PIHER sensing systems
an Amphenol® company

Miniature Position Sensors for Electric Vehicle Charging Inlet Cover Actuators

FUNCTIONAL SAFETY

Involves preventing any hazardous situations that could arise from the charger door flap malfunction. Key aspects include:

Safe Operation, Fault Detection and Management, Redundancy and Fail-Safes, Compliance with Standards such as ISO 26262 which addresses the functional safety of electrical and electronic systems in road vehicles and Environmental Resistance.

This application note discusses the integration of miniature position sensors in the actuation mechanism of electric vehicle (EV) charging flaps. Traditional charging flaps utilize a push-push mechanism combined with a spring device and a four-bar linkage arrangement.

Modern designs, employ motorized actuators to enhance functionality, precision, and reliability. Rotary position sensors play a crucial role in these systems by providing real-time feedback on the flap's position.

Traditional Charging Inlet Cover Mechanism

In conventional designs, the charging flap is actuated by a push-push mechanism. This mechanism operates as follows:

- Push-Push Element: A mechanical component that toggles between open and closed states upon each actuation.
- Spring Device: Provides the necessary force to move the flap to the desired position.
- Latch: Holds the flap in place when closed.

However, this design has some limitations:

- Mechanical Wear: Frequent use leads to wear and tear of mechanical components.
- Lack of Precision: Limited control over the exact position of the flap.
- Manual Operation: Relies on manual or semi-manual actuation, limiting automation potential.

Motorized Actuation

To address the limitations of traditional mechanisms, modern EV charging inlet covers are equipped with motorized actuators. These actuators offer precise control by an accurate positioning of the charging flap and enhanced reliability by eliminating the mechanical wear and tear.

Rotary Position Sensors

Rotary position sensors are integral to motorized actuation systems, providing continuous feedback on the inlet cover's position anytime and during all the angular travel of the flap. These sensors offer several advantages:

- High Accuracy: Ensures precise measurement of the flap's position.
- Real-Time Feedback: Allows for immediate adjustments and corrections.
- Compact Design: Suitable for integration in space-constrained applications.
- Durability: Non-contact operation is suitable for harsh working conditions in terms of vibration, temperature.
- Sealing: Protected from dust and moisture.

Play resis+ant
2-piece
Touchless Miniature Airgap
Rotary Sensor

Application of Miniature Position Sensors.

Sensor selection.

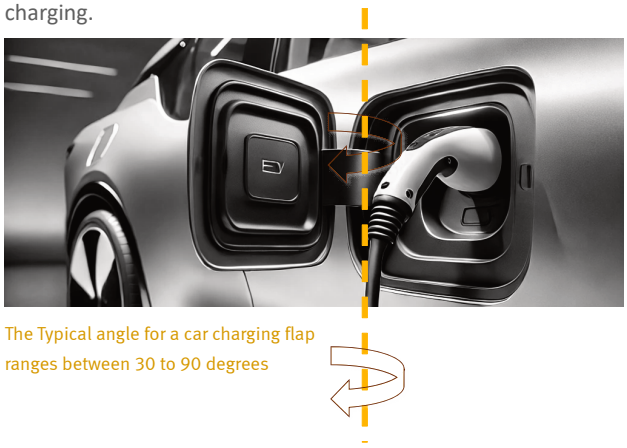
For EV charging inlet cover applications, miniature rotary position sensors are ideal due to their compact size and high performance. Contacting sensrs are being replaced by contactess hall-effect ones that achieve by far the mechanical life required by OEMS. Key considerations include:

■ Size: Must fit within the limited space of the charging flap assembly.

■ Resolution: High resolution for precise angle measurement.

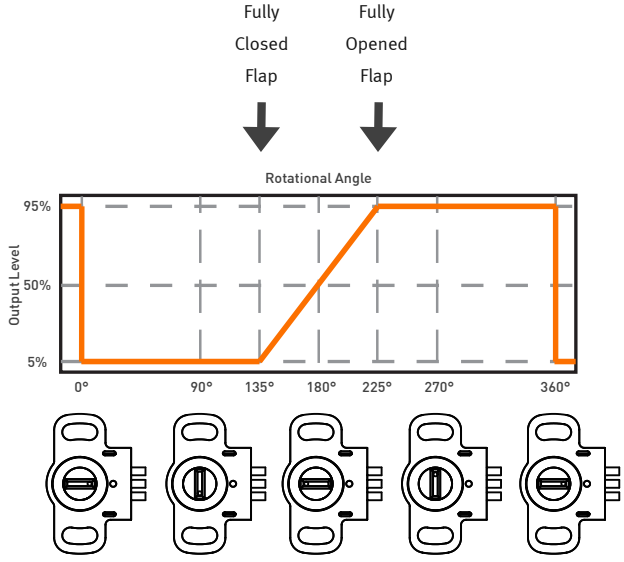
■ Durability: Able to withstand environmental conditions (temperature, humidity, etc.).

The angle for a car charging inlet cover when it is open typically ranges between 30 to 90 degrees from the closed position. The exact angle can vary depending on the car manufacturer and design, but it is usually designed to provide easy access to the charging port while ensuring the flap stays out of the way during charging.



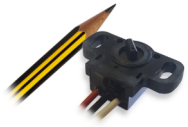
The Typical angle for a car charging flap ranges between 30 to 90 degrees

In the following graph you can see a typical example of the the output level of the position sensor for a 90 degrees angle flap design.



MSC-360 Miniature Magnetic Rotary Angle Sensor

The MSC-360 provides a perfect fit for preferential use in space constraint applications. Despite its lightweight and miniature size of only 28mm x 17mm, this hall-effect sensor delivers high performance with up to 360º electrical angle, 12bit resolution, extended life, and EMI & ESD protection, +20V / -10V Voltage protection and Self-diagnostic features for improved safety.



The MSC-360 can easily be tailored to customers' needs providing high price-performance ratio even for the most demanding environments.

Without any gears or mechanical interfaces the sensor is easily assembled and calibrated and subject to limited wear and tear over lifetime.

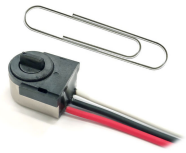
MSC-360 / ENVIRONMENTAL SPECIFICATIONS

Characteristic	Standard	Level
Operating and storage temperature[1]	n/a	-40° to +125°C
Shock	EN 60068-2-27	500 m/s², 11 ms, 3 axis 3 times (Room Temp.)
Vibration	EN 60068-2-6	200 m/s², 5 ~ 500 Hz 10 min, 3 axis 2 hours (Room Temp.)
Sealing	IEC 60529	IP67
EMS	ISO 11452-2, 3	100 V/m, 1 MHz ~ 1 GHz
ESD	IEC 61000-4-2	Contact discharge - case to each terminal: ±15kV Contact discharge - between each terminal: ±15kV

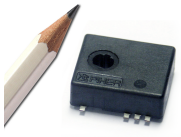
Check availability for other specifications

Why Piher Sensing Systems

At Piher, we believe successful sensor development hinges on understanding our customers' needs. We foster a collaborative environment where our engineers work closely with clients to design sensors that address their specific challenges. Whether it's reducing costs, adding new functionalities, streamlining maintenance, or a combination of these, we deliver custom-tailored solutions that seamlessly integrate into their applications.



MSX-360
Clip-on miniature contactless senssor



MTS-360
Hollow-shaft miniature contactless senssor

N-15
Resistive (contacting) SMD rotary sensor suitable for charger door flap angle feedback when functional safety is not a requirement.

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