

## GROUND FAULT CIRCUIT PROTECTION IN MARINE APPLICATIONS

### Background

Should a person come in contact with a live (hot) wire and a path to ground, the result would be a current through the person's body that can cause injury or death.

This situation is potentially more common and more hazardous in marine environments, where water is frequently present and can serve as an additional conductive element in electrical equipment – which is why specific guidelines around ground fault protection and main shore power circuit protection are detailed in American Boat & Yacht Council E-11 standards.

Those standards require a ground fault circuit interrupter (GFCI) - a device that protects against electric shock and operates by sensing the difference between currents in the “hot” and neutral conductors.

The currents are equal under normal operating conditions. However, if someone touches a hot conductor and inadvertently creates a path to ground, the imbalance between the hot and neutral or ground conductors will be detected and the GFCI will open the circuit within a few milliseconds.

### Solution

Sensata approaches this problem with a tandem solution which provides both overcurrent/short circuit protection as well as GFCI capabilities, using a combination of a LineGard GFCI sensing module and an Airpax LEL Series, UL 489 listed circuit breaker, with shunt trip and auxiliary switch.



The PGFM constantly monitors the current balance of the conductors (wires / cables) supplying power to the load via a differential current transformer. When a ground fault of 27mA nominal (30 mA max) occurs, the PGFM uses the LEL's shunt trip coil to signal the breaker to trip.

Working together, the LineGard GFCI and Airpax LEL circuit breaker combination is UL943 Class A or UL1053 compliant at ratings of .5 to 50 amps, one to three poles and voltages of 120VAC, 120/240VAC and 240VAC. A LineGard module used in conjunction with the LEL circuit breaker to protect a circuit where voltage exceeds 125VAC from any leg to ground would be classified an ELCI (Equipment Leakage Circuit Interrupter) and is UL1053 approved.

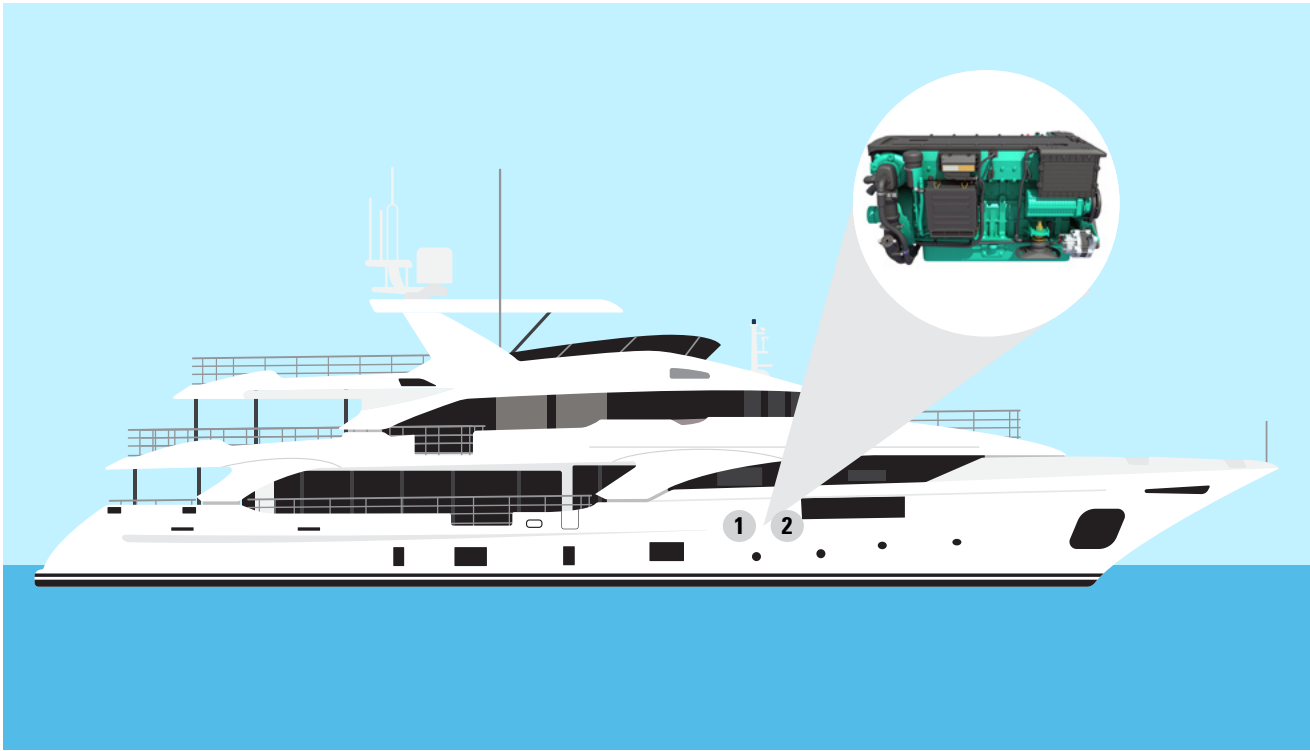
The PGFM can also be paired with an Airpax™ IDLNK breaker for applications requiring ignition protection.

It should be noted that a GFCI alone is not a substitute for a circuit breaker, which is still required to protect equipment and property from over currents or short circuits that can result in fire or other damage. The Airpax LEL provides the over current protection for the application.

# RECOMMENDED PRODUCTS

Reference on Diagram	Product	Features	Function
1	 <p><b>PGFM Series GFCI Ground Fault Protection Sensing Module</b></p>	<ul style="list-style-type: none"> <li>• Trip level of sensing device 5mA ± 1mA Class A UL 943</li> <li>• Sensing module operates at 120VAC or 240VAC, single phase</li> <li>• Provides identification of a ground fault vs. short circuit trip</li> </ul>	Ground fault and equipment leakage sensing device
2	 <p><b>LEL Hydraulic Magnetic Circuit Breaker</b></p>	<ul style="list-style-type: none"> <li>• UL 489 listed circuit breaker</li> <li>• Operating voltages of 120 VAC or 120/240 VAC</li> </ul>	Overcurrent and short circuit protection

# DIAGRAM



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