

Tips & Technology

For Bosch business partners

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BOSCH

Invented for life

Gasoline injection

Engine speed measurement in exhaust emission testing

The complete concept

The engine speed is an important parameter when taking diagnostic measurements and performing exhaust emission tests on vehicles. In Germany, recording of the engine speed is generally essential for conducting such tests. However, measuring the engine speed is not always an easy matter in the light of the ever more complex installation situation in the vehicle body and the almost completely encapsulated and space-saving design of modern assemblies. In certain present day vehicles, engine speed recording has become a highly complicated business requiring practical knowledge, experience and the appropriate equipment.

Day-in, day-out, independent workshops have to deal with a wide variety of customers with different types and makes of vehicle and therefore have to be prepared for all eventualities. To be able to work efficiently and test as many different models as possible, professionals can no longer rely on just one type of engine speed recording, but rather have to be in a position to react flexibly to the given vehicle situation. This presupposes the availability of a wide range of engine speed measurement options, which is why all emission analyzers and exhaust emission test stations from Bosch offer a variety of different methods.

Engine speed recording with Bosch emission analyzers and exhaust emission test stations

On vehicles with compression ignition engines, the following options are available for determining the engine speed:

- ▶ Clip-on sensor
- ▶ OBD
- ▶ BDM (battery engine-speed module) If connection is not possible in the engine compartment, the BDM can also be plugged in to the cigarette lighter by way of a corresponding adapter cable (1 684 460 213). This also applies to use of the BDM on vehicles with spark ignition engine.
- ▶ Alternator terminal W

The engine speed recording options on vehicles with spark ignition engine are as follows:

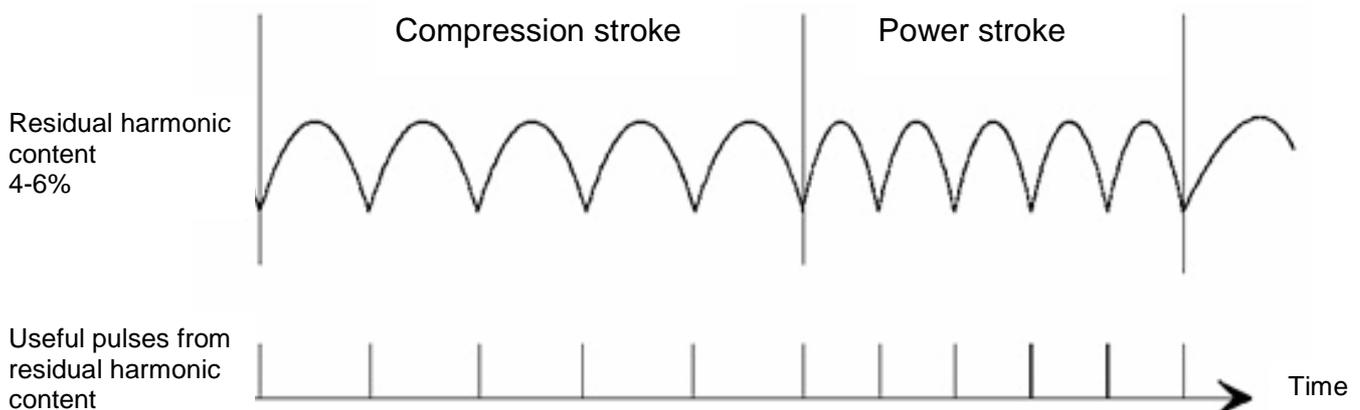
- ▶ Clip-on trigger
- ▶ OBD
- ▶ BDM
- ▶ Primary signal via terminals 1 and 15
- ▶ TD/TN signal from control unit
- ▶ TDC sensor
- ▶ Alternator terminal W
- ▶ Optical sensor (the optical sensor is now only used with BEA 150, BEA 250, BEA 350, BEA 450 and RTT units)

Generally speaking it is most convenient to make use of OBD, terminals 1 and 15 and the clip-on trigger. The method actually used, however depends on the vehicle conditions and of course to some extent on the preference of the workshop personnel performing the exhaust emission test.

Apart from the options mentioned there are a few other alternative ways of measuring engine speed. These are however not generally applicable but were rather developed for specific vehicles or makes such as engine speed recording using the governor impulse method (for Mercedes-Benz).

Engine speed recording with BDM

Engine speed determination with BDM is based on the principle of evaluation of the angular velocity of the pulses resulting from the residual harmonic content. Angular velocity is low on the compression stroke, as the engine has to perform work in this phase to compress the mixture. This results in considerable intervals between the pulses. Angular velocity is high on the power stroke, as work is released in this phase. This shortens the intervals between the useful pulses.



Engine speed recording using BDM is universally applicable but also extremely sensitive. To ensure successful implementation, the correct procedure for handling the BDM is described in the following.

Recommended procedure for engine speed measurement with BDM:

1. Switch on electrical equipment such as lights, heated rear window and seat heating to drain the vehicle electrical system and thus ensure that the alternator subsequently has to provide a high output. This increases the residual harmonic content.
2. Set the number of cylinders on the BDM.
3. Connect up the BDM.
4. Start the engine.
5. Starting the engine initiates determination of the alternator/crankshaft transmission ratio. This requires the engine to run at a steady idling speed for at least 10-30 seconds. Do not accelerate. Only electrical equipment which is not pulsed should now be switched on.

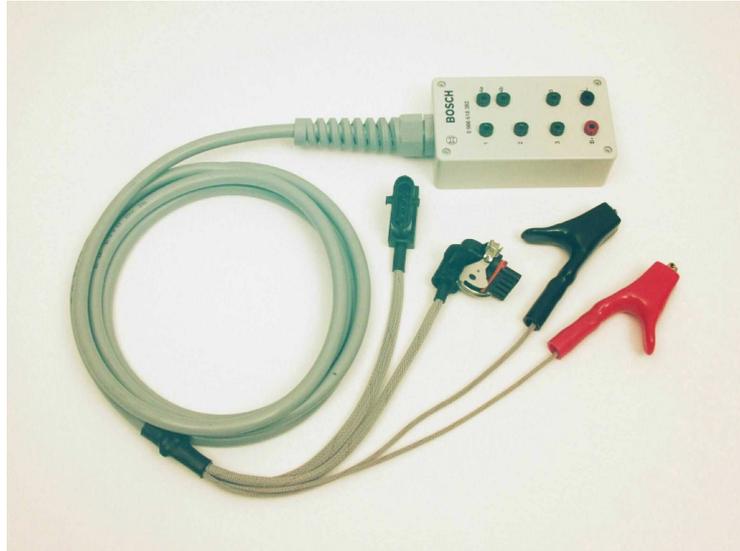
Always heed the following: Modern alternators have a load-response function. Consequently the alternator output is run up slowly. This may slow down the signal detection process.

Check the following if measurement with the BDM does not initially provide the desired result despite employing the correct procedure:

- ▶ Is the V-belt too slack and/or slipping?
- ▶ Are mechanical units or guide/tensioning rollers at the belt drive causing problematic modulation?
- ▶ Is the vehicle to be tested fitted with a common rail injection system?
- ▶ Are you dealing with a sophisticated engine concept employing balance shafts or a high number of cylinders for example for extremely soft and smooth operation?
- ▶ Is there a mechanical or electrical problem with the alternator?
- ▶ Is the alternator provided with a free-wheel pulley?
- ▶ Are welding appliances or chargers also being used?
- ▶ Is there any pulsed electrical equipment in the vehicle electrical system (pulsed dashboard illumination, fan controls, etc.) or is there a complex hi-fi system fitted? These can also cause voltage pulses and thus interference in the electrical system.
- ▶ Pay attention to the correct tapping point with multiple battery systems.
- ▶ Where is the correct voltage tapping point? Recommended: The closer the voltage tap to the alternator, the more reliable the engine speed recording will be. Where possible, always make use of B+ terminals, starters or alternators for the tap.
- ▶ Problems with engine speed recording are often caused by alternators with INA free-wheel pulleys. This type of alternator is mainly used in the diesel sector. Alternators with INA free-wheel pulley can usually be identified from the separate plastic cover over the pulley. By adhering to the procedure outlined above, it is however normally possible to measure the engine speed with BDM on vehicles equipped with such alternators as well.

Engine speed recording via alternator terminal W

With certain types of alternator the engine speed can also be recorded by way of the brought-out terminal W at the alternator (with some makes, this connection is also routed to the rev counter or diagnostic connection). To perform measurement, the wiring harness connector of the multi-function regulator must be unplugged at the alternator and the test adapter 0 986 618 392 fitted.



The setting for the number of pulses depends on the alternator/engine transmission ratio. If this is not known, the setting must be made on the basis of comparison with a rev counter.

Bosch exhaust emission test stations are always the right choice

For reliable, convenient and efficient exhaust emission testing, professional workshops are well advised to rely on proven technology and a system tailored exactly to the requirements.

Bosch Diagnostics can draw on a wealth of experience and expertise in the development of exhaust emission test systems and offer a wide range of emission analyzers and exhaust emission test stations in a variety of combinations to suit every application.

The BEA 850 from Bosch Diagnostics currently sets the standard in terms of exhaust emission testing. With this system, workshops are equipped to deal with all present and future demands associated with exhaust emission testing on vehicles with gasoline, diesel and gas engines.

In addition to the OBD function for vehicles with gasoline engine, the BEA 850 can be used to perform the on-board diagnosis-supported exhaust emission testing on diesel vehicles applicable as of 1st October 2005. The RTM 430 provided permits efficient exhaust emission testing on vehicles with compression ignition engines.

The intuitive software with the easy-to-follow screen menus and soft key control guarantees quick and effective test procedures.

For read-out of the fault memory on OBD vehicles, the BEA 850 is equipped with one of the successful control unit diagnostic testers of the KTS series.

The components of the BEA 850 exhaust emission and diagnosis station are conveniently arranged on a sturdy trolley ideally suited to workshop use. The measurement systems are readily accessible and all the sensors such as the clip-on trigger are neatly hung under the measurement module MTM extended.



Put our expertise to your advantage

To be able to work reliably and efficiently with Bosch emission analyzers and exhaust emission test stations, we recommend attending one of the courses offered at a Bosch Service Training Center near you. There you will receive instruction and support from experienced instructors and have an opportunity to talk about practical matters with other participants and the staff as well as discussing questions arising from working with the equipment.

The Bosch technical documentation directory also contains a wide range of material on diesel and gasoline injection systems, diagnosis, emissions and exhaust treatment.



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