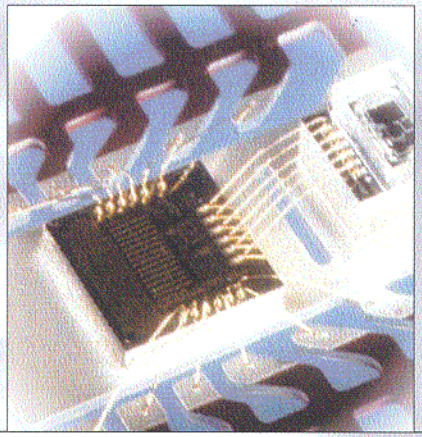
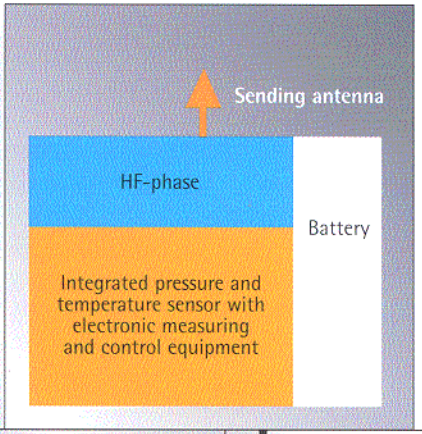
Internal structure of the intelligent, integrated pressure and temperature sensor SP 13



Features of the integrated sensor SP 13	
Pressure range:	0 bis 6,35 bar
Pressure accuracy:	± 75 mbar
Pressure resolution:	± 25 mbar
Measurement interval:	3.14/0.85 s
Transmission interval:	54/0.85 s
Threshold for mode transitions:	200 mbar/54 s
Operating temperature:	-40 to +120 °C
Max. short term temperature:	to 170 °C

Circuit of the wheel electronic

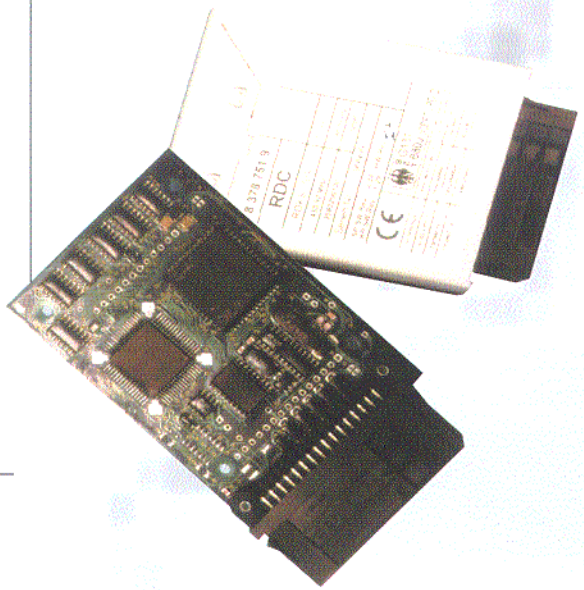


The control device covers two different fields of function:

- The universal tire pressure monitoring functionality (system component)
- The vehicle-specific data bus connection with the corresponding operating and warning philosophy (communication component)

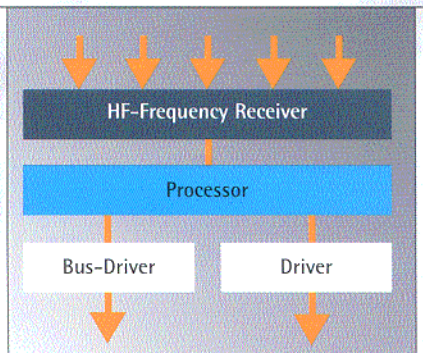
These two fields of function are carried out in two individual program modules which are independent from each other, so that its adaptation to a different manufacturer-specific bus report is relatively simple.

Control device of the tire pressure monitoring system



Receiving antenna of the tire pressure monitoring system

Block wiring diagram of the control device



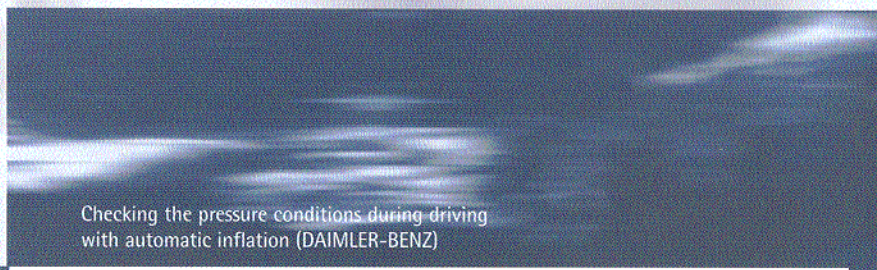
4. Testing

In cooperation with several reputable German automotive manufacturers, extensive tests were carried out to guarantee the reliability of the total system. For this purpose, numerous testing vehicles were equipped, and approximately 50 vehicles were built within the scope of a large-scale test, during which they covered a great mileage. Additionally, tests under extreme conditions were carried out. Vehicles were equipped with automatic inflation systems which allowed the realization of extreme pressure conditions during driving.

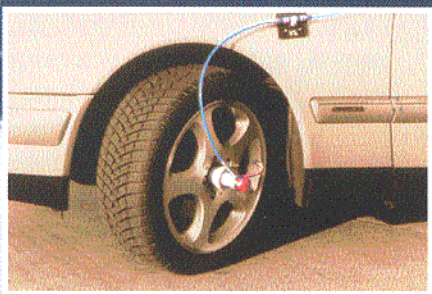
Extreme thermal conditions occur when driving down a mountain pass. The vehicles were loaded to the limit and were then subject to extreme braking forces during a downhill driving period of 45 minutes, which caused extreme heat in wheels and tires. In the subsequent stationary phase, the brake discs with their temperatures of up to 900 °C cause a temperature increase in the interior of the tire of far above 100 °C. The temperatures and pressures occuring during this test are measured on the exterior in order to verify the precision and reliability of the electronic wheel system in extreme temperatures.

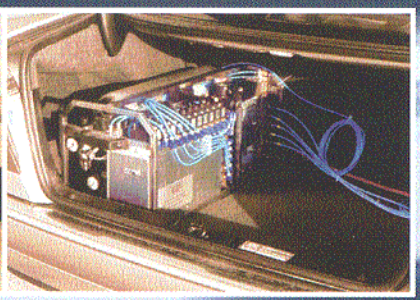
In winter tests, the system was tested for functionality in low temperatures and the potential susceptibility to snow and icy slush.

In the course of high speed tests on the road and on test stands, tests at speeds of over 300 km/h were carried out.



Checking the pressure conditions during driving with automatic inflation (DAIMLER-BENZ)





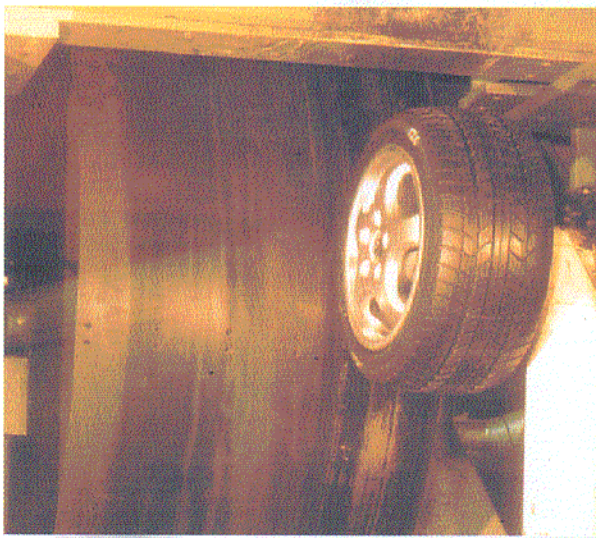
High-temperature tests – driving down a pass, with tire temperatures of far above 100 °C (AUDI)

5. Prospects

With the tire pressure monitoring system presented herein, we succeeded in providing continuous control of another safety-relevant vehicle component. This product concept which was developed on a wide basis can claim to have set new standards in respect to precision, easy operation and reliability in the field of tire pressure monitoring.

The design of the product components allows the exploitation of cost reduction potentials by means of an increase in production quantity, so that an expansion of the market can be expected in the following years. We are in process of developing a tire pressure monitoring system for heavy-duty vehicles which will be medium-termed introduced in the market.

Winter test (BMW)



High-speed test at over 300 km/h (PORSCHE)