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The Effective Radar Calibration

Interview with Dipl.-Phys. Wulf Alexander Kolbe, Radar Expert at DEUTA-WERKE

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Technology under Control

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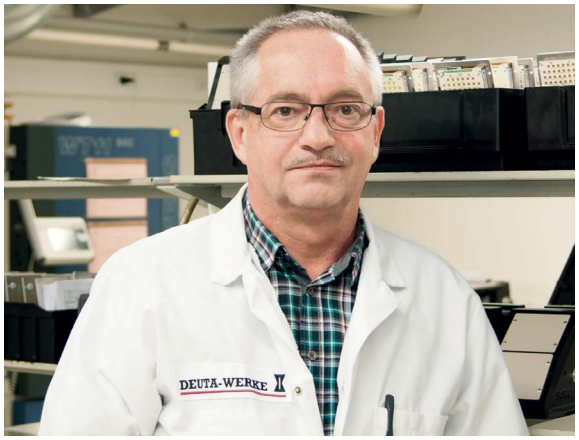
Effective Radar Calibration

Only few years ago, DEUTA radar sensors were calibrated in elaborate test drives. These times have long been gone. Today, the Doppler radar sensors are, firstly, calibrated in an inhouse-test on the basis of representative track data. The second calibration takes place on the vehicle and ensures the horizontal alignment of the mounting position in the customer´s system by using the so-called inclinometer.

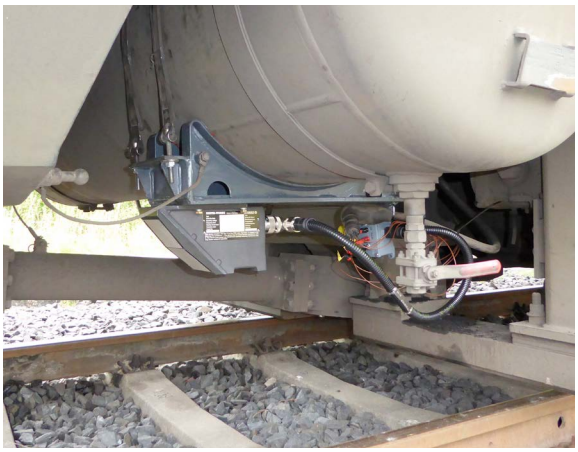
Interview with Dipl.-Phys. Wulf Alexander Kolbe, Radar Expert at DEUTA-WERKE

DEUTA Doppler radar sensor DRS05 is the top-selling radar sensor for rail vehicles worldwide. The wide-range power supply 24 V-110 V, the large measuring range up to 600 km/h and the wide variety of output protocols allow an easy integration into the customers´ system. Especially, the housing variant DRS05/1S1, a housing with integrated protective hood has proven its reliability in many projects.

Special two-channel algorithms reduce the calibration-shift effect thus providing high accuracy even with changing surfaces. Under winter conditions the integrated protective hood together with a redundancy concept basing on Doppler signal amplitudes and taking into acount a spectral evaluation assures the high availability.



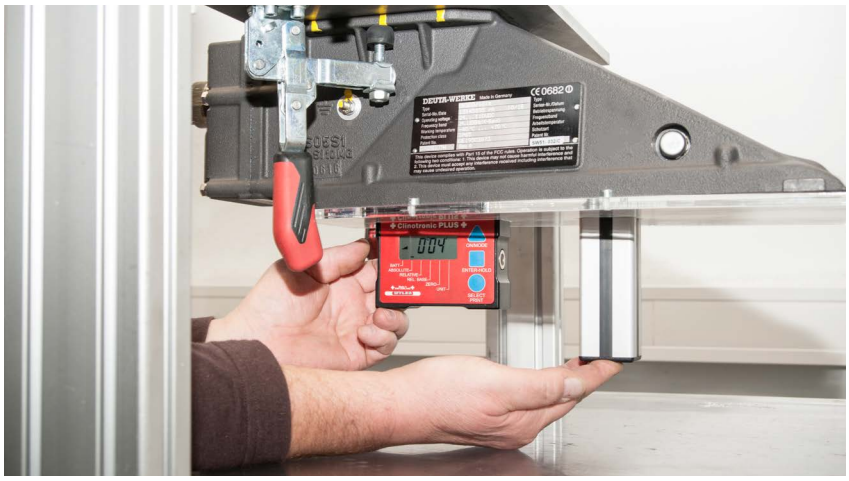
Dipl.-Phys. Wulf Alexander Kolbe has been working with DEUTA since 2001.



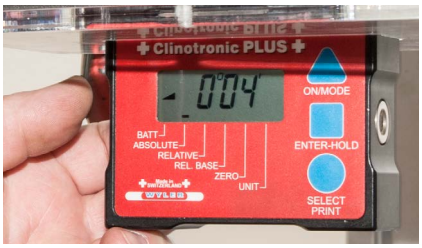
Why is it necessary at all to calibrate a Doppler radar sensor?

Wulf Kolbe: The Doppler radar sensors are even calibrated twice. At first, we calibrate the sensors during the final testing in the manufacturing process. In this inhouse-testing all manufacturing tolerances are compensated by measuring the sensors on a calibrated conveyor belt.

Here, the conveyor belt simulates a representative track of which calibration has been carried out on the basis of long-term trials whereas its reliability is being controlled day to day by so-called gold-samples. Thereafter, the Doppler sensors show a variance of about 0.2 % based on the representative track. This high accuracy and the long-term reliability are a solid basis for precise speed detection. It is independent from wheel/track contact and therefore used as a diverse measurement method for wheel pulse encoders in safe systems.



Place the inclinometer for the first measurement on the contact surface of the radar sensor. The protractor and the display must point towards the nameplate of the radar sensor.



What should our customers take into account when choosing the mounting position?

Wulf Kolbe: We decide together with our customer on the mounting position which will then be optimized during the integration period. Typically, we mount two DRS05 units under the railcar body close to the bogies in direction to the rail fastening material, on two sides of the train in opposite position to each other. This mounting position has proven successfully in order to achieve an optimal diversity of the mounting conditions thus minimizing the so-called Common-Cause effects.

What shall be considered during the mounting with regard to the calibration?

Wulf Kolbe: The horizontal alignment of the mounting position is crucial since the angle to the horizontal in direction of the movement in relation to a reference surface on the radar sensor has a direct impact on the speed detection.

You spoke of two calibration steps.

Wulf Kolbe: The second calibration concerns the error correction in the horizontal alignment of the mounting position in the customers` system. For the calibration our customers use the so-called inclinometer. The inclinometer is a calibrated precision device for measuring angles with an accuracy of 1/10 degrees. In addition, during measuring any vibrations should be avoided, for example all power units shall be off during measuring. The angle correction in the system of the customer increases the absolute accuracy of the speed detection, deviations from the real speed should be less than 0.4 % after that calibration.

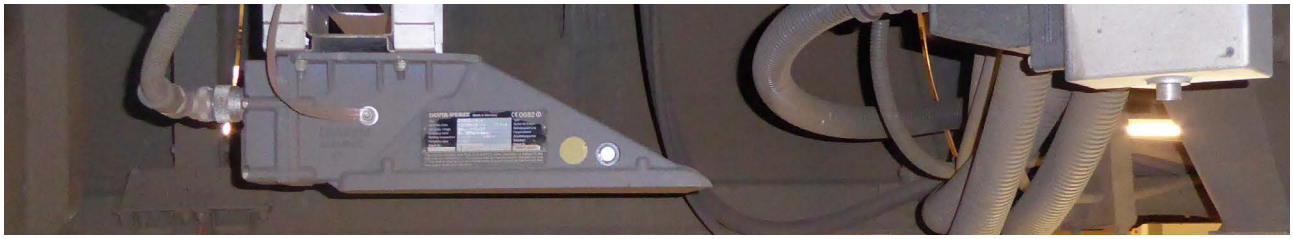
How many calibration drives are necessary after that?

Wulf Kolbe: The DRS05 radar sensors are ready for immediate use. Calibration drives would only take place during the integration phase in order to confirm the optimal mounting position as agreed.

Is it necessary to renew these calibrations in the course of time?

Wulf Kolbe: No, the calibration does not have to be repeated after a certain period of time. There are only very few situations where a new calibration is necessary on the train or at DEUTA. This is the case when the angle has to be measured anew, or if the bracket of the radar sensor has to be exchanged, or the mounting position of the radar sensors has been changed. When a DRS05 unit fails a new sensor can be mounted without calibration, thanks to the final testing all units are identical and the mounting angle is maintained. The former calibration drives are no longer necessary, in addition, they mix up the influences of the manufacturing tolerances and the mounting position which results in a new calibration at any replacement.

In the event that DEUTA or the customer updates the firmware of the DRS05 sensor no new calibration is required, in general.



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