

# IHM Series Proximity Sensors for Aerospace Applications

## An Application Note

### Background

Honeywell's IHM Series Proximity Sensor is an inductive sensing device providing a three-state output to indicate target positions and detected faults. The proximity switch electronics includes Honeywell's unique IHM (Integral Health Monitoring) technology.

### Continuous Health Monitoring

The IHM Series' sensing mechanism shares many similarities with the industry standard Eddy Current Killed Oscillator (ECKO) type proximity sensors. However, Honeywell has designed and implemented the patented FAVCO (Fixed Amplitude Variable Current Oscillator) technology which allows for continuous health monitoring capable of detecting the majority of circuit and sensor faults. The sensor design incorporates continuous health monitoring circuitry into the inductive sensor that can detect internal faults and indicate internal fault conditions without additional output pins. The internal sensing electronics are lightning isolated from the external housing and integrate an internal shield to provide a high level of lightning and EMI protections. The proximity switch is hermetically sealed with all-welded, stainless steel and Inconel® construction, and a hermetic connector.

### Solution

The proximity sensing system senses the presence or absence of a ferrous metal target. This allows the sensor to be reliable and operate in extreme environments. (See Figure 1)

<b>1</b>	<b>Cargo loading</b> - Latch detection (pallet locked)
<b>2</b>	<b>Doors</b> - Open or closed position - Locked status
<b>3</b>	<b>Evacuation slide door-lock mechanism</b> - Detects proper actuation
<b>4</b>	<b>Flight controls</b> - Flap and slat skew/position - Spoiler position
<b>5</b>	<b>Landing gear</b> - Uplock, downlock, and Weight On Wheels (WOW)
<b>6</b>	<b>Thrust Reverser Actuation System (TRAS)</b> - Stowed or deployed status



- 1 Cargo loading latch detection (pallet locked):** Can be used to detect if the lock is in the locked or unlocked position. Confirming lock position is essential to prevent unexpected weight distribution changes that could lead to catastrophic failure.
- 2 Doors - Open or closed position:** If the door is closed, the proximity sensor reads Near and it's safe to travel.
- 2 Doors - Locked status:** Used to provide an additional security layer, meaning that the lock is in place, the proximity sensor reads Near, and it is safe to travel.
- 3 Evacuation slide door-lock mechanism:** Used to detect that the slides are actuating properly. The system controller can compare results from the door locks and the slides to confirm with redundancy that the system is operational.
- 4 Flight controls - Flap and slat position and skew:** It is critical that there are no left versus right asymmetries in the flaps and slats when they are deployed. For aircraft with multiple slats or flaps, it is imperative to ensure that all panels/surfaces are moving together (i.e., without skew). The proximity sensor is used to detect targets on the flap deployment system and supporting actuation system to ensure there is no skew.

**Figure 1. IHM Proximity Sensor Applications for Aircraft**



**4 Flight controls - Spoilers:** Used to measure presence or absence of a gap between spoiler surface.

**5 Landing gear - Uplock, downlock, Weight On Wheels (WOW), and open/close status of doors:** A suite of proximity sensors are used to indicate when the landing gear is in up or downlock position, or traveling in between positions. Locking provides additional security.

When the lock is in place, the proximity sensors show Near, which means that the landing gear will not buckle or fold upon impact. WOW: when the plane lands, the weight of the aircraft compresses the landing gear suspension and triggers the WOW system. The WOW switch communicates with various controllers used to arm/disarm other systems in the aircraft (e.g., TRAS).

**6 Thrust Reverser Actuation System (TRAS) - Stowed or deployed status:** Proximity switches on the TRAS are used on actuators to confirm if the TRAS is stowed or deployed. They are used on primary door locks (PDL), tertiary lock (TL), and on Fan Cowl door to sense actual position of the service.

## Features

- Industry-leading indirect lightning and dielectric ruggedness: Meets the increased requirements of today's composite aircraft and most challenging applications including landing gear, thrust reversers, and flight controls
- Superior vibration ruggedness: Capable of withstanding extremely high vibration applications
- Environmentally rugged: Fully hermetic packages provide long-term reliability in very harsh environments by eliminating the potential for contamination of the sensor from the application environment. In addition, Honeywell has developed an innovative method to hermetically seal wire-lead (pigtail) configurations
- Integral Health Monitoring Capability: Optional third output state to indicate the health of the sensor (whether it is healthy or failed). Reduces maintenance time, reduces delayed flights, and lowers overall maintenance cost across the life of the aircraft
- Non-contact design: Utilizes non-contact technology to sense the presence or absence of a target regardless of the dirty, harsh environment in which it is placed, eliminating mechanical failure mechanisms, reducing wear, minimizing downtime, increasing durability, and increasing reliability

## Benefits to the Customer

- Integral Health Monitoring provides true “three-state” output – target near, far, fault detected
- Health monitoring helps to increase revenue (flight hours), reduce cost to serve (maintenance), and reduce cost of goods (spares)
- Customizable, platform approach helps to increase revenue (speed to market) and reduce cost to serve (lower engineering investment)
- Enhanced vibration and EMI specifications help to increase revenue (flight hours) and reduce cost to serve (system maintenance)
- Hermetic sealing helps to increase revenue (flight hours), reduce cost to serve (maintenance), and reduce cost of goods (spares)
- Supplier stability helps to reduce cost to serve (troubleshooting with original supplier)
- Current installed base helps to reduce cost to serve [proven performance and Mean Time Between Failures (MTBF)]

### **⚠ WARNING PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

### **⚠ WARNING MISUSE OF DOCUMENTATION**

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

**Failure to comply with these instructions could result in death or serious injury.**

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## For more information

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