SIEMENS

Automotive Systems
AT SE SC1 CA13

Operating Manual/Functional Description

for

Siemens

Child seat Presence and Orientation Detection/ Passenger Presence Detection

(CPOD/PPD)

FCC ID: KR55WK4291

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CPOD Technical Description

I. Technical description CPOD

The Child Seat Presence and Occupant Detection (CPOD) is a transponder principle based sensing device that provides information on the passenger and child seat presence in order to adapt the airbag deployment in regard to the occupant situation. The system is comprised of a Force Sensitive Resistor (FSR™) that has both a sending and receiving antenna and an Electronic Control Unit (ECU), both are permanently connected and built into the passenger seat, along with two resonators that are permanently built into the child seat.

The ECU generates a 130kHz-band inductive field which charges up the resonators. After capturing the transmitted signal, the resonators modulate the phase shift of the carrier signal by periodically switching of the resonance frequency. The phase modulated signal is captured by the receiving antenna and re-transformed by way of a demodulator circuit. The CPOD-ECU sends the child seat status to the Central Airbag ECU by way of an interface line. In addition, the passenger presence status is also evaluated by way of a resistance measurement through force sensors on the FSR mat. This information is also entered to the Central Airbag ECU.

II. Power Supply

The CPOD-ECU operates on the passenger vehicle power supply, an internal voltage regulator unit delivers a steady operating voltage of 5 volts to supply the controller and peripheral components. If the operating voltage falls below a defined threshold due to the loss of input voltage, a signal is sent to reset the microcontroller.

III. Transmitting Frequency Generator

The transmitting frequency generator produces a signal in the 125 to 135kHz band which drives the transmitting antenna. The micro controller can modify the transmitting frequency in 2kHz steps. This ensures that the resonance frequency in a specific child seat is optimized.

IV. Microcontroller

A microcontroller is used to control the entire process. The controller includes an analog to digital converter for the evaluation of the demodulated signals, for passenger seat occupancy status detection, and an EEPROM for storing system parameters, part identification and system failures.

V. Process

To detect an infant seat, a carrier field in the 130kHz band is transmitted via the transmitting antenna. The respective receiving antennae on the left and right side of the passenger seat are scanned sequentially for the response of the resonators in the child seat, by variation of the carrier frequency the optimum response of each resonator is determined. Based on the signal strength (phase modulation), detected via the receiving antenna, the presence and orientation of the child seat is detected. Also, complementary information on the manufacturer / type of the child seat can be read.

Having detected a correctly positioned child seat (forward- or rear-facing), its position is verified every 4.8 seconds and the child seat type every 40 seconds.

With an incorrectly positioned child seat (out-of-position), the position as well as the resonator messages are checked every 4.8 seconds.

The transmitting antenna is stimulated sequentially every 2.4 seconds or 38.4 seconds, depending on the occupant status of the PPD sensor. The transmitting signal strength is programmed in the EEPROM. In case that no auxiliary frequency should be detected, a test signal is sent to test for the system functionality.

The occupancy status of the passenger seat is determined by measurement of the resistance of the FSR™ sensor mat implemented in the seat. The presence of a passenger on the seat and the resulting pressure on the sensor spots leads to a reduction of the resulting FSR™ sensor resistance which falls under a fixed threshold.

The occupancy status is determined periodically with a defined cycle time.

In order to check the conductor FSR™ sensor tracks for interruptions or disconnections, the resistance of these parallel PPD conductor traces is measured. For this purpose, a diode is connected in series with the traces and in parallel to the sensing elements and is driven in forward direction. Thereby, a disconnection can properly be distinguished from a non occupied seat. In the normal functioning mode, when measuring the resistance of the FSR™ sensor elements for seat occupancy detection, the diode is driven in a blocking direction and thus does not influence the resistance measurement.

VI. Communication Interface

The communication between the PPD/CPOD interface electronics and the airbag ECU is based on a serial single wire unidirectional interface. This serial link shall be connected to the K-line of the airbag ECU. The data transmission rate is either 20 or 1000 Baud, depending on the end customer.

After "ignition on", the PPD/CPOD interface electronics periodically sends a status message to the airbag ECU. In this standard operational mode, the communication with the airbag ECU is unidirectional. For that purpose an "open collector" output is provided by the interface electronics which must be connected via a pull-up-resistor to U_{batt} in the airbag ECU.

VII. Mechanical

Either Action Pins ™ or soldered pins are used for both the connection between interface electronics and the conductors of the PPD sensor mat as well as for the connection between interface electronics and transmitting/receiving antennae.

The connection between the PPD/CPOD ECU and the airbag ECU is by a cable link with the customer specified three pin connector attached. The interface electronics is designed for automotive use in the interior of the vehicle seat, the over molded ECU conforms to the IP54 standard.

VIII. Block Diagram

Key for diagram:
Control unit - Steuergerät
Voltage supply / reset - Spannungsversorgung / Reset
Serial interface - Serielle Schnittstelle
Evaluation logic - Auswertungslogik
Microprocessor - Mikroprozessor
Transmitting frequency generator - Sendefrequenzgenerator
Output stage 1 of low pass - Endstufe 1 des Tiefpaßfilters
Amplifier with demodulator 2 - Verstärker mit Demodulator 2
Transmitting antenna - Sendeantenne
Receiving antennae - Empfangsantennen
FSR-Sensor - FSR-Sensor