

# Magnetic Sensors are a Great Alternative to Traditional Shunt Resistors for Industrial Current Sensing

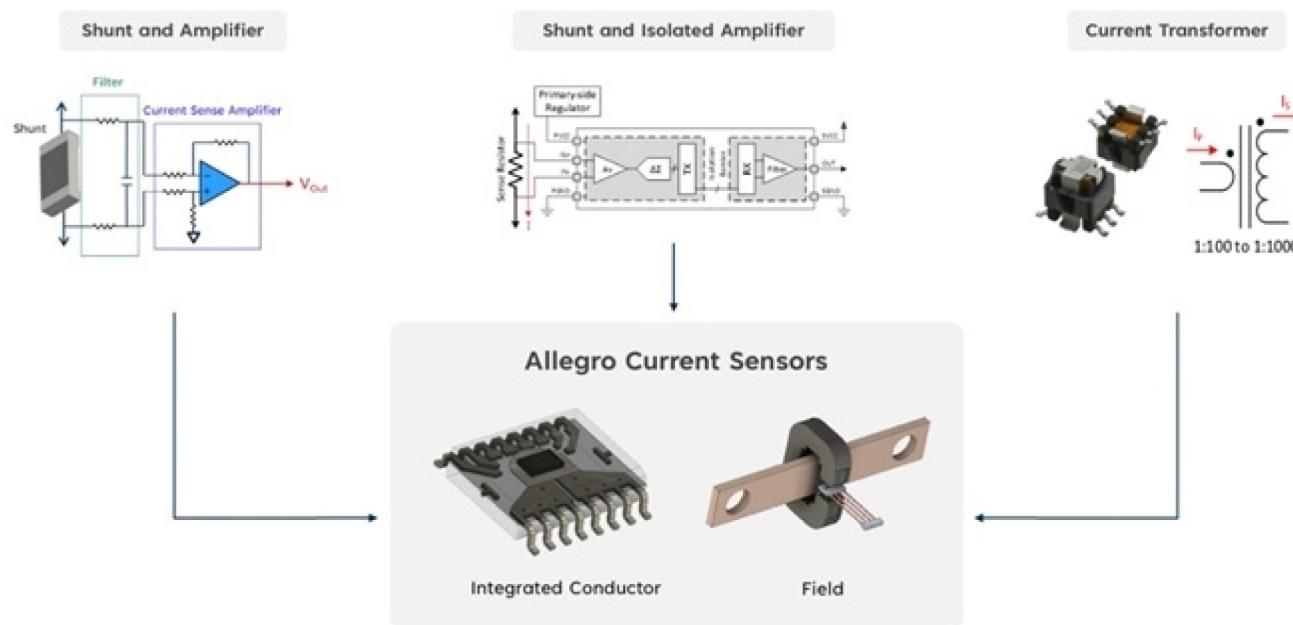
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Let's talk about current sensing in the industrial world. It's critical in countless applications, from keeping motors running efficiently to making sure power supplies remain reliable. For many years, shunt resistors were the default choice – simple, affordable, and readily available. But times have changed, and frankly, shunts are starting to show their deficiencies. Magnetic sensors have entered the market, bringing a whole new level of performance, safety, and reliability to the table, much like what Allegro is doing with our current sensor portfolio. So, what makes them so special? Let's discuss it now.

## Shunt Resistors: Showing Their Limitations

Shunt resistors work well, but they have limitations. One of the biggest drawbacks is their power consumption. They're like energy vampires, sucking power proportional to the square of the current being measured (that's  $P = I^2R$  for the technically inclined). In high-current industrial settings, this power loss can be substantial, impacting overall system efficiency and generating a lot of unwanted heat. Another issue is the lack of isolation between the sensed current path and the measurement circuitry. This can be a safety concern, especially in high-voltage industrial systems. And if you're working with high-side current sensing, get ready to see their limitations. The common-mode voltage challenges require extra circuitry to get accurate readings, adding complexity and cost to your design. Finally, shunts can have bandwidth limitations due to inductive effects, making them less suitable for high-frequency applications.



## Magnetic Sensors: The Modern Solution

Magnetic sensors, especially those based on Hall-effect or TMR (Tunnel Magnetoresistance) technology, offer a refreshing alternative. They provide complete galvanic isolation, creating a protective barrier between the sensed current path and the measurement circuitry. This isolation enhances safety and safeguards sensitive electronics from high voltages and those pesky transients that can wreak havoc in industrial environments. Allegro is a leader in galvanically isolated

current sensors, and we will continue to innovate to delight our customers. What's more, magnetic sensors are incredibly energy efficient. They measure current indirectly by sensing the magnetic field around a conductor, eliminating the power loss associated with shunt resistors. This contactless approach means less wasted energy and a cooler, more efficient system. Allegro's innovative magnetic sensor designs excel in minimizing power loss and maximizing efficiency. And when it comes to speed, magnetic sensors are advantageous. They can handle high-frequency currents with ease, making them ideal for applications like switching power supplies and motor control where fast, accurate measurements are essential. Allegro offers high-bandwidth magnetic current sensors that provide precise measurements even in high-frequency applications. Plus, advanced magnetic sensors, especially those using TMR technology, provide exceptional accuracy and linearity, ensuring precise current measurements across a wide range of currents. Allegro's industry-leading TMR technology delivers exceptional accuracy and linearity, making our sensors ideal for applications requiring precise current measurements.

### Industrial Applications: Where Magnetic Sensors Excel

In the demanding world of industrial applications, magnetic sensors have value over shunts resistors. In motor control systems, they deliver precise current feedback, enabling efficient and reliable operation. Their high bandwidth allows them to keep up with rapidly changing currents, optimizing motor performance and reducing torque ripple. Allegro's magnetic sensors are designed to excel in motor control applications, providing the precision and speed needed for optimal performance. For industrial power supplies, magnetic sensors provide accurate current monitoring and control, maximizing efficiency and protecting against overcurrent conditions. Their inherent isolation is a crucial safety feature in these high-voltage systems. Allegro's isolated current sensors ensure safe and reliable operation in industrial power supply applications. Process automation also benefits greatly from the robustness and reliability of magnetic sensors. They provide consistent and accurate current measurements for monitoring and controlling various industrial processes, even in harsh operating conditions. Allegro's robust magnetic sensors provide stable and accurate measurements in challenging industrial environments. And in the realm of robotics, magnetic sensors enable the precise current control required for accurate positioning and movement of robotic arms and actuators. Their compact size and low power consumption make them a perfect fit for robotic applications. Allegro's compact and efficient magnetic sensors are well-suited for integration into robotic systems.

### Ready to Further Explore the Advantages of Magnetic Sensors?

[Read our application note](#) about Allegro's innovative magnetic sensor solutions and how they can enhance your industrial designs.



Inspired to innovate, Allegro MicroSystems is redefining the future of sensing and power semiconductor technologies.