Frequently Asked Questions (FAQs)

Custom Magnetic Debris Detector (MDD)

General Questions

Q1. Does the NZMS debris sensor detect non-ferrous debris?

A1. No, the NZMS debris sensor does not collect or detect non-ferrous debris such as aluminum, brass, ceramics, or dirt.

Q2. Is the NZMS debris sensor orientation-specific?

A2. No, the NZMS debris sensor is completely axially symmetric and can operate reliably in any orientation. Its performance is unaffected by how it is mounted, allowing flexible installation in a wide variety of systems.

Q3. Does the NZMS debris sensor require calibration?

A3. In applications where the sensor is positioned away from nearby ferrous materials, the NZMS debris sensor does not require calibration. Because it detects disturbances in magnetic fields, non-ferrous metals such as aluminum, annealed stainless steel, magnesium, brass, lead, copper, zinc, and titanium have absolutely no effect on its readings. These materials are invisible to the sensor and allows for straightforward installation without the need for adjustment.

Q4. Can debris sensors detect both fine and coarse particles?

A4. Yes. KasperAero debris sensors are designed to respond to a wide range of particle sizes, from fine metallic dust that may point to early-stage wear, to larger chips or fragments that typically signal more severe mechanical damage. While the NZMS sensor can detect both, it does not differentiate particle size. The signal is influenced by the overall mass of metallic material accumulated on the sensor rather than whether that mass comes from many tiny particles or a single larger chip.

Q5. Can other lubrication and fuel measurements be incorporated into the NZMS debris sensor?

A5. Yes, additional measurements can be integrated alongside debris sensing to create a more comprehensive monitoring system. Common examples include temperature, pressure, and water-in-fuel or water-in-oil detection. These features are not standard on the NZMS debris sensor, but our team can explore integration options based on your application requirements. Please contact us to discuss customization.

Q6. How are debris sensors integrated into a system?

A6. Debris sensors can be connected via analog, digital, IO Link, CAN bus, or Modbus outputs, depending on system requirements. They can also be tailored to trigger alerts when debris levels exceed safe thresholds.

Q7. Can the NZMS debris sensor be embedded in other sensors or larger components?

A7. The NZMS sensor can also be configured for very low sensitivity. By tuning circuit components for a wide dynamic range, the sensor maintains low sensitivity even when paired with a strong magnet. This approach is useful for avoiding nuisance trips, filtering out

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debris generated during normal break-in periods, or in applications where a certain amount of wear is expected.

Q8. I checked my debris sensor and there's debris on the face. Should I clean it?

A8. Whether or not to clean the sensor face depends on your specific application. Some systems may allow periodic cleaning, similar to a magnetic drain plug, while others may recommend leaving the sensor untouched. Always follow your maintenance guidelines to determine if and when cleaning is appropriate during the sensor's operational life.

Q9. How long is the expected service life?

A9. The NZMS debris sensor is highly reliable due to its lack of moving parts. Its service life can be influenced by factors such as vibration, thermal cycles and thermal shocks, maximum operating temperature, and chemical compatibility with the monitored fluid. The durability of the housing and the sensor's seals (o-rings) also play a role. When installed and maintained according to specifications, the sensor is designed to provide long-term, dependable operation.

Technical Questions

Q10. What is the smallest possible diameter of an NZMS debris sensor?

A10. The minimum sensor diameter depends on the required magnet strength and the physical size of key circuit components. With our current manufacturing processes, we can reliably produce sensors as small as Ø0.380 inches. While an electromagnet could enable a smaller design, this solution introduces trade-offs such as intermittent sensing and increased debris attraction.

Q11. Why is proximity to ferrous objects important when implementing the NZMS debris sensor?

A11. The NZMS debris sensor works by detecting disturbances in a magnetic field. Nearby ferrous materials such as steel or even cold-worked stainless steel can alter the field and be picked up by the sensor. These effects can be minimized through careful design and post-installation calibration, though both add cost and complexity. For best results, the sensor should be positioned away from other ferrous objects. Fortunately, magnetic strength decreases rapidly with distance (dropping off with the cube of the distance), so objects farther away have little influence. Our engineering team can also model these interactions to ensure your installation performs as expected.

Q12. How do transient magnetic fields affect NZMS sensor performance?

A12. Transient magnetic fields (such as those generated by high-voltage wiring, motors, fuel injectors, or ignition systems) can influence NZMS debris sensor readings if the sensor is mounted too close. To minimize these effects, KasperAero employs several strategies:

Signal Averaging

Because transient fields vary with time, multiple readings can be averaged (via analog circuitry) to filter out noise.

Startup/Shutdown Monitoring
In certain applications, accurate readings can be taken during startup or shutdown, before other systems generate significant magnetic interference. The sensor then holds the output until the next cycle.

On-Vehicle Testing
Practical testing with real hardware helps validate performance in the intended environment.

Simulation Support
Our engineering team can model the impact of nearby magnetic sources to ensure optimal installation.

Q13. Does the NZMS sensor detect rust?

A13. Yes, but only to a limited extent. Rust is weakly magnetic, and its detectability depends on the type present. Magnetite (Fe_3O_4) is more magnetic and easier to detect, while hematite (Fe_3O_3) is less magnetic and produces a weaker response. Because rust composition can vary significantly, KasperAero recommends independent testing to confirm performance in rust detection applications.

Q14. What is the maximum sensitivity of the NZMS debris sensor?

A14. The NZMS sensor is capable of extremely high sensitivity. In testing, it has exceeded the 0.015-gram detection threshold published in our product datasheets. With the use of higher-grade PCB components and stronger magnets, sensitivity can be pushed beyond typical industrial needs and into laboratory-grade performance.

Q15. What is the minimum sensitivity of the NZMS debris sensor?

A15. The NZMS sensor can also be configured for very low sensitivity. By tuning circuit components for a wide dynamic range, the sensor maintains low sensitivity even when paired with a strong magnet. This approach is useful for avoiding nuisance trips, filtering out debris generated during normal break-in periods, or in applications where a certain amount of wear is expected.

Q16. How quickly does the sensor respond to debris?

A16. Most NZMS debris sensors are intentionally designed to have a delayed reaction (typically under three seconds) to reduce false positives and ensure highly reliable data. If your application requires faster response times, KasperAero's engineering team can provide customized solutions.

Commercial Questions

Q17. How cost effective is the NZMS debris sensor?

A17. The NZMS debris sensor is designed to deliver exceptional performance at a cost that makes large-scale deployment practical. At its core, the technology requires only a small set of components: a housing, a permanent magnet, epoxy, a circuit board, and a wiring harness. This simplicity makes the underlying sensor inherently economical compared to many other condition-monitoring technologies. Cost is influenced by the following factors:

Assembly and Calibration

Although the bill of materials is straightforward, the precision required for assembly, calibration, and quality assurance introduces proprietary manufacturing costs. These ensure that each sensor meets strict performance standards.

Material and Tooling Choices

Different applications may call for specialized housings, high-temperature materials, or custom form factors. Each of these decisions influences both tooling requirements and unit price.

Production Volume

As with most electronic devices, volume has the largest impact on cost per unit. Low-volume custom runs are inherently more expensive, while high-volume production allows for aggressive economies of scale.

As an example, a custom order of around 100 units might result in a per-sensor cost of roughly $350. In contrast, scaling production to 100,000 units can drive the cost down to the $40–50 range per sensor. This wide range demonstrates both the flexibility of the technology and the strong cost advantage it can provide when deployed at scale.

Q18. What is the timeline for development and production of a custom NZMS sensor?

A18. The development timeline for a custom NZMS debris sensor depends on several factors, both on our side and the customer's. While KasperAero is a small, agile engineering team, project schedules are influenced by workload, complexity, and the level of testing and validation required for your application.

Requirements Definition

A project begins with establishing clear design requirements: target sensitivity, form factor, environmental conditions, electrical interface, and integration constraints. The clarity of these specifications greatly impacts how quickly development can proceed.

Design & Prototyping

Once requirements are confirmed, our engineers create preliminary designs and build prototypes. Depending on complexity, this stage can take anywhere from a few weeks to several months. Early prototypes are used to validate the concept and uncover any unforeseen challenges.

Testing & Iteration

Prototypes undergo testing to ensure accuracy, durability, and compatibility with the intended system. Some customers require extensive testing—such as vibration, temperature cycling, or fluid exposure—while others may only need functional validation. More extensive testing lengthens the timeline but provides added assurance.

Tooling & Manufacturing Preparation

Custom housings, specialized materials, or unique geometries may require new tooling or machining processes. These steps can add several weeks depending on supplier lead times and complexity.

Pilot Production & Scale-Up

After validation, a small batch is produced to verify customer satisfaction. Once approved, production can be scaled to meet the required volume.

Q19. What kind of technical support is available after purchase?

A19. KasperAero provides comprehensive support for all NZMS debris sensors. Our team can assist with installation guidance, system integration, calibration questions, and troubleshooting. We also offer support for interpreting sensor data, optimizing sensor placement, and modeling the effects of nearby ferrous materials. For custom applications, our engineers are available to review design requirements and provide recommendations to

ensure optimal sensor performance. Support is available via email, phone, or virtual consultation, and we aim to respond promptly to all inquiries.