

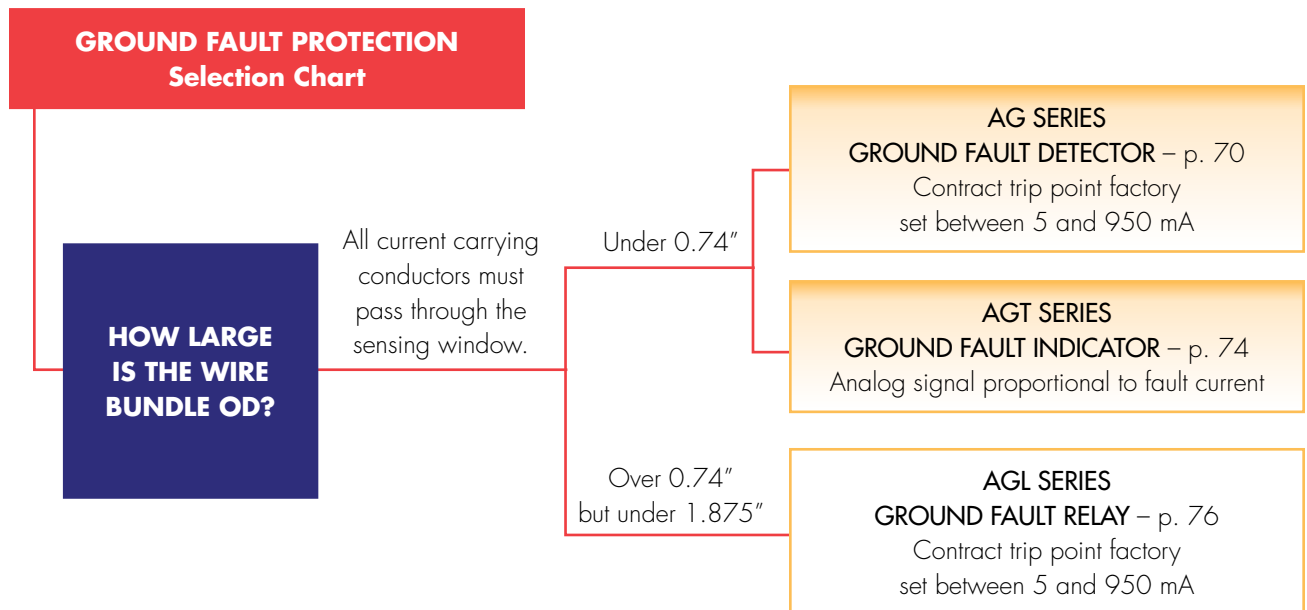
Ground Fault Protection

Detecting ground fault conditions and protecting sensitive equipment or personnel from harm are where AG Series sensors can help. A compact design eliminates two-piece solutions while options include factory-set or field adjustable trip point; N.O. or N.C. latching or auto-reset relays, 24/120/240 V power supply and noise immunity.

Features:

- N.O./N.C. solid-state switch or mechanical relay outputs
- Field selectable 5 mA, 10 mA or 30 mA setpoints
- Noise immunity option for EMI/RFI sensitive environments
- UL, CE approved

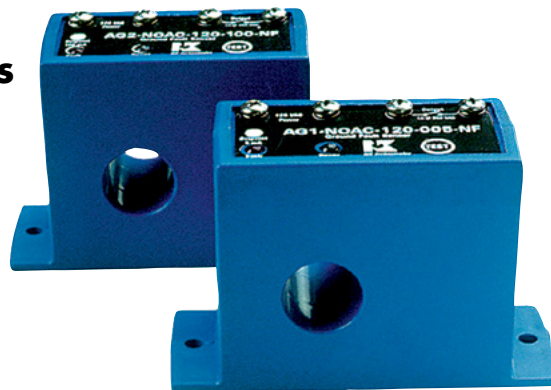
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AG SERIES

Ground Fault (Earth Leakage) Detectors

AG Series Ground Fault Detectors help protect people, products, and processes from damage by ground fault conditions by monitoring all current-carrying conductors in grounded single- and three-phase delta or wye systems.



Ground Fault Protection Applications

Personnel Protection (typically 5 mA)

- Detects sensitive ground fault conditions, which may be injurious to personnel and processes.
- Functions as sensor and alarm trigger when part of an overall ground fault protection system.

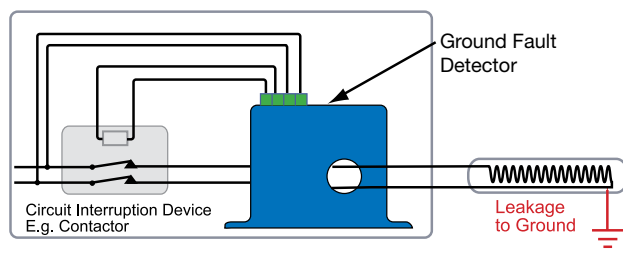
Equipment Protection (typically 10 mA or 30 mA)

- For applications where personal protection is not the primary concern, higher setpoint capability helps eliminate nuisance tripping while still providing adequate ground fault detection to protect machine electronics.

Regulatory

- Meets requirements as stipulated by governmental and industrial regulatory groups for ground fault sensing.

Insulation Breakdown Monitoring



- For additional Application Examples, see page 110 and www.nktechnologies.com



Free program expedites evaluation process. See page 1 for details.

Ground Fault Protection Features

Broad Range of Options to Match Application Needs

- N.O./N.C. solid-state switch or mechanical relay outputs.
- Normally energized or normally de-energized contacts.
- Noise Immunity option for use in EMI/RFI sensitive environments.

Setpoint Options Maximize Ease-of-Use

- Field selectable 5 mA, 10 mA or 30 mA setpoints on the AG3 "Tri-set" model makes user adjustments fast, sure and convenient.
- Single factory calibrated setpoints available from 5 mA to 950 mA.

Compatible with Standard Equipment

- Applicable on single- and three-phase systems.
- Ideal for use with shunt trip breakers.
- Magnetically isolated from monitored circuit and control power.

Agency Approved

- UL, CE approved.

"Zero Sum" Operating Principle:

In three-phase delta and wye systems, under normal conditions current in the 'hot' leg of a two-wire load is equal in magnitude but opposite in sign to the current in the neutral leg. As a result, the electromagnetic fields surrounding these two conductors cancel, producing a "zero sum current." As soon as current leaks to ground (fault condition) the two currents become imbalanced and a net magnetic field results. AG Series detectors monitor this field and trip alarm contacts when the leakage rises above setpoint.



Solid-state Outputs



Mechanical Outputs

Available Models

AG Series with Solid-state Outputs offer the benefit of reliable, long-lasting solid-state switches. Solid-state design provides unlimited switch operating life, superior resistance to shock and vibration, zero off-state leakage, high switch speeds and high input-output isolation. Available in solid-core case with screw terminals.

AG Series with Mechanical Outputs are available in solid-core enclosures with a choice between a N.O. or N.C. SPST latching relay and a SPDT Form C relay with auto-reset. All mechanical models can be ordered with factory-set, field adjustable setpoint or with a "Tri-set" option, which provides three factory-set setpoints. A noise immunity option is available for applications in harsh EMI/RFI environments.

Output Tables

Normally Energized Models (-FS Option and -ENE Option)

Protection from faults and control power loss.

	Control Power Applied		
	No Power	No Fault	Fault
N.C. Normally Closed	closed	open	closed
N.O. Normally Open	open	closed	open

Normally De-energized Models (-NF and -DEN Options)

Protection from faults only when power is applied.

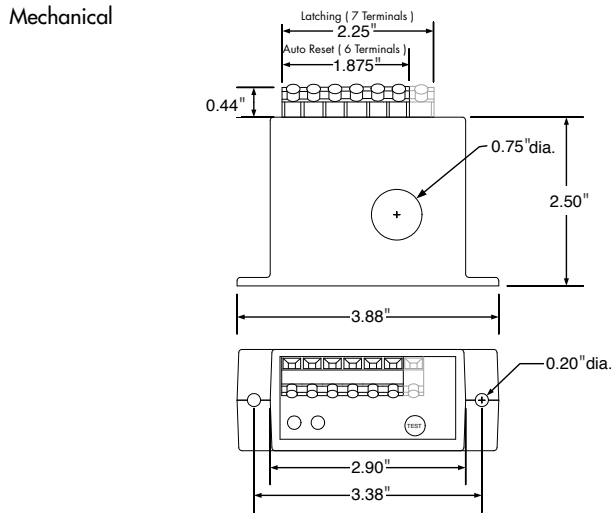
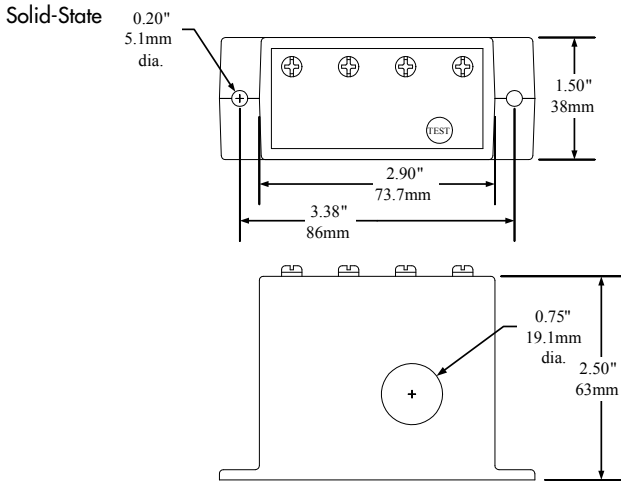
	Control Power Applied		
	No Power	No Fault	Fault
N.C. Normally Closed	closed	closed	open
N.O. Normally Open	open	open	closed

Latching Models (-LA Option)

Latching models power up initially in the rest (normal) mode. If there is a fault condition or the test button is pushed, the output contacts will change state and latch. The output will remain latched regardless of whether the fault is cleared or control power is removed. To reset the output apply a momentary contact across "reset" terminals.

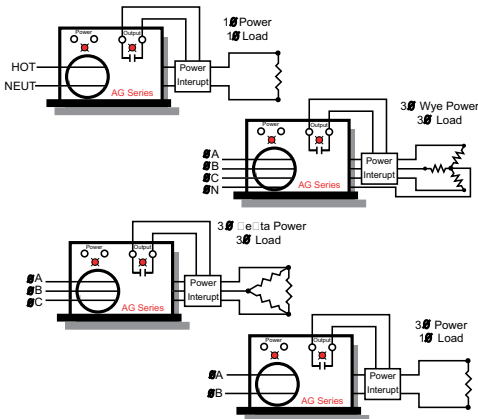
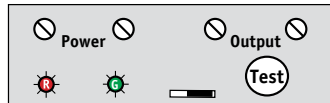


Ground Fault Protection Dimensions

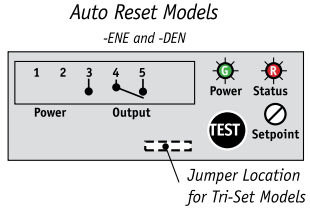
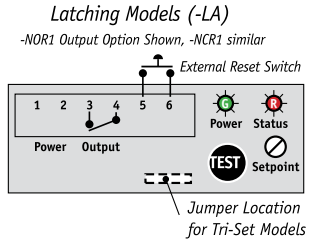


Connections

AG Series Solid-State Switch



AG Series Mechanical Relay



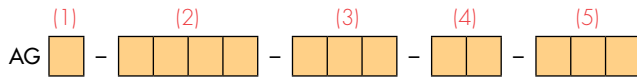
Ground Fault Protection Specifications

Setpoint Range	Factory calibrated models (specify when ordering): <ul style="list-style-type: none"> AG1: 5–100 mA (005–100) AG2: 80–950 mA (080–950) TR3 "Tri-set" models (field jumper select): <ul style="list-style-type: none"> AG3: 5, 10, or 30 mA 	
	Solid-state Output Models	Mechanical Output Models
Output	Isolated Dry Contact	Mechanical Relay
Output Rating	<ul style="list-style-type: none"> Solid-state AC Switch 1 A @ 240 VAC Solid-state DC Switch 0.15 A @ 30 VDC 	<ul style="list-style-type: none"> Auto Reset: SPDT Relay 1 A @ 125 VAC, 2 A @ 30 VDC Latching: SPST Relay 1 A @ 125 VAC, 2 A @ 30 VDC
Off State Leakage	<ul style="list-style-type: none"> <10 micro A (N.O.) <2.5 mA (N.C.) 	None
Response Time	<ul style="list-style-type: none"> 200 ms @ 5% above trip point 60 ms @ 50% above trip point 15ms @ 500% above trip point 	
Isolation Voltage	UL listed to 1270 VAC, tested to 5000 VAC	
Frequency Range	50–400 Hz (monitored circuit)	
Noise Immunity Option	N/A	<ul style="list-style-type: none"> EMI/RFI Shielding Power supply noise filtering
Power Supply	<ul style="list-style-type: none"> 120 VAC (55–110% of nominal voltage) 24 VAC/VDC (±20%) Green LED = Power On indication 	
Loading	2 VA Max.	
Case	UL94 V0 Flammability Rated	
Environmental	-4 to 122°F (-20 to 50°C) 0–95% RH, non-condensing	
Listings	UL 1053, Class 1 Recognized, CE, UL recognized for monitoring AC circuits from 1 to 600 V	

Ground Fault Protection Ordering Information

Solid-state Output Models

Sample Model Number: AG1-NOAC-120-FS-005
 Ground fault detector with normally open solid-state contact output, 120 VAC power supply, 5 mA trip point, fail safe version.



(1) Setpoint Range

1	5–100 mA factory set
2*	80–950 mA factory set
3	5/10/30 mA jumper set

*Not UL recognized in any configuration.

(2) Output Type

NOAC	Normally Open, 1 A @ 240 VAC
NCAC	Normally Closed, 1 A @ 240 VAC
NODC	Normally Open, 0.15 A @ 30 VDC
NCDC	Normally Closed, 0.15 A @ 30 VDC

(3) Power Supply

120	120 VAC
24U*	24 VAC/VDC
240*	240 VAC

*Not UL recognized in any configuration.

(4) Options

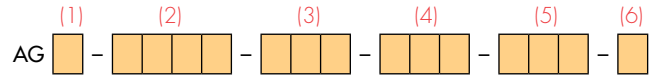
FS	Normally Energized
NF	Normally De-energized

(5) Setpoint

TR3	Tri-set
005 to 950	Factory set trip point in mA

Mechanical Output Models

Sample Model Number: AG1-NOR1-120-LA-005
 Ground fault detector with normally open SPST latching relay output, 120 VAC power supply and 5 mA trip point.



(1) Setpoint Range

1	5–100 mA factory set
2	80–950 mA factory set
3	5/10/30 mA jumper set

(2) Output Type

NCR1	Normally Closed SPST Relay Form B (Available only with -LA option)
NOR1	Normally Open SPST Relay Form A (Available only with -LA option)
SDT1	SPDT Relay (Form C) with auto-reset (Available only with -DEN and -ENE options)

(3) Power Supply

120	120 VAC
24U	24 VAC/VDC

(4) Options

ENE	Normally Energized, auto-reset (SDT1 output only)
DEN	Normally De-energized, auto-reset (SDT1 output only)
LA	Latching (NOR1 and NCR1)

(5) Setpoint

TR3	Tri-set
005 to 950	Factory set trip point in mA

(6) Noise Immunity

N	Noise Immunity
	None (blank)

AGT SERIES

Ground Fault Indicators

AGT Series Ground Fault Indicators combine a current transformer and a True RMS signal conditioner into a single package. The AGT Series is designed to produce an analog 4–20 mA signal proportional to earth or ground fault current. Available in a solid-core case. When connected to a controller or data logger, NEC requirements for alarm can be met.



Ground Fault Protection

Ground Fault Protection Applications

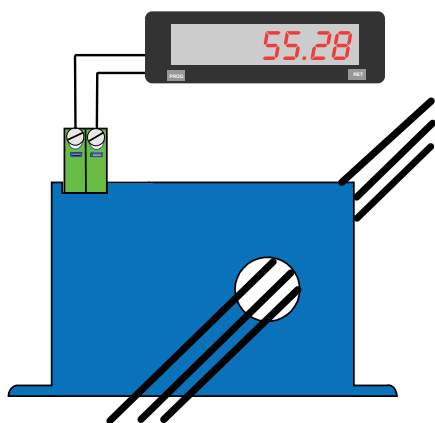
Current Leakage Detection

- Monitor heating or other loads to detect increasing leakage current.
- Pass all current carrying conductors through aperture to sense zero-sum current.

Very Light Loads

- Accurate measurement of very small but critical loads.
- Current measurement gives faster response than temperature measurement.

Ground Fault Currents



For additional Application Examples, see page 110 and www.nktechnologies.com

Ground Fault Protection Features

True RMS Output

- True RMS technology is accurate on distorted waveforms like VFD or SCR outputs.

Single Range

- No chance of field range selection errors.
- Eliminates zero and span pots.

Isolation

- Output is magnetically isolated from the input for safety.
- Eliminates insertion loss (voltage drop).

Agency Approval

- UL, CUL 508 listed.

Selecting the right ground fault detector:

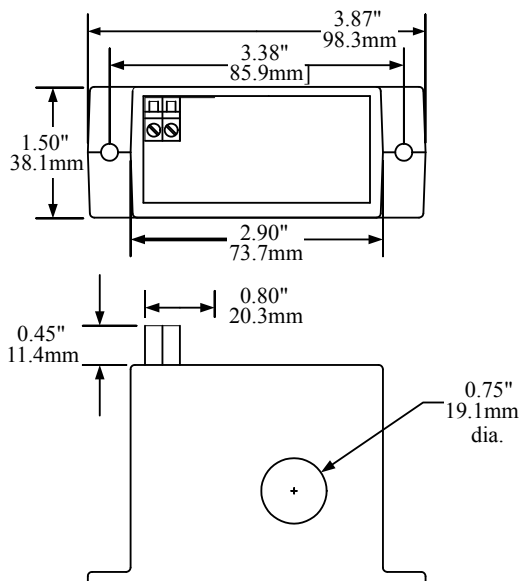
NEC Article 427-22 requires that fault currents be monitored on industrial equipment. However, where maintenance and supervision ensure that only qualified persons will service the equipment and continued circuit operation is necessary for safe operation and processes, alarm indication is also required. A fault current transducer can send a signal to a panel meter with alarm contacts or a controller. As an example, the alarm points can be configured so one alarm is initiated when fault current reaches 30 mA, and another when it rises above 70 mA. Ground fault protection is required in many applications, and NK Technologies has a sensor that can be coupled with your control system to provide this needed alarm or circuit disconnection.

Test & Evaluation Units
For OEMs Free program expedites evaluation process. See page 1 for details.



Ground Fault Protection Dimensions

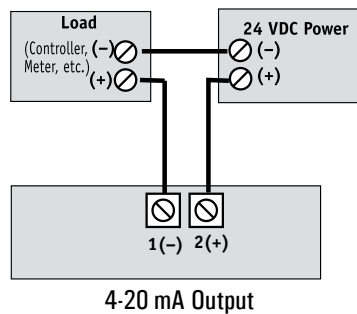
FL Case



Ground Fault Protection Specifications

Output Signal	4–20 mA, Loop-powered, True RMS
Output Limit	23 mA
Accuracy	1.0% FS from 10% to 100% of range
Response Time	600 ms (to 90% step change)
Frequency Range	40–400 Hz
Power Supply	24 VDC Nominal, 12–40 VDC
Isolation Voltage	UL listed to 1270 VAC, tested to 5 KV
Input Ranges	Single range of 0–50 or 0–100 mA; custom ranges available; consult factory.
Sensing Aperture	-FL Case: 0.74" (19 mm) dia.
Case	UL94 V0 Flammability Rated
Environmental	-4 to 122°F (-20 to 50°C) 0–95% RH, non-condensing
Listings	UL 508 Industrial Control Equipment (USA & Canada)

Ground Fault Protection Connections



Notes:
Finger safe captive screw terminals.
12–22 AWG solid or stranded.
Observe polarity.

Ground Fault Protection Ordering Information

Sample Model Number: AGT2-420-24L-FL
True RMS AC ground fault indicator, 100 mA ranges, 4–20 mA output, 24 VDC loop-powered in a solid-core case.

(1) (2) (3) (4)
AGT - - -

(1) Full Scale Range

1	0–50 mA
2	0–100 mA

(2) Output Signal

420	4–20 mA
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(3) Power Supply

24L	24 VDC Loop-powered (4–20 mA output ONLY)
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(4) Case Style

FL	Solid-core, Top Term.
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Ground Fault Protection



AGL SERIES

Large Aperture Ground Fault Relays

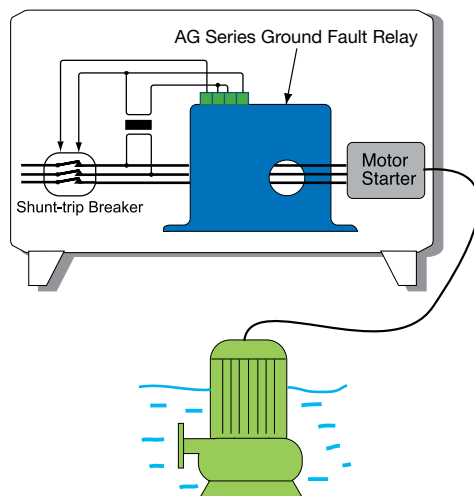
AGL Series is a large aperture ground fault relay that offers one of the largest aperture diameters in the industry while maintaining a compact overall profile. Intended for sensing earth leakage in applications up to 400 A, the AGL Series offers a choice of N.O. or N.C. latching relays or an SPDT Form C relay with auto-reset. Enclosure features integral DIN rail mounting as standard and optional noise immunity coatings for applications in harsh EMI/RFI environments.



Ground Fault Protection Applications

- Replace bulky two-piece sensor solutions which require separate CTs or relay modules.
- Use with shunt trip breakers to provide total ground fault protection to sensitive machine electronics.
- Detect ground faults in resistance/impedance heating, industrial automation and control, theatrical lighting, portable power distribution, and snow melt/heat trace applications.
- Sense progressive levels of ground fault in motors or heating systems to detect deterioration prior to catastrophic failure.

Moisture Ingress on a Submersible Pump Motor



- For additional Application Examples, see page 110 and www.nktechnologies.com

Test & Evaluation Units

For **OEMs**

Free program expedites evaluation process. See page 1 for details.

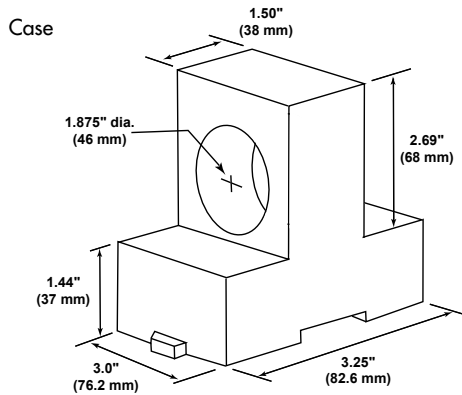
Ground Fault Protection Features

- Integral DIN rail Mount with Spring Loaded Mounting Clips. *
- Setpoint Options Include Factory Adjustable Setpoint from 5 mA – 100 mA or “TR3 Tri-Set” Models with Field-selectable 5/10/30 mA Settings.
- Finger-safe Terminals for Worry-free Installation and Operation.
- Aperture Orientation is Perpendicular to DIN rail, Allowing for Clean and Efficient Wiring and Minimizing Space Between Multiple Components.
- Choice of Dependable Latching SPST or SPDT (Form C) Electromechanical Relay Outputs.
- Uses “Zero Sum” Operating Principle to Reliably Sense Imbalance in Magnetic Fields Associated with Current Leakage to Ground.
- Typical Response Times from 15ms to 200 ms.
- Integral “Push-to-test” Button with LED Indication of Contact Status.

*For information on the DIN Rail accessories kit, see page 109.



Ground Fault Protection Dimensions



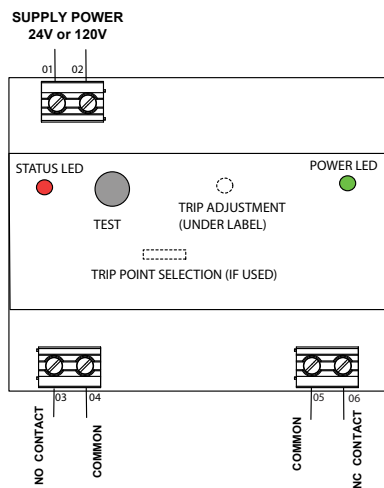
Ground Fault Protection Specifications

Setpoint Range	Factory calibrated models (specify when ordering):
	<ul style="list-style-type: none"> AGL1: 5–100 mA (005–100) AGL2: 80–950 mA (080–950)
	TR3 “Tri-set” models (field jumper select):
	<ul style="list-style-type: none"> AGL3: 5, 10, or 30 mA
Output	<ul style="list-style-type: none"> Auto Reset: SPDT Relay 1 A @ 125 VAC, 2 A @ 30 VDC Latching: SPST Relay 1 A @ 125 VAC, 2 A @ 30 VDC
Response Time	<ul style="list-style-type: none"> 200 ms @ 5% above trip point 60 ms @ 50% above trip point 15 ms @ 500% above trip point
Isolation Voltage	UL listed to 1270 VAC, tested to 5000 VAC
Frequency Range	50–60 Hz (monitored circuit)
Noise Immunity Option	<ul style="list-style-type: none"> EMI/RFI Shielding Power supply noise filtering
Power Supply	<ul style="list-style-type: none"> 120 VAC (55–110% of nominal voltage) 24 VAC/VDC (± 10% of nominal voltage) Green LED = Power On indication
Case	UL94 V0 Flammability Rated
Environmental	-4 to 122°F (-20 to 50°C) 0–95% RH, non-condensing
Listings	UL 508 Industrial Control Equipment (USA & Canada) UL recognized for monitoring AC circuits from 1 to 600 V

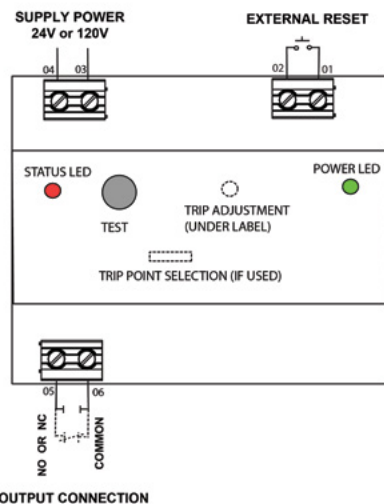
Ground Fault Protection

Ground Fault Protection Connections

Auto-Reset

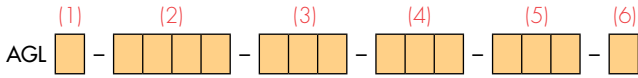


Latching



Ground Fault Protection Ordering Information

Sample Model Number: AGL1-NOR-120-LA-005
 Ground fault relay with normally open SPST latching relay output, 120 VAC power supply and 5 mA trip point.



(1) Setpoint Range

1	5-100 mA factory set
2	80-950 mA factory set
3	5/10/30 mA jumper set

(2) Output Type

NCR1	Normally Closed SPST Relay Form B (Available only with -LA option)
NOR1	Normally Open SPST Relay Form A (Available only with -LA option)
SDT1	SPDT Relay (Form C) with auto-reset (Available only with -DEN and -ENE options)

(3) Power Supply

120	120 VAC
24U	24 VAC/VDC

(4) Options

ENE	Normally Energized, auto-reset (SDT1 output only)
DEN	Normally De-energized, auto-reset (SDT1 output only)
LA	Latching (NOR1 and NCR1)

(5) Setpoint

TR3	Tri-set
005 to 950	Factory set trip point in mA

(6) Noise Immunity

N	Noise Immunity
	None (blank)