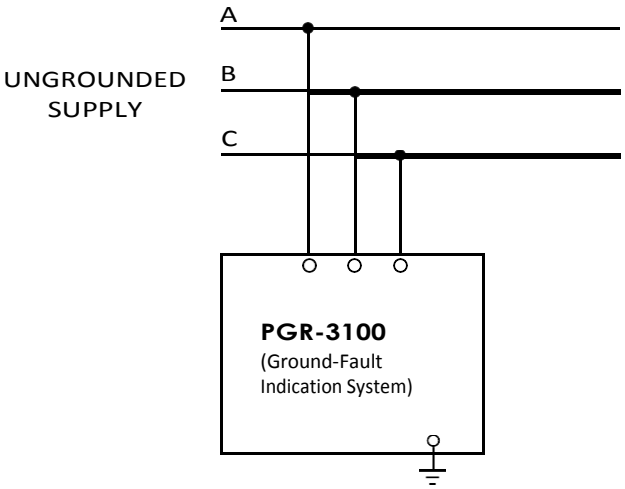
PGR-3100 SERIES

Ground-Fault Indication System

Description

The PGR-3100 indicates the presence of voltage on each phase of a three-phase system. The LEDs on the panel illuminate when voltage is present. When a ground-fault occurs, the voltage on the faulted phase reduces to ground potential, causing the LEDs for the faulted phase to dim and the LEDs for the unfaulted phases to become brighter. Ungrounded ac systems are required by the National Electrical Code (NEC®) Article 250.21(B) and the Canadian Electrical Code Part 1, Section 10-106 (2) to have ground detectors, such as the PGR-3100, installed on the system. External potential transformers (PTs) can be used to step down system voltage, allowing the PGR-3100 to be applied to any system voltage. PTs are not required for system voltages up to 600 Vac.

Simplified Circuit Diagram



Features & Benefits

FEATURES	BENEFITS
NEC® and CEC Code compliant	Meets National Electrical Code (NEC®) Article 250.21(B) and Canadian Electrical Code Part 1, Section 10-106 (2) requirements for ungrounded systems
Phase LEDs	Indicates presence of a ground fault and the faulted phase as well as phase-to-ground voltage on an energized bus
Redundant LEDs	Redundant long-life LEDs (two per phase) to ensure reliability
Lamp test button	Verifies LEDs are operating

Specifications

Input Voltage	Up to 600 Vac 50/60 Hz
Indicator Off Voltage	< 30 Vac line to ground
Dimensions	**H** 88.9 mm (3.5”); **W** 108 mm (4.3”); **D** 54 mm (2.1”)
Test Button	Local
Approvals	CSA certified, UL Listed No RCM Labelling
Conformally Coated	Standard feature
Warranty	5 years
Mounting	Panel

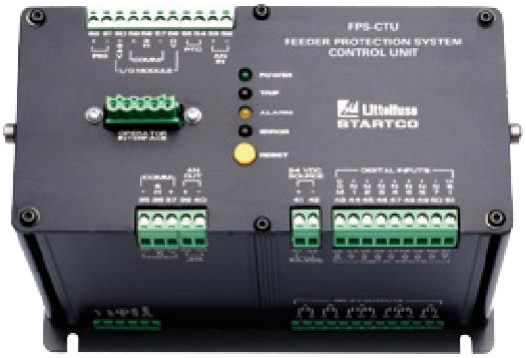
Ordering Information

ORDERING NUMBER	MOUNTING
PGR-3100	Panel mount

FPS SERIES

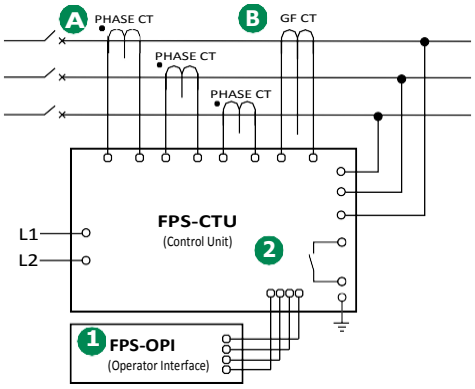
Feeder Protection System

1



2

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	COMMUNICATIONS
FPS-CTU-01-00	RS-485
FPS-CTU-02-00	RS-485 & DeviceNet™
FPS-CTU-03-00	RS-485 & Profibus®
FPS-CTU-04-00	RS-485 & Ethernet

ACCESSORIES	REQUIREMENT
FPS-OPI-01-00	Recommended
SE-IP65CVR-M	Optional
Phase CTs	Required
Ground-Fault CT	Recommended
MPS-RTD-01-00	Optional

Description

The FPS Feeder Protection System monitors voltage and current to provide a comprehensive package of 17 protective functions. The FPS is a modular system with integrated protection, breaker control, metering, and data-logging functions.

1 Operator Interface (FPS-OPI)

- Large, bright, 4 x 20 vacuum-fluorescent display
- Display metered values
- Access set points
- Powered by Control Unit
- Panel mount or attach directly to Control Unit
- Remote mounting (1.2 km or 4000 ft maximum loop length)
- 1/2 DIN size
- Hazardous-location certified

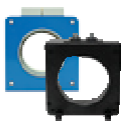
2 Control Unit (FPS-CTU)

- Current inputs—5-A or 1-A secondary phase current transformers
- Voltage inputs—up to 600 V without PTs
- Earth-leakage input—5-A or 1-A secondary or sensitive transformer
- 8 digital inputs, 5 relay outputs, 1 analog input and output
- 24-Vdc supply for OPI and RTD modules, and for digital inputs
- IRIG-B time-code input
- 1/2 DIN size, surface mount
- RS-485 network communications (Standard)
- DeviceNet™, Profibus®, or Ethernet communications available

Accessories

A 

Phase Current Transformers
Phase CTs are required to detect phase currents.

B 

Ground-Fault Current Transformer
Zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.

C 

MPS-RTD Temperature Input Module
Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.

D 

SE-IP65CVR-M Cover
Optional gasketed, transparent cover for limited access and IP65 protection for an Operator Interface Module.

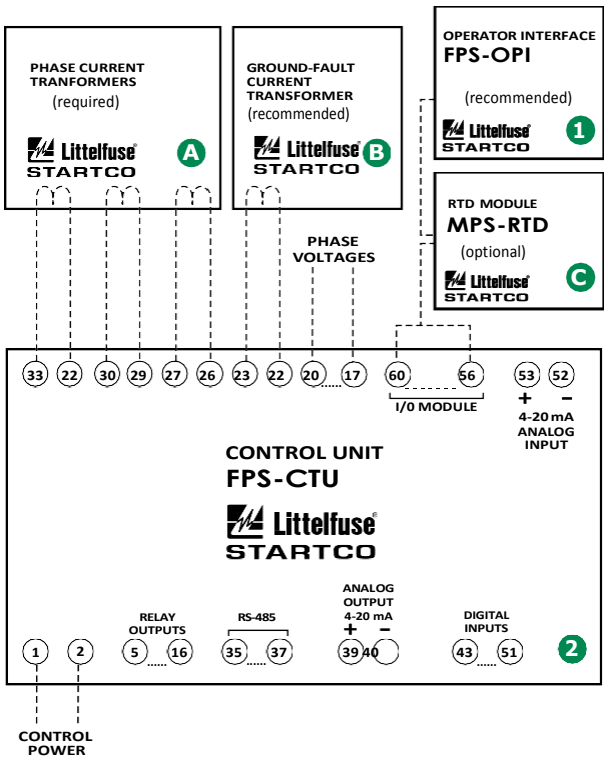
FPS SERIES

Feeder Protection System

Features & Benefits

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Long-time overcurrent provides thermal protection for feeder or load
Inverse-time overcurrent	50, 51	Coordination using IEEE and IEC Curves
Definite-time overcurrent	50, 51	Instantaneous overcurrent to detect catastrophic failure
Current unbalance/ Phase loss/Phase reverse	46	Detects an open or high-impedance phase
Ground fault	50G/N, 51G/N	Inverse and definite time. Early insulation-failure detection.
RTD temperature	38, 49	Optional protection (MPS-RTD module) for load-temperature monitoring
Overvoltage	59	Limits stress to insulation
Undervoltage	27	Detects a damaging brown-out condition
Voltage unbalance	47	Detects unhealthy supply voltage
Two setting groups		Minimizes Arc-Flash hazards during maintenance
Breaker control		Allows local and remote operation; reduces component count
Metering		Displays the measured and calculated parameters
Data logging		On-board 64-event recorder helps with system diagnosis
Communications		Remotely view measured values, event records, & reset trips
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Wiring Diagram



Specifications

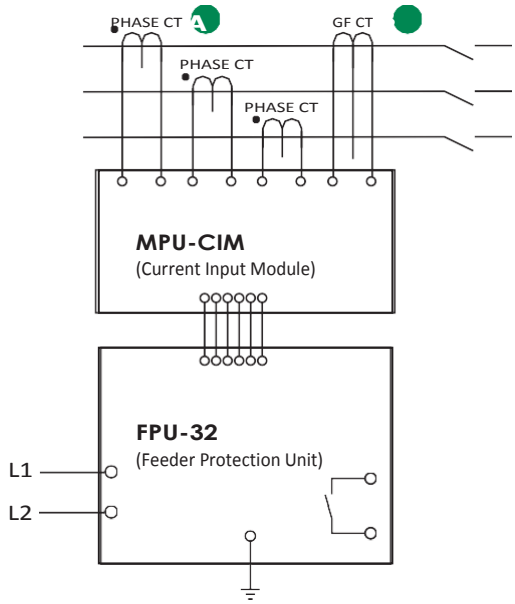
Protective Functions (IEEE Device Numbers)	Overload (49, 51); Phase reverse (current) (46); Overfrequency (81); Overcurrent (50, 51); Underfrequency (81); Ground fault (50G/N, 51G/N); Unbalance (voltage) (47); RTD temperature (38, 49); Unbalance (current) (46); Phase loss (voltage) (47); Overvoltage (59); Phase loss (current) (46); Undervoltage (27); Phase reverse (voltage) (47); Power factor (55)
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 25 W
Power-Up Time	800 ms at 120 Vac
Ride-Through Time	100 ms minimum
24-Vdc Source	100 mA maximum
AC Measurements	True RMS and DFT, Peak, 16 samples/cycle, and positive and negative sequence of fundamental
Frequency	50 or 60 Hz
Inputs	Phase current, Earth-leakage current, Phase voltage, 7 digital, 1 analog
Output Contacts	5 contacts — See Product Manual
Approvals	CSA certified, C-Tick (Australian)
Communications	Allen-Bradley® DFI and Modbus® RTU (Standard); DeviceNet™, Profibus®, Ethernet (Optional)
Conformal Coating	Standard feature
Warranty	10 years
Mounting:	
Control Unit	Surface
Operator Interface	Panel, Control-Unit mounted

FPU-32 SERIES

Feeder Protection Unit

NOTE: The FPU-32 consists of the Feeder Protection Unit (pictured ABOVE) and the MPU-CIM Current Input Module (not pictured).

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	COMMUNICATIONS
FPU-32-00-00	TIA-232
FPU-32-01-00	TIA-232 & RS-485
FPU-32-02-00	TIA-232 & DeviceNet™
FPU-32-04-00	TIA-232 & Ethernet

NOTE: One of the following is required: MPU-CIM-00-00 Current Input Module, or MPU-CTI-RT-00 Current Input Module with ring-tonque terminals.

ACCESSORIES	REQUIREMENT
Phase CTs	Recommended
Ground-Fault CT	Optional
MPU-16A-Y92A-96N	Optional

Description

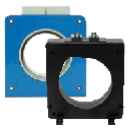
The FPU-32 Feeder Protection Unit provides integrated protection, metering, and data-logging functions. It is an excellent choice for retrofitting and upgrading older relays because of its compact size and ability to use existing CTs. The FPU-32 is used to protect distribution feeders in processing, manufacturing, petroleum, chemical, and wastewater treatment facilities.

Features & Benefits

FEATURES	BENEFITS
IEC & IEEE overcurrent protection curves	Definite and inverse time settings for system coordination; prevents catastrophic failures
Two setpoint groups	Create distinctive settings for maintenance or for two different loads
Reduced overcurrent mode	Maintenance mode setting to reduce the risk of arc-flash hazards
Data logging	On-board 100-event recorder and remote data logging helps with system diagnostics
Overload	Thermal protection for connected load
Phase loss/Phase reverse (current)	Detects unhealthy supply conditions
Unbalance (current)	Prevents overheating due to unbalanced phases
Communications	Remotely view measured values, event records & reset trips

Accessories

Phase Current Transformers
Phase CTs are required to detect phase currents.



Ground-Fault Transformer
Zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.

Specifications

Protective Functions (IEEE Device Numbers)

Overload (49, 51)	Definite-time overcurrent (50, 51)
Phase sequence (46)	Inverse-time overcurrent (50, 51)
Unbalance (46)	Ground fault (50G/N, 51G/N)
Phase loss (46)	RTD/PTC temperature (49)

Input Voltage 65-265 Vac, 30 VA; 80-275 Vdc, 25 W
Power-Up Time 800 ms at 120 vac
Ride-Through Time 100 ms minimum
24-Vdc Source 400 mA maximum
AC Measurements True RMS and DFT, Peak 32 samples/cycle and positive and negative sequence of fundamental
Frequency 50, 60 Hz
Output Contacts Three Form C
Approvals CSA certified, CE, C-Tick (Australian), UL Recognized
Communications TIA-232 (standard); TIA-485, DeviceNet™, Ethernet (optional)
Analog Output 4-20 mA, programmable
Conformally Coated Standard feature
Warranty 10 years
Mounting
(Control Unit) Panel (standard)
Surface (with MPU-32-SMK converter kit)
(Current Input Module) DIN, Surface

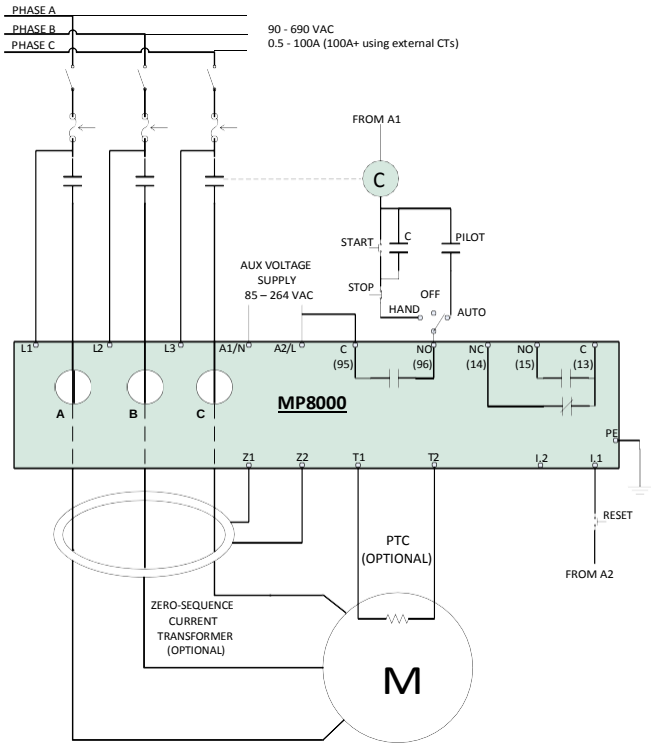
MP8000

Bluetooth Overload Relay

Patent Pending

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR 3-PHASE



Description

The MP8000 is an advanced motor protection electronic overload relay that is fully programmable via Bluetooth* using the Littelfuse app on an Android* or iPhone* mobile device. It is easy to use and arc-flash safety is increased because the app allows settings to be modified and real-time operational information viewed. Viewing operational information and faults on the app does not require the user to open the control panel.

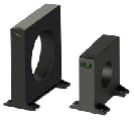
The MP8000 protects any motor drawing 0.5-1,000 full load Amps (external CTs are required above 100 amperes). It is designed for single or 3-phase systems with operating voltages of 90-690 VAC (use of external potential transformers can extend upper voltage range above 690 VAC). Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application.

Protection is unsurpassed by combining overload, voltage, phase loss and reversal, voltage and current unbalance, power monitoring, and underload in one package. For standalone applications, the Bluetooth interface can be used when paired with a smartphone or tablet. The units also feature an Ethernet communications port that can be used to form an Ethernet Modbus TCP/IP network or Ethernet/IP. Units can be remotely monitored and controlled from a PC, or SCADA system, and data logging through a PC with the optional Solutions software or other software program using the MP8000 memory map. This capability allows for a simple cost-effective way to further enhance arc-flash safety.

Features & Benefits

FEATURES	BENEFITS
Bluetooth interface	Visual indication for programming, viewing real-time voltage or current, and last fault information (date and time stamped)
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
4 programmable delay timers	Program separate delay times for power up, rapid cycle protection, motor cool down, and underload restarting
Flexible reset	Reset can be done through pushbutton on panel, remotely via the network
Network communications capability	Compatible with Ethernet Modbus TCP/IP and Ethernet/IP

Accessories



ZSCT Series Current Transformer
Used with Littelfuse relays to detect low levels of earth-leakage current.

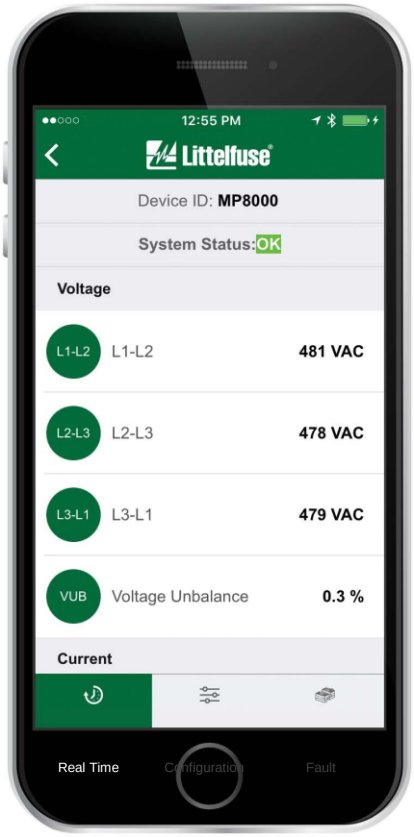
Ordering Information

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
MP8000	90-690VAC (use of external potential transformers can extend upper voltage range above 690VAC)	0.5-1,000A+ (external CTs required above 100A)	Provides remote wired communication via Ethernet Modbus TCP/IP or Ethernet/IP

MP8000

Advanced Features

- Overload/Overpower (49)
- Underload/Underpower (37P)
- Overcurrent (51)/Jam
- Undercurrent (37)
- Current Unbalance/Phase Loss (46)
- Phase Reversal (47)
- Overvoltage (59)
- Undervoltage (27)
- Voltage Unbalance (47)
- Rapid Cycling/Jog
- Contactor Failure
- Zero-Sequence Ground Fault (50Ns)
- PTC Motor Overtemperature (49)



Littelfuse MP8000

MP8000
Littelfuse App icon

Available on the App Store

GET IT ON Google Play

Specifications

Functional Characteristics

Frequency	50/60Hz
TC- Overcurrent Trip Class	Trip class 02-60 or linear

Output Characteristics

Output Contact Rating	
Control relay	SPST - Form A
Auxiliary relay	SPDT - Form C
Pilot Duty Rating	B300
General Purpose	5A @ 240VAC

General Characteristics

Ambient Temperature Range	
Operating	-40° to 70°C (-40° to 158°F)
Storage	-40° to 85°C (-40° to 185°F)

Accuracy

Voltage	±1% of reading ±0.5 V
Current	±2% (2 to 100 amperes direct)
Timing	+/-0.5% of setting +/- 1second
GF Current	±5%

Repeatability

Voltage	±0.5%
Current	±1% (2 to 100 A direct)
Power Consumption	<5 W
Pollution Degree	3 (conformal coating standard)
Class of Protection	IP20
Relative Humidity	10-95%, non-condensing per IEC68-2-3
Terminal Torque (depluggable terminal blocks)	5.5 in.-lbs.
Terminal Torque (Earth Ground)	7.9 in.-lbs.

Standards Passed

Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
Radio Frequency Immunity (RFI), Conducted	IEC 61000-4-6, Level 3 10V/m
Radio Frequency Immunity (RFI), Radiated	IEC 61000-4-3, Level 3 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5kV input power
Surge	IEC61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground
FCC Rating	Part 15.107 for emissions, Part 15.247 for intentional radiators
Short Circuit Withstand Rating	100kA symmetrical at 690VAC
Hi-Potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)

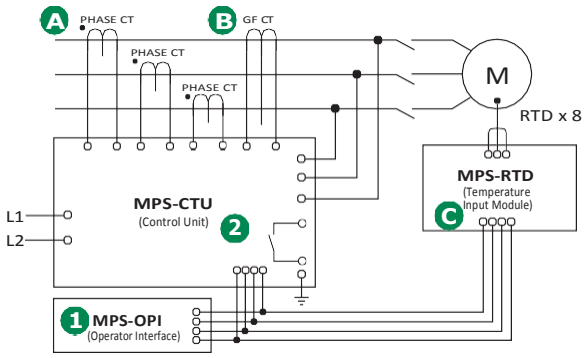
Safety Marks

cULus	UL60947, UL1053, C22.2 (File #E68520)
CE	IEC 60947 Edition 5.2, IEC 60947-8
Maximum Conductor Size (with insulation)	0.63”
Dimensions	**H** 74.42 mm (2.93”); **W** 103.63 mm (4.08”); **D** 121.67 mm (4.79”)
Weight	0.85 lbs (13.6 oz, 385.6 g)
Mounting Method	Surface mount (4 - #8 screws) or DIN-rail mount

MPS SERIES

Motor Protection System

Simplified Circuit Diagram



Description

The MPS Motor Protection System monitors voltage, current, and temperature to provide a comprehensive package of 22 protective functions. The MPS is a modular system with integrated protection, motor control, metering, and data-logging functions. This system is typically used to provide protection for three-phase low- and medium-voltage, medium- to high-horsepower induction motors.

1 Operator Interface (MPS-OPI)

- Large, bright, 4 x 20 vacuum-fluorescent display
- Display metered values
- Access set points
- Powered by Control Unit
- Panel mount or attach directly to Control Unit
- Remote mounting (1.2 km or 4000 ft maximum loop length)
- 1/2 DIN size
- Hazardous-location certified

2 Control Unit (MPS-CTU)

- Current inputs—5-A or 1-A secondary phase current transformers
- Voltage inputs—up to 600 V without PTs
- Earth-leakage input—5-A or 1-A secondary or sensitive transformer
- Tachometer (high-speed pulse) input
- 8 digital inputs, 5 relay outputs, 1 analog input and output
- 24-Vdc supply for OPI and RTD modules, and for digital inputs
- IRIG-B time-code input
- 1/2 DIN size, surface mount
- RS-485 network communications (Standard)
- DeviceNet™, Profibus®, or Ethernet communications available

Ordering Information

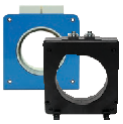
ORDERING NUMBER	COMMUNICATIONS
MPS-CTU-01-00	RS-485
MPS-CTU-02-00	RS-485 & DeviceNet™
MPS-CTU-03-00	RS-485 & Profibus®
MPS-CTU-04-00	RS-485 & EtherNet/IP™ & Modbus® TCP

ACCESSORIES	REQUIREMENT
MPS-OPI-01-00	Recommended
Phase CTs	Required
Ground-Fault CT	Recommended
MPS-RTD-01-00	Optional
MPS-DIF-01-00	Optional
SE-IP65CVR-M	Optional

Accessories

A 

Phase Current Transformers
Phase CTs are required to detect phase currents.

B 

Ground-Fault Current Transformer
Required zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.

C 

MPS-RTD Temperature Input Module
Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.

D 

MPS-DIF Differential Current Module
Optional motor differential protection, compatible with core balance and summation current transformer connections.

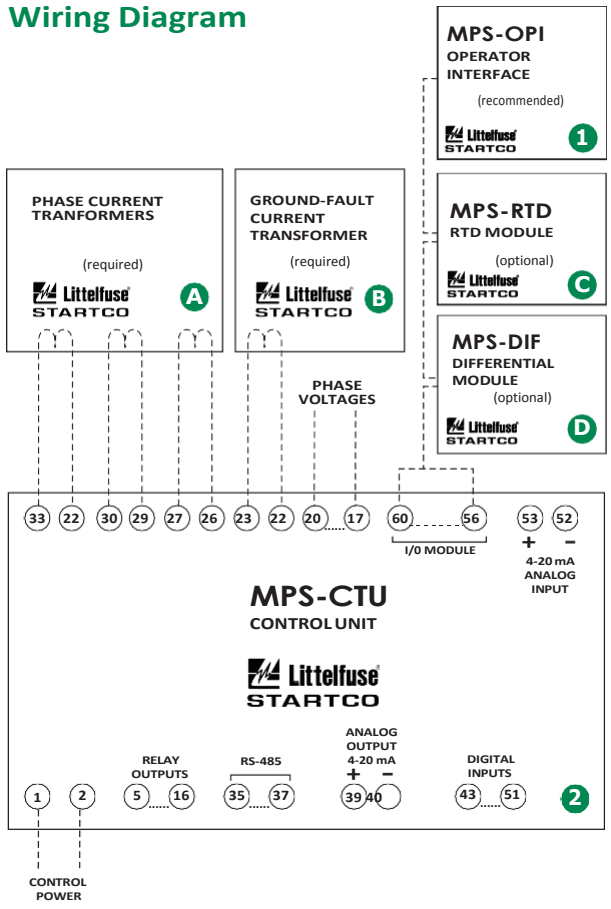
MPS SERIES

Motor Protection System

Features & Benefits

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Extends motor life and prevents insulation failures and fires
Current unbalance/ Phase loss/Phase reverse	46	Prevents overheating and extends motor life
Overcurrent/Jam	50, 51	Prevents catastrophic failures and fires and extends motor life
Undercurrent	37	Detects low-level or no-load conditions
Ground fault	50G/N, 51G/N	Prevents catastrophic failures and fires
RTD temperature	38, 49	Optional RTD temperature protection (MPS-RTD module) for high ambient or loss of ventilation protection
Overvoltage	59	Prevents stress to insulation
Undervoltage	27	Prevents a start attempt when it will damage the motor
Voltage unbalance	47	Detects unhealthy supply voltage
Phase differential	87	Provides sensitive protection for high-resistance winding faults
Dynamic thermal mode		Provides protection through starting, running, overload, and cooling cycles
Reduced overcurrent mode		Minimizes Arc-Flash hazards during maintenance
Starter control		Simplifies the installation by reducing component count
Metering		Displays the measured and calculated motor parameters
Data logging		On-board 64-event recorder helps with system diagnosis
Communications		Remotely view measured values, event records & reset trips
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Wiring Diagram



Specifications

Protective Functions (IEEE Device Numbers)	Overload (49, 51) Phase reverse (current) (46) Overfrequency (81) Overcurrent (50, 51) Jam Underfrequency (81) Ground fault (50G/N, 51G/N) Undercurrent (37) Unbalance (voltage) (47) Failure to accelerate	RTD temperature (38, 49) Unbalance (current) (46) Underspeed (14) Starts per hour (66) Phase loss (voltage) (47) Overvoltage (59) Differential (87) Phase loss (current) (46) Undervoltage (27) Phase reverse (voltage) (47) Power factor (55)
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 25 W	
Power-Up Time	800 ms at 120 Vac	
Ride-Through Time	100 ms minimum	
24-Vdc Source	100 mA maximum	
AC Measurements	True RMS and DFT, Peak, 16 samples/cycle, and positive and negative sequence of fundamental	
Frequency	50, 60 Hz or ASD	
Inputs	Phase current, Earth-leakage current, Phase voltage, 7 digital, tachometer, 1 analog	
Output Contacts	5 contacts — See Product Manual	
Approvals	CSA Certified, RCM (Australian), UL Recognized	
Communications	Allen-Bradley® DFI and Modbus® RTU (Standard); DeviceNet™, Profibus®, Ethernet (Optional)	
Conformally Coated	Standard feature	
Warranty	10 years	
Mounting		
(Control Unit)	Surface	
(Operator Interface)	Panel, Control-Unit mounted	

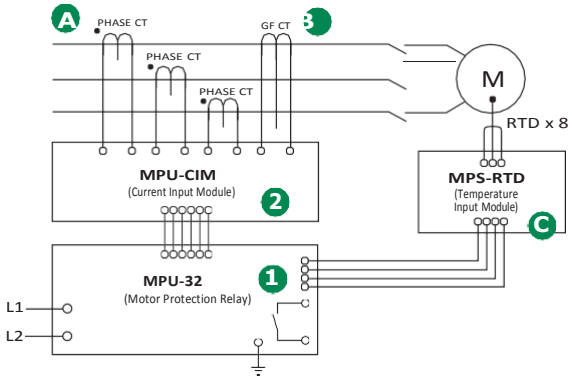
MPU-32 SERIES

Motor Protection Unit

1

2

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	COMMUNICATION
MPU-32-00-00	TIA-232
MPU-32-01-00	TIA-232 & TIA-485
MPU-32-02-00	TIA-232 & DeviceNet™
MPU-32-04-00	TIA-232 & EtherNet/IP™ & Modbus® TCP

NOTE: One of the following is required: MPU-CIM-00-00 Current Input Module, or MPU-CTI-RT-00 Current Input Module with ring-tonque terminals.

ACCESSORIES	REQUIREMENT
Phase CTs	Required
MPS-RTD-01-00	Optional
MPS-DIF-01-00	Optional
MPU-32-SMK	Optional
CA-945	Optional
MPU-16A-Y92A-96N	Optional

Description

The MPU-32 Motor Protection Unit is used to provide current- and temperature-based protection, metering, and data logging for three-phase low-voltage medium-horsepower induction motors. This relay is ideal for retrofitting and upgrading obsolete or aging motor protection using existing CTs. See the PMA Family of Panel Mount Adapter Kits to replace common obsolete relays.

1 Motor Protection Unit

- Three ac-current inputs
- Earth-leakage-CT input
- Programmable digital input
- 24-Vdc source for digital input
- Programmable 4-20-mA analog output
- On-board temperature-sensor input,
- 100-Ω-Platinum RTD or PTC
- Three programmable output relays
- Local RS-232 communications, optional Network Communications
- PC-interface software (SE-Comm-RIS)
- 4 line x 20 character backlit LCD display
- Keypad for programming and display selection
- 4 LEDs; 1 user programmable

2 Current Input Module (MPU-CIM)

The MPU-CIM Current Input Module is the interface between the MPU-32 relay and the 5-A-secondary, 1-A-secondary, and sensitive current transformers. The MPU-CIM is ordered separately from the MPU-32 and can be surface- or DIN-rail mounted. Wire-clamping terminals are standard but the MPU-CTI is available for those who require ring-tongue terminals.

Accessories

A **Phase Current Transformers**
Phase CTs are required to detect phase currents. For upgrade applications, existing CTs can be used.

B **Ground-Fault Current Transformer**
Optional zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.

C **MPS-RTD Temperature Input Module**
Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.

D **MPS-DIF Differential Current Module**
Optional motor differential protection, compatible with core balance and summation current transformer connections.

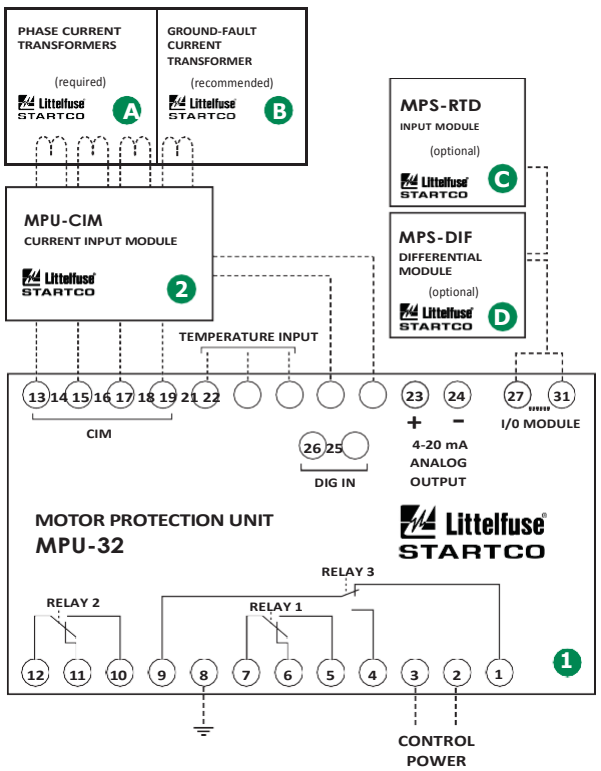
MPU-32 SERIES

Motor Protection Unit

Features & Benefits

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Extends motor life and prevents insulation failures and fires
Dynamic thermal model		Provides protection through starting, running, and cooling cycles
Communications		Remotely view measured values and event records, reset trips, and access setpoints
Ground fault	50G/N, 51G/N	Prevents catastrophic failures and fires
Current unbalance/ Phase loss/Phase reverse	46	Prevents overheating due to unbalanced phases
RTD temperature	38, 49	RTD temperature protection (MPS-RTD module) for high-ambient or loss-of-ventilation protection
Phase loss/Phase reverse (current)	46	Detects unhealthy supply conditions
Overcurrent	50, 51	Prevents catastrophic failures and fires; extends motor life
Jam		Prevents motor damage by detecting mechanical jams or excessive loading
Undercurrent	37	Detects low level or no-load conditions
PTC overtemperature	49	Overtemperature (PTC) protection for high-ambient or loss-of-ventilation detection
Starts per hour	66	Limits the motor starts per hour to prevent overheating
Differential	87	Optional MPS-DIF module for sensitive winding-fault protection
Reduced overcurrent mode		Minimizes arc-flash hazards during maintenance
Metering		View measured and calculated parameters with on-board display
MPU-CIM		Separate current input module to reduce risk of open-CT hazard and for convenient installation
Analog output		Provides means for metering selectable parameters
Data logging		On-board 100-event recorder for data logging
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Wiring Diagram



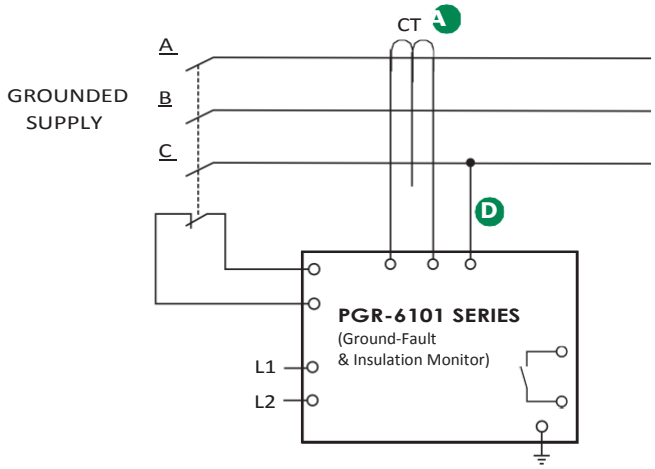
Specifications

Protective Functions (IEEE Device Numbers)	Overload (49, 51)	RTD temperature (38, 49)
	Phase reverse (current) (46)	Unbalance (current) (46)
	Overcurrent (50, 51)	Starts per hour (66)
	Jam	Differential (87)
	Ground fault (50G/N, 51G/N)	Phase loss (current) (46)
	PTC overtemperature (49	Undercurrent (37)
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 25 W	
Power-Up Time	800 ms at 120 Vac	
Ride-Through Time	100 ms minimum	
24-Vdc Source	100 mA maximum	
AC Measurements	True RMS and DFT, Peak, 16 samples/cycle, and positive and negative sequence of fundamental	
Frequency	50, 60 Hz or ASD	
Output Contacts	Three Form C programmables	
Communications	TIA-232 (standard); TIA-485, DeviceNet™, Ethernet (optional)	
Analog Output	4-20 mA, programmable	
Conformally Coated	Standard feature	
Warranty	10 years	
Mounting (Control Unit)	Panel (standard)	
	Surface (with MPU-32-SMK converter kit)	
(Current Input Module)	DIN, Surface	
Approvals	CSA certified, CE (European Union), UL Recognized, C-Tick (Australian)	

PGR-6101 SERIES

Ground-Fault & Insulation Monitor

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
PGR-6101-120	120 Vac

ACCESSORIES	REQUIREMENT
PGC-5000 Series	Required
PGH Family	Required >1300 V
PGA-0500	Optional
PGA-0510	Optional

For optional conformal coating please consult factory.

Description

The PGR-6101 combines the features of a ground-fault protection relay and insulation monitor into one unit. It protects against ground faults by monitoring insulation resistance when the motor is de-energized and by monitoring ground-fault current when the motor is energized. The PGR-6101 features two separate analog outputs for optional current and ohm meters, and two separate alarm relays. It operates on one- or three-phase solidly grounded, resistance grounded and ungrounded systems up to 6 kV.

Features & Benefits

FEATURES	BENEFITS
Adjustable GF pickup (30-200 mA)	Trip setting provides a wide range of low-level protection and system coordination
Adjustable insulation pickup (60-600 k∧)	Customizable insulation resistance setpoints for maximum protection
Adjustable time delay (50-250 ms)	Adjustable trip delay for quick protection and system coordination
Output contacts	Two Form C output contacts for ground fault and insulation-resistance fault
Analog outputs (0-1 mA)	Two analog outputs indicate insulation resistance and ground-fault current
CT-Loop monitoring	Alarms when CT is not connected
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil

Accessories

A 

PGC-5000 Series Ground-Fault Transformers
Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.

B **C** 

PGA-0500 Analog % Current Meter
PGA-0510 Analog Ohm Meter
Optional panel-mounted meters display ground-fault current as a percentage of the set-point and insulation resistance.

D 

PGH Family High Tension Couplers
Required (for systems >1,300 V) PGH Family high-tension coupler must be connected between the phase conductor and the PGR-6101.

Specifications

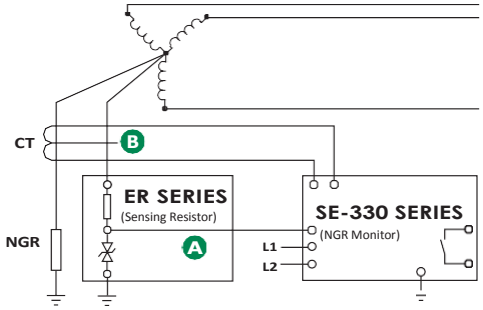
No RCM Labelling

IEEE Device Numbers	Ground Fault (50G/N, 51G/N), Ground detector (64), Alarm Relay (74)
Input Voltage	See ordering information
Dimensions	**H** 75 mm (3”); **W** 100 mm (3.9”); **D** 115 mm (4.5”)
Response delay	< 50 ms
Contact Operating Mode	Selectable fail-safe or non-fail-safe
Harmonic Filtering	Standard feature
Test Button	Standard feature
Reset Button	Standard feature
CT-Loop Monitoring	Standard feature
Output Contacts	Two Form C
Analog Output	0-1 mA
Approvals	UL Listed (E183688)
Warranty	5 years
Mounting	DIN, Surface

SE-330, SE-330HV SERIES

Neutral-Grounding-Resistor Monitor - New Revision

Simplified Circuit Diagram



For detailed wiring diagram, see adjacent page.

Ordering Information

ORDERING NUMBER		POWER SUPPLY	COMM			K4 UNIT HEALTHY CONTACT
SE-330	-	X	X	-	0	X
SE-330 for all apps. 35 kV or less SE-330HV for 72 kV apps.		0=120/240 Vac/Vdc 2=48 Vdc	0=USB Only 1=DeviceNet 3=EtherNet (Dual RJ45) 4=EtherNet (SC Fiber & RJ45) 5=EtherNet (Dual SC Fiber) 6=IEC61850 (Dual RJ45) 7=IEC61850 (SC Fiber & RJ45) 8=IEC61850 (Dual SC Fiber)			0=Normally Open 1=Normally Closed

NOTE: For Australian applications, see the SE-330AU.

ACCESSORIES	REQUIREMENT
ER Series Sensing Resistor	Required
Current Transformer	Required
SE-IP65CVR-G	Optional
SE-MRE-600	Optional
RK-332	Optional
NGRM-ENC	Optional
PGA-0520	Optional
SE-330-SMA	Optional

Description

The SE-330 is an advanced ground-fault and neutral-grounding-resistor monitoring relay that is compliant with Rule10-302 of the 2018 Canadian Electrical Code Part I (CE Code). It measures neutral current, neutral-to-ground voltage, and neutral-to-ground resistance. It provides continuous monitoring of the neutral-to-ground path to verify that the neutral-grounding resistor (NGR) is intact and that it has not been bypassed or shorted. An open NGR renders current-sensing ground-fault protection inoperative and could result in a false belief that the system is functioning properly. A shorted NGR results in higher-than-expected ground-fault current. The SE-330 can be used with low- and medium-voltage transformers and generators with low- or high-resistance grounding used in processing, manufacturing, chemical, pulp and paper, petroleum, and water-treatment facilities. For high-voltage applications, use the SE-330HV. For applications that require conformance to Australian standard AS/NZS 2081.3:2002, use the SE-330AU.

Resistor Monitoring

The SE-330 combines the measured values of resistance, current, and voltage to continuously determine that an NGR is intact. It is able to detect an open or shorted resistor with or without a ground fault present. Sensing resistors are matched to the system voltage and are used to monitor NGRs on systems up to 72 kV.

Ground-Fault Monitoring

The SE-330 uses an application-appropriate current transformer to reliably detect ground-fault currents as small as 100 mA. Discrete-Fourier Transform (DFT) filtering ensures that false trips due to harmonic noise from adjustable-speed drives do not occur. Should the resistor open and a ground fault subsequently occur, the SE-330 will detect the fault through voltage measurement, while other current-only sensing relays would be ineffective.

Pulsing Ground-Fault Location

The SE-330 is capable of controlling a pulsing contactor, which is used to switch the NGR resistance in a pulsing-compatible NGR package. The resulting ground-fault current is distinguishable from charging currents and noise and will only appear upstream of the ground fault, making fault location fast and easy, even without isolating feeders or interrupting loads.

Accessories

A 

ER Series Sensing Resistor
Required interface between the power system and the SE-330/SE-330HV. Eliminates hazardous voltage levels at the relay.

B 

EFCT Series Ground-Fault Current Transformer
Sensitive ground-fault current detection (5 A primary).

SE-CS30 Series Ground-Fault Current Transformer
Sensitive ground-fault current detection (30 A primary).

Other Current Transformer
For low-resistance NGRs choose a CT primary approximately equal to the NGR rating. Inputs are provided for 1- and 5- A- secondary CTs.

SE-IP65CVR-G Hinged Transparent Cover
Watertight cover, tamper resistant, IP65 protection.

SE-330, SE-330HV SERIES

Neutral-Grounding-Resistor Monitor - New Revision

Features & Benefits

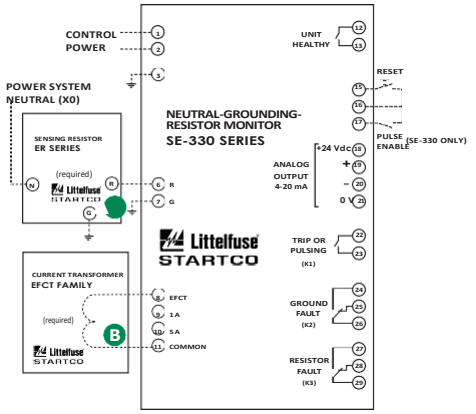
FEATURES	IEEE #	BENEFITS
Continuous NGR monitoring	3	Detects resistor failure within seconds, reduces transient-overvoltage risk, removes risk of ground-fault-detection failure
Ground-fault detection	50G/N, 51G/N, 59N	Main or backup protection to detect a ground fault anywhere on the monitored system
Adjustable pickup (2-100%)		Select greatest sensitivity without false operation, adjustable in 1% increments (MEM setting)
Adjustable time delay (0.1-10 s)		Adjustable trip delay allows quick protection and system coordination
Universal CT compatibility		Allows the use of a CT that gives required ground-fault settings
Programmable output contacts		Two Programmable Form C (Ground Fault, Resistor Fault, Unit Health), Two Form A (Trip/Pulse, Healthy)
Selectable contact operating mode		Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil or alarm circuit (Trip, Ground Fault, Resistor Fault relays)
Analog output (4 -20 mA)		Connect an optional PGA-0520 meter or control system
Pulsing output (SE-330 only)		Control the operation of a pulsing ground-fault-location circuit
Trip records		On-board 100-event (with date and time) recorder helps with system diagnostics
Harmonic filtering (DFT)		Eliminate false trips due to harmonic noise from ASDs
Local communications		Mini USB port to view measured values, configure settings, and check event records
Data logging		On-board microSD card (included) can be used for long-term data logging
Network communications		Remotely view measured values and event records, reset trips, and cause a remote trip Available Protocol Options: **IEC 61850 -** with dual RJ45, SC Fiber and RJ45, or Dual SC Fiber Interface **Modbus TCP and Ethernet/IP** - with dual RJ45, SC Fiber and RJ45, or Dual SC Fiber Interface **DeviceNet -** with CAN interface
Software		PC-interface software (SE-MON330) is available at Littelfuse.com/RelaySoftware
Selectable reset mode		Selectable latching or auto-reset operation
Unit-healthy output		Verifies SE-330 is operating correctly
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Typical Values

SYSTEM VOLTAGE (VOLTS)	NEUTRAL-GROUNDING RESISTOR		SENSING RESISTOR		GROUND-FAULT PICKUP LEVEL (AMPERES)	V_N PICKUP LEVEL (VOLTS)
	CURRENT (AMPERES)	RESISTANCE (OHMS)	MODEL	RESISTANCE (SWITCH S5 SETTING)		
480	5	55	ER-600VC	20 kΛ	2.5	170
600	5	69	ER-600VC	20 kΛ	2.5	200
2,400	5	277	ER-5KV	20 kΛ	2.5	800
4,160	5	480	ER-5KV	20 kΛ	3	1,700
7,200	10	416	ER-15KV	100 kΛ	2	170 x 5 = 850
14,400	15	554	ER-15KV	100 kΛ	3	340 x 5 = 1,700

DISCLAIMER: The above table is for illustrative purposes only. Actual values may differ based on a variety of individual system considerations, such as capacitive charging current and coordination study results.

Wiring Diagram



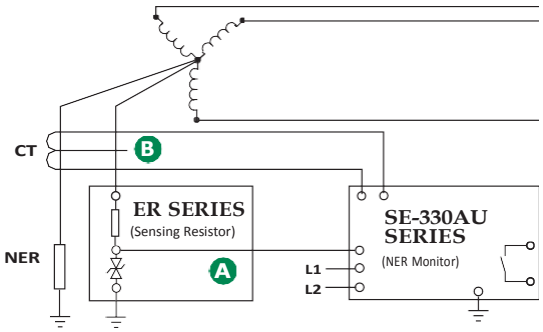
Specifications

IEEE Device Numbers	Ground Fault (50G/N, 51G/N, 59N), Checking Relay (3), Lockout Relay (86)
Input Voltage	See ordering information
Dimensions	**H** 213 mm (8.4"); **W** 98 mm (3.9"); **D** 132 mm (5.2")
GF Trip-Level Settings	2-100% of CT-Primary Rating in 1% increments
GF Trip-Time Settings	0.1-10 s
Vn Trip-Level Settings	20-2,000 Vac (≤5 kV systems) 100-10,000 Vac (>5 kV systems)
Contact Operating Mode	Selectable fail-safe or non-fail-safe (K1, K2, K3)
Harmonic Filtering	Standard feature
Reset Button	Standard feature
Output Contacts	Two Form A and two Form C
Pulsing Circuit	1.0-3.0 s in 0.2 s increments (SE-330 only)
Approvals	CSA certified, UL Listed (E340889), CE (European Union), C-Tick (Australian)
Communications	Mini USB (standard); DeviceNet (optional), IEC 61850 (optional), Modbus TCP and EtherNet/IP (optional)
Analog Output	4-20 mA, self or loop powered
Conformally Coated	Standard feature
Warranty	5 years
Mounting	Panel and Surface (optional)

SE-330AU SERIES

Neutral-Earthing-Resistor Monitor - New Revision

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER		POWER SUPPLY	COMM			K4 UNIT HEALTHY CONTACT
SE-330AU	-	X	X	-	0	X
SE-330AU for all apps. 35 kV or less SE-330HV for 72 kV apps.		0=120/240 Vac/Vdc 2=48 Vdc	0=USB Only 1=DeviceNet 3=EtherNet (Dual RJ45) 4=EtherNet (SC Fiber & RJ45) 5=EtherNet (Dual SC Fiber) 6=IEC61850 (Dual RJ45) 7=IEC61850 (SC Fiber & RJ45) 8=IEC61850 (Dual SC Fiber)			0=Normally Open 1=Normally Closed

ACCESSORIES	REQUIREMENT
ER Series Sensing Resistor	Required
Current Transformer	Required
SE-IP65CVR-G	Optional
SE-MRE-600	Optional
RK-332	Optional

Description

The SE-330AU is an advanced earth-fault and earthing-resistor monitoring relay for low- and medium-voltage transformers and generators. It monitors neutral current, neutral-to-earth voltage, and neutral-to-earth resistance. It provides continuous monitoring of the neutral-to-earth path to verify that the neutral-earthing resistor (NER) is intact. This is of utmost importance—an open NER renders current-sensing earth-fault protection inoperative and could result in a false belief that the system is functioning properly. The SE-330AU earth-fault function complies with AS/NZS 2081.3:2002. Outputs include four relay outputs, and an analog output. A mini USB port is included to view measured values, configure settings, and check event records. An on-board micro SD card can be used for long-term data logging. Network communications options are available. For non-AS/NZS 2081 applications, see the SE-330 or SE-330HV.

Resistor Monitoring

The SE-330AU combines the measured values of resistance, current, and voltage to continuously determine that the NER is intact. It is able to detect a resistor failure with or without an earth fault present. Sensing resistors are matched to the system voltage and are used to monitor NGRs on systems up to 35 kV.

Earth-Fault Monitoring

The SE-330AU uses a 5- or 30-A-primary current transformer to provide a pickup-setting range of 0.125 to 5 A or 0.75 to 30 A to comply with AS/NZS 2081.3:2002. DFT filtering ensures that false trips due to harmonic noise from adjustable-speed drives do not occur. Open-CT detection is provided.

Accessories

A

ER Series Sensing Resistor
Required interface between the power system and the SE-330AU. Eliminates hazardous voltage levels at the relay.

B

EFCT Series Earth-Fault Current Transformer
Sensitive earth-fault current detection (5 A primary).

SE-CS30 Series Earth-Fault Current Transformer
Sensitive earth-fault current detection (30 A primary).

Specifications

Input Voltage	See ordering information
Dimensions	**H** 213 mm (8.4"), **W** 98 mm (3.9"), **D** 132 mm (5.2")
GF Trip-Level Settings	0.125 to 30 A
GF Trip-Time Settings	0.1 to 0.5 s
Vn Trip-Level Settings	20-2,000 Vac (≤5 kV systems) 100-10,000 Vac (>5 kV systems)
Output Contacts	Two Form A, Two Form C
Operating Mode	Fail-Safe
Harmonic Filtering	Standard feature
Reset	Front panel push button and remote input
Approvals	C-Tick (Australian), CE
Communications	Mini USB (standard); DeviceNet (optional), IEC 61850 (optional), Modbus TCP and EtherNet/IP (optional)
Analog Output	4-20 mA, self or looppowered
Conformal Coating	Standard feature
Warranty	5 years
Mounting	Panel, Surface (optional)

EFCT SERIES

Current Sensor

Description

The EFCT series is a sensitive nickel-core current transformer used with Littelfuse relays to detect low levels of earth-leakage current.

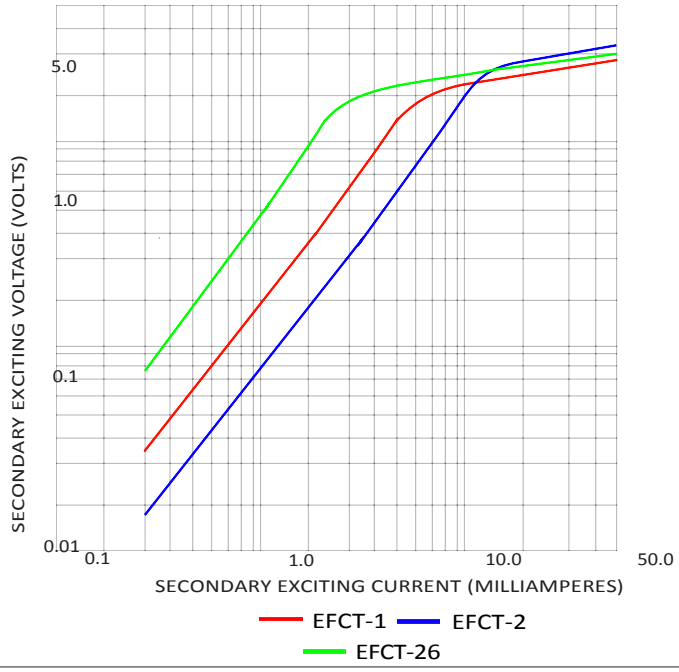
Accessories

EFCT-1FC Flux Conditioner
used with the EFCT-1 to reduce saturation and prevent false operation due to large surge currents.

Specifications

Turns Ratio	100:1
Current Rating	5:0.05 A
Accuracy	3% @ 0.01 VA
Frequency	50 to 400 Hz[1] 0 to 6 kHz for EL731
Insulation Level	600 V
Operating Temperature	-55 to 60ºC (-67 to 140ºF)
Application	EL731, FPU-32, FPS, MPU-32, MPS, SE-330, SE-701, SE-703
Certification	CSA, UL, CE
Compliance	RoHS, IEC 60044-1

Note: 1 Frequency response may be extended for specific product families.

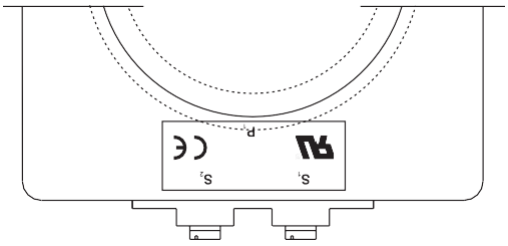


Ordering Information

ORDERING NUMBER	WINDOW SIZE, ID	WEIGHT
EFCT-26	26 mm (1.0”)	0.4 kg (1 lb)
EFCT-1	82 mm (3.2”)	0.9 kg (2 lb)
EFCT-2	139 mm (5.5”)	2.7 kg (6 lb)

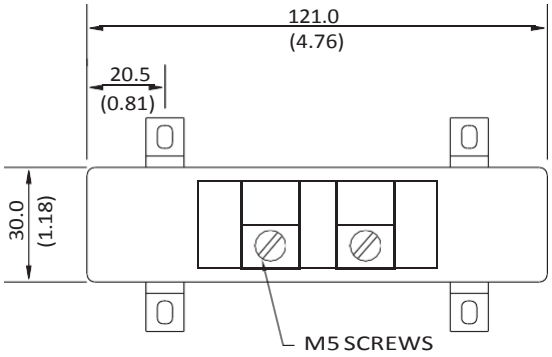
Dimensions and Mounting Diagram

EFCT-1



NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M4 OR 8-32.
3. PRESS MOUNTING FEET IN PLACE USING INSTALLATIONTOOL PROVIDED.
4. RoHS COMPLIANT.
5. EN 60044-1 COMPLIANT.



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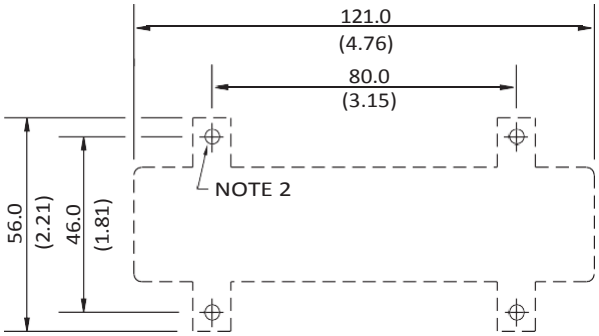
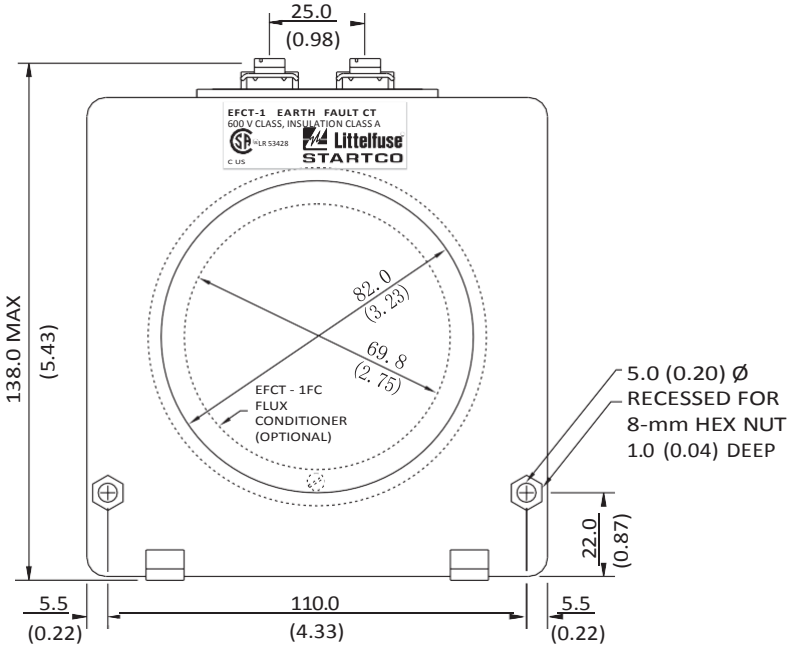


MOUNTING DETAIL



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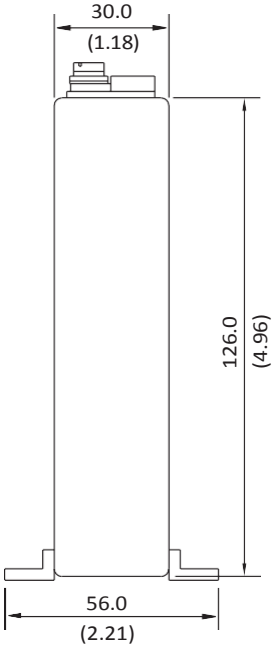
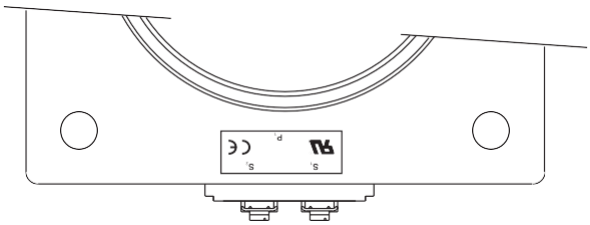


SIDE

EFCT SERIES

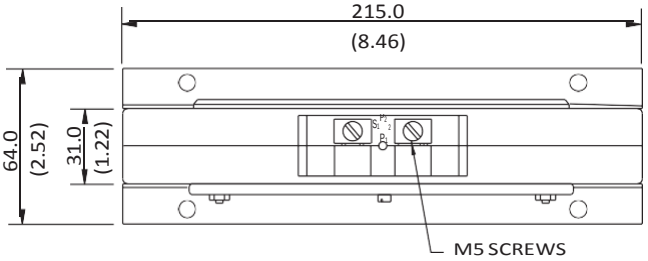
Dimensions and Mounting Diagram

EFCT-2



NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M5 OR 10-32.
3. RoHS COMPLIANT.
4. EN 60044-1 COMPLIANT.



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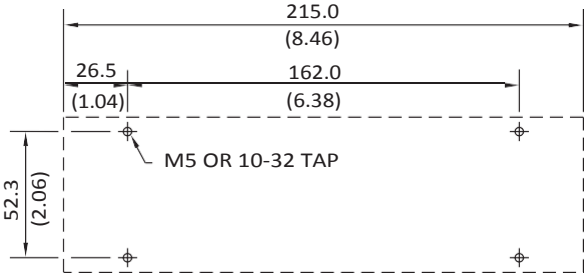
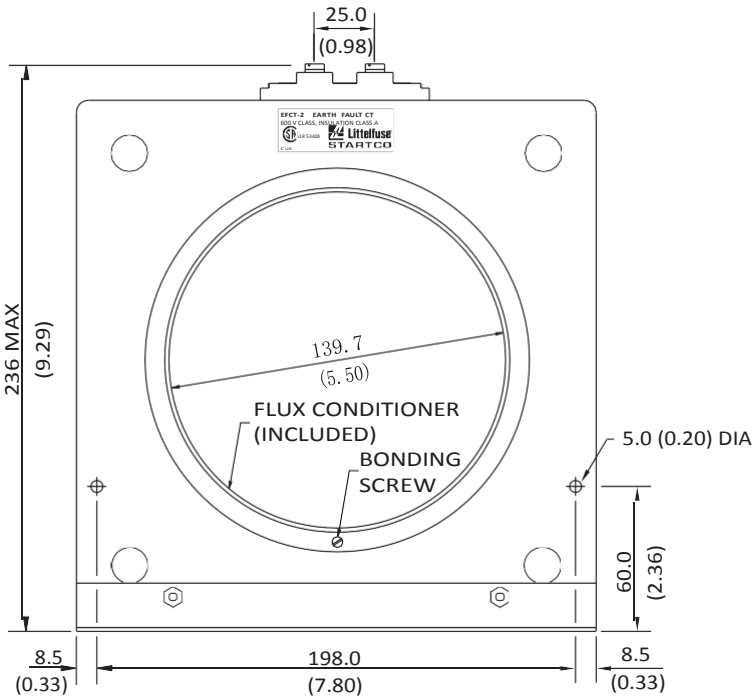


MOUNTING DETAIL



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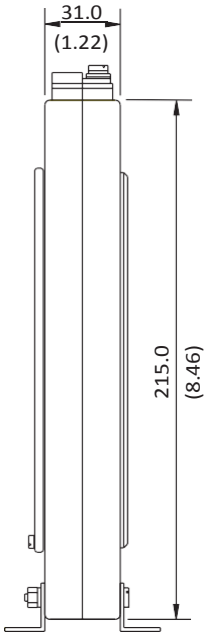
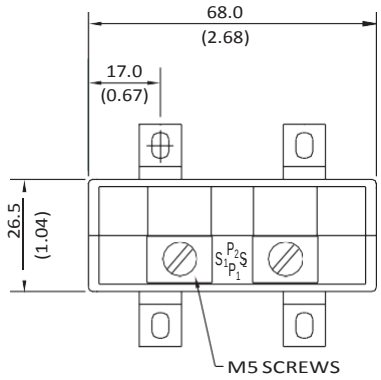


SIDE

Dimensions and Mounting Diagram

EFCT-26



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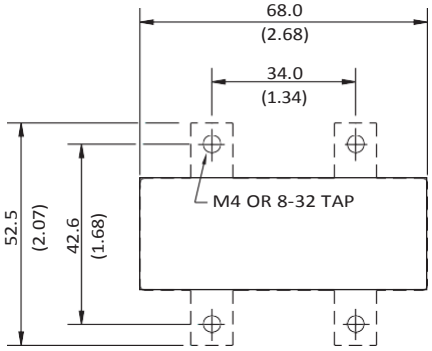
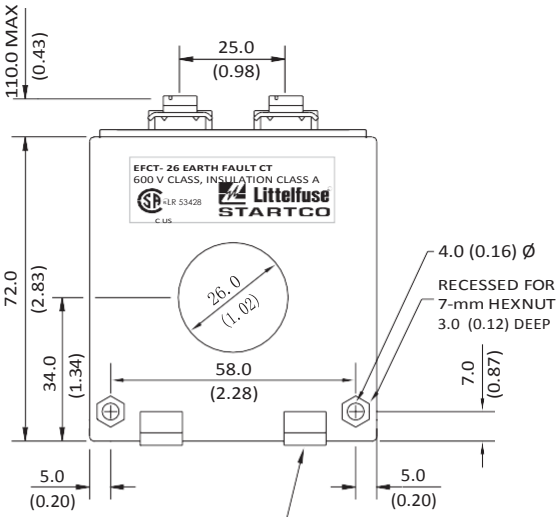


MOUNTING DETAIL



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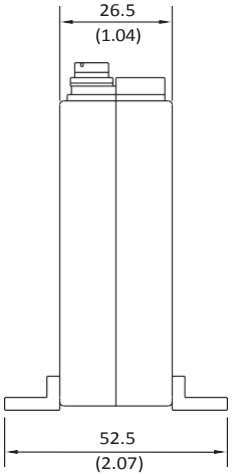
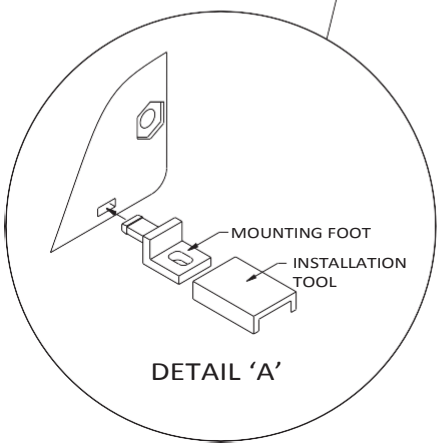


SIDE



DETAIL 'A'

NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M4 OR 8-32.
3. PRESS MOUNTING FEET IN PLACE USING INSTALLATIONTOOL PROVIDED. (DETAIL 'A')
4. RoHS COMPLIANT.
5. EN 60044-1 COMPLIANT.
6. NOT ALL CERTIFICATIONS SHOWN.

REMOTE INDICATION, SENSING RESISTORS

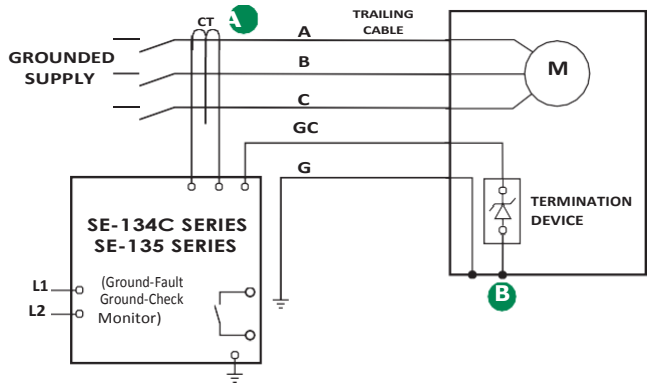
REMOTE INDICATION & METERS		
Product	Features	Accessory for
PGA-0500 Analog % Current Meter	Panel-mounted analog meter displays ground-fault current as a percentage of the set point.	**SE-601 SE-701** **PGR-4300 SE-703** **PGR-6100 SE-704**
PGA-0510 Analog Ohm Meter	Panel-mounted analog ohmmeter displays insulation resistance from 0 ∧ to infinity.	**PGR-3200** **PGR-6100**

SENSING RESISTORS		
Product	features	accessory for
ER-600VC (PGE-600V) Sensing Resistor 	Used on systems up to 1 kV. (Continuous duty)	**SE-330 SE-325** **SE-330AU**
SE-MRE-600 Enclosure 	Used in outdoor enclosures. (ER-600VC ordered separately)	**ER-600VC**
ER-5KV (PGE-05KV) Sensing Resistor 	Used on systems up to 5 kV. (Continuous duty)	**SE-330 SE-325** **SE-330AU**
ER-5WP (PGE-05WV) Sensing Resistor 	Used on systems up to 5 kV, includes weather-protected terminals for use in outdoor enclosures. (Continuous duty)	**SE-330 SE-325** **SE-330AU**
ER-15KV (PGE-15KV) Sensing Resistor 	Used on systems up to 15 kV. (Non-continuous duty)	**SE-330 SE-325** **SE-330HV SE-330AU**
ER-25KV (PGE-25KV) Sensing Resistor 	Used on systems up to 25 kV. (Non-continuous duty)	**SE-330 SE-325** **SE-330HV SE-330AU**
ER-35KV (PGE-35KV) Sensing Resistor 	Used on systems up to 35 kV. (Non-continuous duty)	**SE-330 SE-330HV** **SE-330AU**
ER-72KV (PGE-72KV) Sensing Resistor 	Used on systems up to 72 kV. (Non-continuous duty)	**SE-330HV**

SE-134C, SE-135 SERIES

Ground-Fault Ground-Check Monitor

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	OPTION	POWER SUPPLY	COMM
SE-134C	Blank or XGC	0=120/240 Vac/Vdc 1=24/48 Vdc (1)	0=None
SE-135	Blank or XGC	0=120/240 Vac/Vdc 1=24/48 Vdc (1) (2)	0=None 3=Ethernet (1)

ACCESSORIES	REQUIREMENT
SE-CS10 Series	Required
SE-CS40 Series (for SE-135)	Optional
SE-TA6A Series (for SE-134C)	Required
SE-TA12A/SE-TA12B Combination (for SE-134C)	Optional
SE-TA12A Series (for SE-135)	Required
SE-IP65CVR-G	Optional
RK-132	Optional
PPI-600V	Optional

(1) CE/C-Tick not available.
(2) Not available with Ethernet option 3.
(3) See ordering information.
See Current Transformer Selection Guide and Accessory Information.

Description

The SE-134C/SE-135 is a microprocessor-based, combination ground-wire monitor and ground-fault relay for resistance-grounded or solidly grounded systems. It continuously monitors the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults. The SE-134C/SE-135 is field proven in monitoring trailing cables on large mobile equipment such as drag-lines, mining shovels, shore-to-ship power cables, dock-side cranes, stacker-reclaimers, submersible pumps, and portable conveyors.

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (0.5-12.5 A for SE-CS10) (2 - 50 A for SE-CS40)	Unit can be used on a wide variety of trailing cable applications
Adjustable time delay (0.1-2.5 s)	Adjustable trip delay for quick protection and system coordination
Output contacts	Separate annunciation of ground-fault and ground-check faults
Ground-check LED indication	Indication of open or short ground-check wire makes it easier to find faults
CT-loop monitoring	Alarms when CT is not connected
High-induced-ac rejection	Makes unit suitable for applications with high voltages and long cables
DFT (Harmonic) filter	Prevents false operation
Zener-characteristic termination assembly	Provides reliable ground-check loop verification
Fail-safe circuits	Ensures ground-check and ground-fault circuits remain safe even in the event of equipment failure
Conformal coating	Additional coating protects circuit boards against harsh environment
XGC option	Increases maximum cable length for ground-check monitoring (10 km typical)

Accessories

A 

SE-CS10 or SE-CS40 Series Ground-Fault Current Transformer
Required zero-sequence current transformer detects ground-fault current.

B 

SE-TA6A Series, SE-TA12A Series Termination Assembly
Required termination assembly; temperature compensated.

Specifications

IEEE Device Numbers	Checking or Interlocking Relay (3GC), Ground fault (50G/N, 51G/N)
Input Voltage	65-265 Vac; 85-275 Vdc; 18-72 Vdc
Dimensions	**H** 213 mm (8.4"); **W** 99 mm (3.9"); **D** 132 mm (5.2");
Trip Level Settings	0.5-12.5 A for SE-CS10, 2 - 50 A for SE-CS40
Trip Time Settings	0.1-2.5 s
Contact Operating Mode	Selectable fail-safe or non-fail-safe
Harmonic Filtering	Standard feature
Test Button	Standard feature
Reset Button	Standard feature
Output Contacts	Isolated Form A and Form B, Two Form C
Approvals	CSA certified, UL Listed (E340889), C-Tick (Australia)(3), CE(3)
Conformally Coated	Standard feature
Warranty	5 years
Mounting	Panel, Surface
GC Trip Resistance	28Ω (Standard), 45Ω (XGC Option)

SE-105, SE-107 SERIES

Ground-Fault Ground-Check Monitor

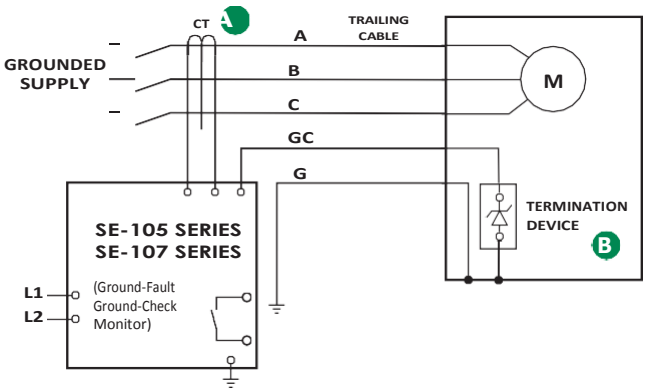
Description

The SE-105/SE-107 is a combination ground-wire monitor and ground-fault relay for resistance-grounded systems. It continuously monitors the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults. The SE-105/SE-107 is an excellent choice for trailing cables 5 kV and under in underground mining applications. For higher voltages or long-cable applications, see the SE-134C/SE-135.

Features & Benefits

Adjustable pickup (0.5, 2.0, 4.0 A)	Unit can be used on a wide variety of trailing cable applications
Adjustable time delay (0.1-2.0 s)	Adjustable trip delay for quick protection and system coordination
Harmonic filter	Prevents false operation
Zener-characteristic	Provides reliable ground-check loop verification
Fail-safe ground-check circuit	Ensures ground-check circuit remains safe even in the event of equipment failure
Conformal coating	Additional coating protects circuit boards against harsh environment
SE-105: Selectable UV- or shunt-trip mode	Provides flexibility for different applications
SE-107: UV-trip mode only	Eliminates chance of unauthorized change to trip circuit

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-105	120 Vac
SE-105D	120 Vac/Vdc
SE-105E	240 Vac
SE-107	120 Vac
SE-107D	120 Vac/Vdc
SE-107E	240 Vac

Consult manual online for additional ordering options.

ACCESSORIES	REQUIREMENT
CT200 Series	Required
1N5339B	Included
SE-TA6, SE-TA6-SM	Optional
SE-TA6A Series	Optional
RK-102, RK-105, RK-105I	Optional
RK-13	Optional
PPI-600V	Optional

Accessories

A 

CT200 Series Current Transformer
Required CT detects ground-fault current.

B 

1N5339B Termination Device
5 W axial-lead ground-check termination; included with SE-105/SE-107.

SE-TA6 Termination Assembly
Optional termination assembly with convenient terminals and mounting holes

SE-TA6-SM Stud-Mount Termination Assembly
Optional 50 W ground-check termination that is robust and compact for submersible pumps. Wire lead simplifies installation.

Specifications

IEEE Device Numbers	Checking or Interlocking Relay (3GC), Ground Fault (50G/N, 51G/N)
Input Voltage	See ordering information
Dimensions	**H** 150 mm (5.9”); **W** 109 mm (4.3”); **D** 100 mm (4.0”)
Trip Level Settings	0.5, 2.0, 4.0 A
Trip Time Settings	0.1-1.0 s
Contact Operating Mode	Selectable fail-safe or non-fail-safe (SE-105) Fail-safe only (SE-107)
Harmonic Filtering	Standard feature
Reset Button	Local and remote
Output Contacts	Isolated Form A
Approvals	CSA certified, UL Listed (E340889), C-Tick (Australian)
Conformally Coated	Standard feature
Warranty	5 years
Mounting	Surface

NOTES:

NOTES: