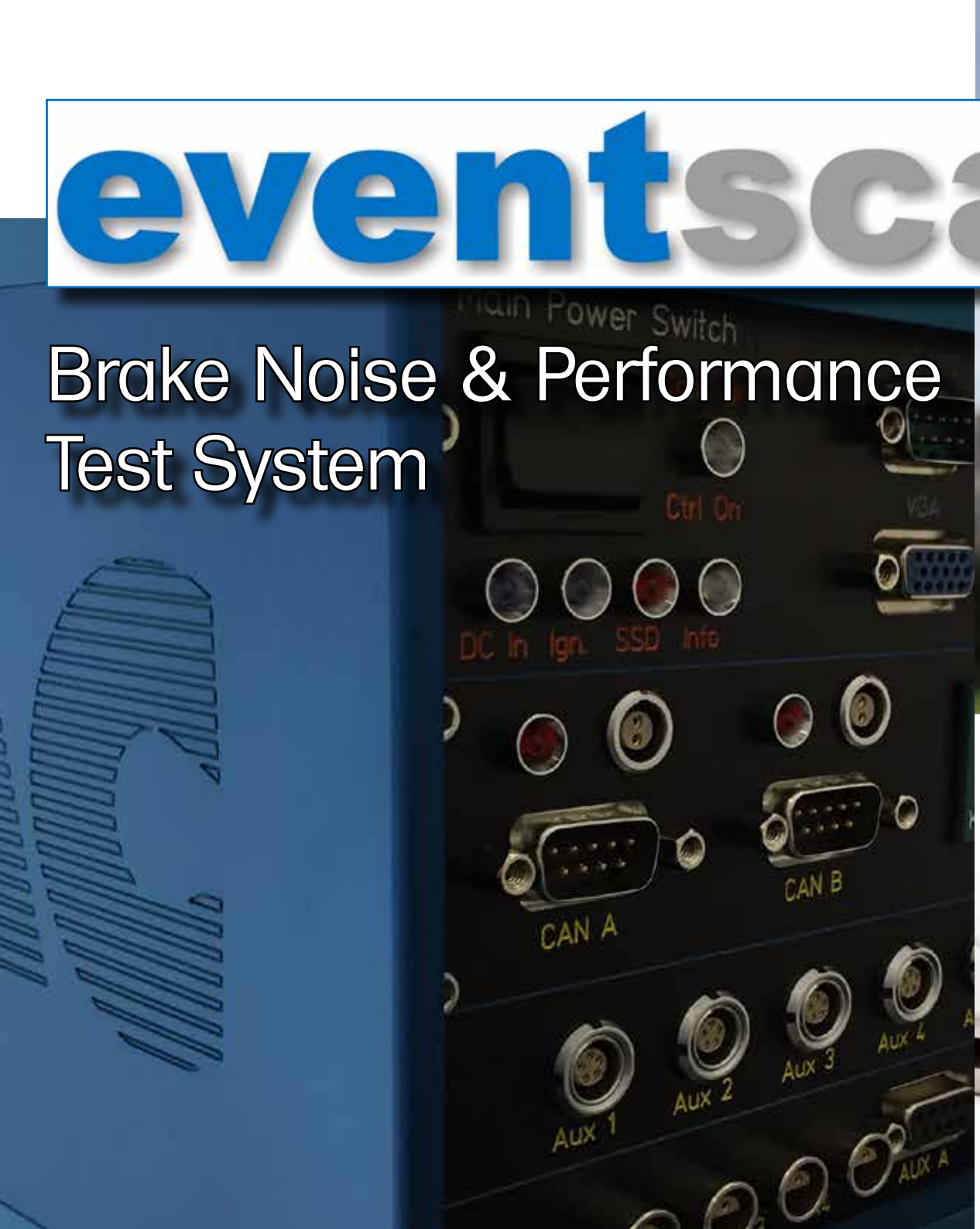
eventscan CAR

Brake Noise & Performance Test System



STAC

Noise & performance brake test system

EventScan CAR is used to acquire brake performance data and to identify and analyze brake noise and vibration effects. It has been especially developed for in-vehicle tests on the road.

Extensive trigger options, fast trigger reactions, as well as high dynamic and precise speed, deceleration, and stop distance measurements allow to use the system for brake performance tests, like ECE R13, ECE R90 type approval, FMVSS 135, FMVSS 105, On-Brake DTV, ABS operational tests, and any special stop distance test, even with high initial speeds up to 300 km/h.

Sound, vibration, and other fast varying signals are synchronously acquired with present operating conditions of the brake (like brake pressure, lining or disc temperature, brake speed, torque etc.). Signals are collected by analog inputs, CAN bus connections, GPS sensors, tachometer pulse inputs, network connections, and other devices. All acquisition and analyzing tasks are performed online and in real time.

The system is compatible with all common brake noise test standards and it meets the requirements of the current EKB and SAE recommendations dealing with brake noise tests.

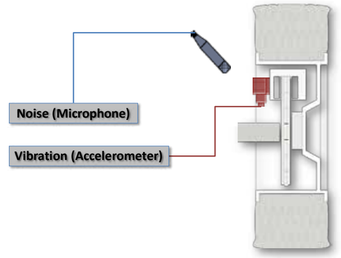
EventScan systems have been applied by leading US, European, and Asian car manufacturers and it is globally used by brake system suppliers, friction and damping material manufacturers.

EventScan CAR provides a ruggedized and compact aluminium housing especially designed for in-vehicle testing. It covers all components - the embedded PC with multi-core processors, solid state disc, extensive memory, display support unit, all measurement components with signal and risc processors, and a flexible power supply unit for in-vehicle use.

To ensure the desired high quality, all measurement components and the housing are manufactured by STAC itself.

Detecting brake noise & vibration in real time

Brake squeal effects are identified by special squeal analysis modules of the system. For each brake under test (up to 4) one separate squeal analysis module is available.



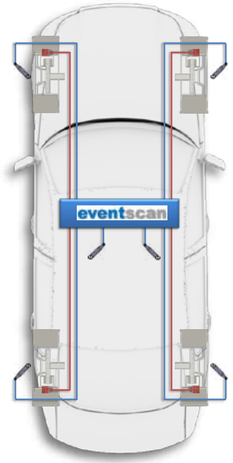
One or multiple microphones may be used to detect squeal effects. Once a squeal is detected it is validated by wheel sensors (accelerometers) to determine the source of the squeal.

Typical brake noise measurement configurations supported by EventScan CAR are:

- one or two microphone(s) in the cabin and a sensor at each brake (5-6 channels).
- one microphone and one sensor in each wheel house (8 channels).
- one microphone and one sensor in each wheel house as well as two microphones in the cabin (10 channels).

A squeal analysis module allows the detection of squeal effects in the range from DC to 23 kHz; it may be used with each fast input channel in real time and parallel to acquisition and signal recording. The detection range may be limited to a certain frequency band. All signals used for squeal analysis are transferred into the frequency domain using a FFT analysis (selectable resolution up to 8192 points; selectable window function, default Hanning) with selectable overlap processing (default 75%).

Multiple squeal events can be reported during one brake application. Events are differentiated by their frequency which has to be nearly constant during the event (slightly moving within certain margins is tolerated).



Other noise or vibration effects - like “Groan” or “Judder” - are identified by specialized time domain analysis and/or real time order tracking modules which may optionally added to the system.

Finally, any type of high dynamic signal may be acquired, analysed and recorded in real time, like DTV, torque and pressure variations.

Multitude of options

EventScan CAR provides a large number of measurement inputs, like high and low speed analog input channels, thermo couple inputs, digital inputs, pulse tachometers, CAN bus, etc.. All signals fed into these inputs may be stored on the disc at full speed and analyzed in real time. However, meaning and function of each signal is freely defined by the user. This allows to use completely different sources for a certain signal - like for speed or for brake trigger.

Speed

Depending on the actual requirements or the availability of sensors and signals, EventScan may be easily setup to use different sources for any kind of signal, like speed. The desired quality and behavior of the speed signal differs: for brake noise tests less precise and less dynamic speed signals are often sufficient, whereas travel direction (forward or backward) is crucial. Apart from that, the speed signal has to be very precise and acquired at a higher rate if performance tests have to be realized - usually the travel direction is forward and a further information about the direction is irrelevant. Data like speed may be acquired with different effort using EventScan:

With EventScan's OBD support one CAN port may just be connected with the OBD-II port of the car to obtain actual speed information with an update rate of typical 20 Hz.

Furthermore, a speed signal may be derived directly from the car's CAN bus with a typical update rate of approx. 100 Hz. Direction information is often available, too. The configuration of the CAN access may easily be setup using a CANdb data base.

Accordingly, any type of analog speed sensors may be used with any of the low-speed or high-speed analog inputs of the system.

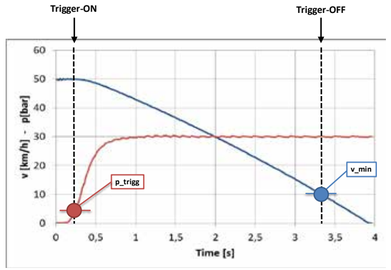
EventScan's high speed pulse tachometer inputs are usable with any sensor providing pulse output signals, like optical sensors (e.g. Correvit), microwave sensors, or GPS assisted sensors (e.g. VBox). Speed measurements with these tachometer inputs are extremly precise due to the high pulse sampling rate of 26 MHz.

The optionally available MSM100 module may be connected to one CAN input and provides GPS speed measurements which are enhanced by an integrated accelerometer. In addition, the module is able to identify the travel direction.

Brake trigger

The vehicle's stop light switch or a dedicated pressure switch may be connected to the BLS-Input (9-30 VDC, galv. isolated). Alternatively, simple potential-free switches or contacts (e.g. mounted on the brake pedal) may be connected with one of the available digital inputs and can be used as brake trigger signal.
If connected to the vehicle's CAN-Bus the trigger signal may also be obtained by the CAN device.

On the other hand, any measuring input channel (like brake pressure, pedal travel, pedal force etc.) may be used. Threshold values define the "on" and "off" status of the brake trigger. If, for example, the brake pressure is used, with a value above 0.5 bar the trigger can be set to "on" and a value below 0.3 bar could be used to reset the trigger to "off".



Other signals may define additional conditions. In order to avoid triggering at standstill, a minimum speed threshold value can be defined. As an example, in the figure above the trigger is set to "on" if the brake pressure exceeds "p_trigg", and the trigger is set to "off" again, if the actual speed falls below "v_min" (or if the pressure falls below the "off" threshold).

Measurement I/O devices

ANA: High-Speed Analog Inputs (4 to 16)

High speed analog inputs may be used to acquire signals of higher bandwidth, like sound pressure and vibration for noise detection, and/or other fast varying signals to analyze high frequency fluctuations of torque, pressure, disk thickness, and even more. The modular system layout provides up to 16 high speed analog input channels. All such inputs provide IEPE/ICP sensor power supplies, AC/DC coupling circuits, programmable high quality instrument amplifiers, automatic anti aliasing filters, and 24 bit A/D converters (setup for all devices under software control).

RPM: High-Speed Pulse Inputs (1 to 4)

EventScan's high speed pulse tachometer inputs may be used with any sensor providing pulse output signals, like optical sensors (e.g. Correvit), microwave sensors, or GPS assisted sensors (e.g. VBox). A system may contain up to 4 of such inputs. Speed measurements with these tachometer inputs are extremly precise due to the high pulse sampling rate of 26 MHz. The tachometer inputs are as well synchronized with the mentioned high speed analog input channels and may thus be utilized for order tracking or torsional vibration analysis.

CAN: CAN-Bus Ports (1 to 4)

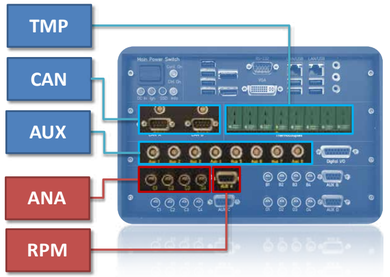
Up to 4 fully separated and galvanically isolated CAN bus ports may be used to acquire data directly from the vehicle's internal CAN buses or the OBD II onboard diagnostic port as well as to acquire data from external measurement modules. By using the car's CAN bus, a vast number of additional sensors (like speed, brake trigger and pressure, ambient temperature, etc.) become superfluous. This will drastically reduce time and cost for test vehicle preparation.
(CAN ports may be operated in standard high speed CAN mode or in fast CAN-FD mode - up to 12 Mbps).

AUX: Auxiliary Analog Inputs (8 to 16)

The system provides up to 8 or up to 16 low speed analog inputs (galvanically isolated) for any kind of sensors providing analog output signals (e.g. pressure, pedal force, pedal travel, humidity, ambient temperature etc.).
Sensors may be fed by the integrated power supply which may be set from 0V to +/-15V in steps of 4mV (separately for each input).

TMP: Thermo Couple Inputs (8 to 16)

The integrated thermo couple module enables the use of 8 or 16 K-type thermo couple inputs providing precise temperature measurements by using 24 bit A/D converters. All such inputs are galvanically isolated.

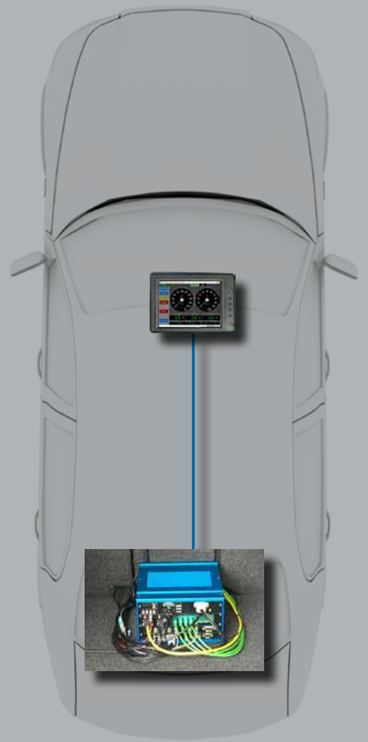


Flexible System Expansion

The CAN bus ports provided may be used to establish digital sensor networks. External acquisition modules (like modules with general purpose analog or thermo couple inputs, GPS and accelerometer modules, pressure sensors with CAN bus output, etc.) may be connected to EventScan using one small CAN bus cable. By using such external modules the system may easily be expanded to a vast amount of inputs in a flexible way. External modules are powered by the system.

Other Input & Output Units

Other available inputs and outputs (which are not described here):
- brake trigger input (9-30 VDC), galv. isolated
- digital inputs (8 channels), sampling rate 100 to 200 Hz
- high speed digital inputs (14 channels), sampling rate 50 kHz
- FlexRay port (Channels A and B, Bosch E-Ray core)
- Ethernet LAN ports, 1 Gbps
- RS232 port, USB 2.0/3.0 ports



Simple to install & easy to use

The compact and ruggedized EventScan main unit is just placed in the trunk or anywhere in the cabin - e.g. on a passenger seat. It is simply powered by the car's battery (nominal input voltage range is 9 to 30 Volt - voltage drops down to 6 Volt or high voltage peaks up to 80 Volt are maintained).

to the dashboard (suction mounting) - making it easy for the driver to obtain online information and to enter commands by using onscreen touch buttons.
The touchscreen is automatically powered by the system. Integrated loudspeakers may be used to produce advising or warning tones or to playback recorded noise effects.
A keyboard or a data stick may be connected using the USB port of the touch display.

To start and stop operation the on/off switch of the system or a remote contact (ignition or external switch) is used.

The system is controlled by a separate TFT touchscreen (8.4") which may be attached

An optional secondary (small) screen with full customizable display items may be connected to the system and placed - for example - directly into the driver's line of vision. The installation of additional instruments - like a pressure gauge - is not neccessary.

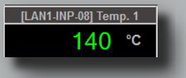
Keeps the driver informed

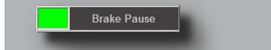
During test the driver is supported by an immediate feedback of the system. The online display of EventScan informs about the actual state of input signals (like actual pressure, temperatures, speed etc.) as well as about actual results provided by the real-time process (like MFDD, stop distance, noise events etc.). By just one touch the driver may select different display panels.

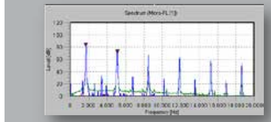
The driver will also be notified if target values for the next stop are reached or if the execution of the last stop was successful.

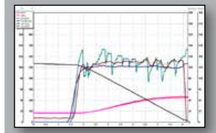
The on-screen information is fully customizable to meet different requirements. There is an unlimited amount of display panels - each display panel consists of several different display items which may be placed by the user (and connected to any available signal). Examples for display items are "Tacho", "Digital", "Bar", "LED", "Scope", "Graph", or "Table".

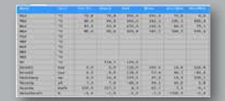
User-defined display layouts are stored in parameter sets and reloaded on request with only a few clicks.

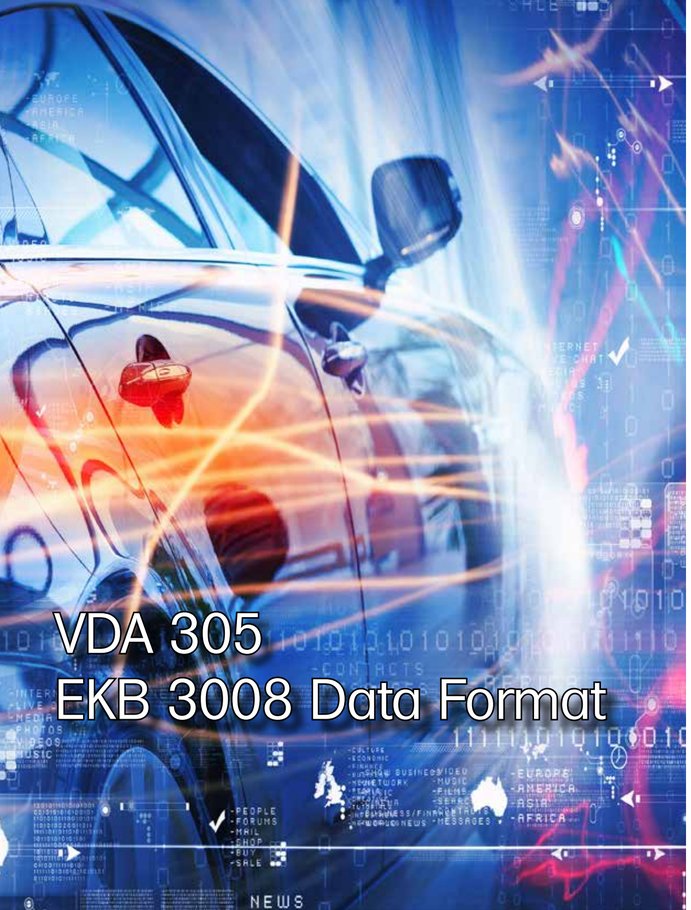












State of the art: EKB 3008 data

EventScan stores all test data and results online and in real time. Data and results may not only be examined or transferred after finishing the test - all data are accessible even if the test is still running. The user may decide - for example - to stop a test or to continue a test with different setup if actual results are not successful.

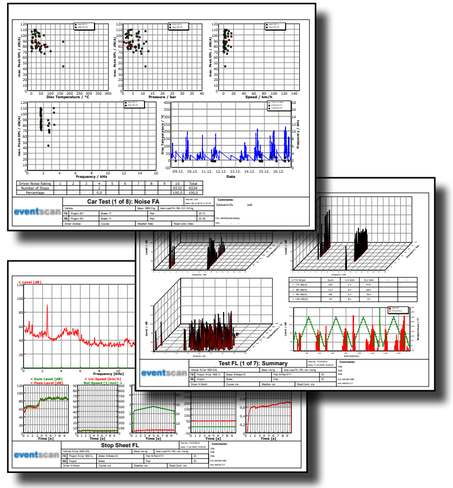
Whilst most data loggers utilize proprietary file formats based on proprietary software only (and which excludes to use the data if the data logger is no longer supported) EventScan CAR uses the open and well documented EKB 3008 “Brake Test Data Format”.

EKB 3008 has been developed by EKB (“European Circle of Brake Experts”) in close cooperation with STAC. Today it is recommended also by the SAE, and published under recommendation VDA 305. EKB 3008 is requested by most OEM car and brake manufacturers.

EventScan CAR generates native EKB 3008 data (no subsequent conversion from internal data is necessary) and supports all features of the flexible file format. Due to STAC’s integration in the development process of EKB 3008 an exact implementation of all existing and new features is assured.

The reporting tool “EventScan Documents” is enclosed in the EventScan CAR system delivery. It generates ready-made reports (based on EKB and SAE recommendations) and uses EKB 3008 data directly.

For special analyses the EKB 3008 data may also easily be used and examined by a lot of standard software packages like MS-Excel, MatLab, etc.. Moreover, in the brake development and testing field, the amount of special software and macros for EKB 3008 is increasing steadily.

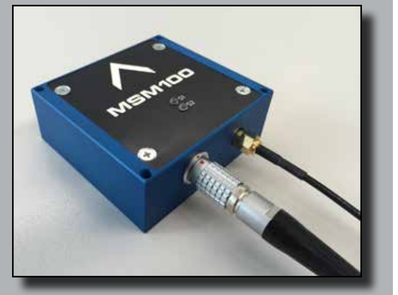


JURID-E3 compatibility JURID-E3 services

EventScan CAR may optionally contain a software module which enables the system to operate in JURID-E3 compatibility mode. The JURID option allows to use setups generated for E3 systems and tests executed in JURID mode will generate files in DAF format. All existing report software modules for JURID-E3 systems may then be used for evaluation and reporting.
The JURID option allows to add EventScan CAR systems to an existing JURID test system pool without the need to change the established work flow for setup and evaluation.

In addition, JURID systems are in safe keeping - STAC now provides the complete service for existing JURID-E3 systems: calibration, repair service, spare parts.

Optional modules



GPS Speed Measurement

The optionally available MSM100 module contains a 10 Hz GPS receiver, a 3-axis accelerometer, a 3-axis magnetometer, and a 3-axis gyrometer.

It provides GPS position information and GPS speed measurements which are enhanced by the integrated accelerometer. In addition, the module is able to identify the travel direction.

The module itself is mounted inside the car near the center of gravity, and its magnet mount GPS antenna is put on the roof. The module is connected to one CAN port of EventScan and is automatically powered by the system. It provides the actual deceleration, a precise and dynamic speed signal as well as direction and position information.

Axle-/Wheel Deactivation Unit

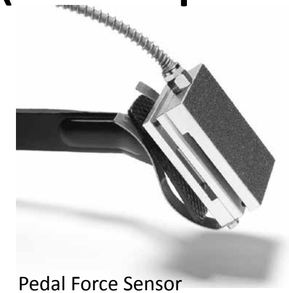
The optionally available RAS/AAS wheel deactivation units are electronic control devices to operate additional control valves for a temporary deactivation of the wheel-related or axle-related brakes. It may be used for split-axle tests or other special functional tests during brake performance or brake noise evaluations. Several savety features, like preselection, cancelling by a single tip on the brake pedal, emergency off, watch dog, key locks, and others round off this device.

Microphones

Accelerometers & Cabling

Accessories (examples)

Pressure Sensors



Pedal Force Sensor

OBD-II Connection Cable

Pedal Travel Sensor

Temperature & Humidity Sensor

Slip Ring Transducer

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