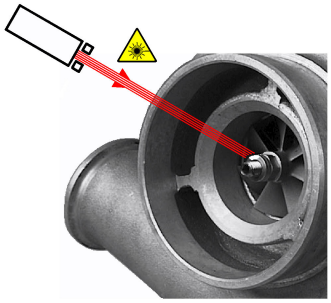
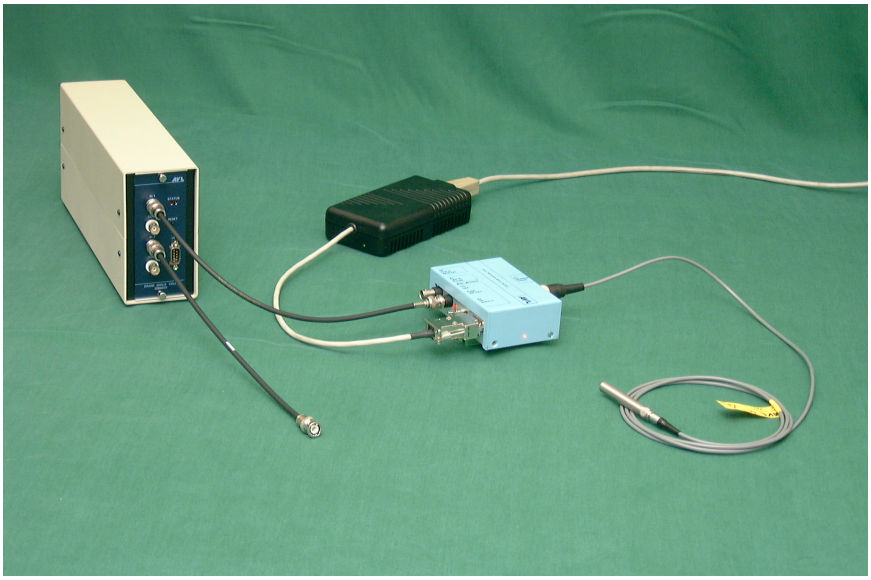
AVL TURBO SPEED SENSOR TS350

The AVL Turbo-Speed Sensor TS350 is an optical sensor specially designed for non contact measurement of turbochargers running at speed up to 200.000 rpm for purposes of measurement in stationary and transient engine-mode.



A Laser-beam is sent to the compressor wheel, scattered back by means of a reflecting mark once each revolution. The scattered light is detected and converted into a periodical sequence of voltage signals that is available for further processing (e.g. AVL Trigger-Box TB350 for test-stand-connection, oscilloscope and counter). The large optical range (more than 300mm) enables measurement without changes in design and without any distortion of the inlet mass flow.

In combination with AVL´s Pulse-Conditioner 3069A01 a measuring chain is provided suitable for analogue voltage output corresponding to the turbocharger speed. The Crank Angle Calculator is commonly used for indicating purposes but it is also able to generate the analogue speed signal from the periodical signal of the Turbo-Speed-Sensor TS350. This chain is either used in stand alone operation (recorder, x/y-display) or might be added to AVL´s Indicating Instruments.

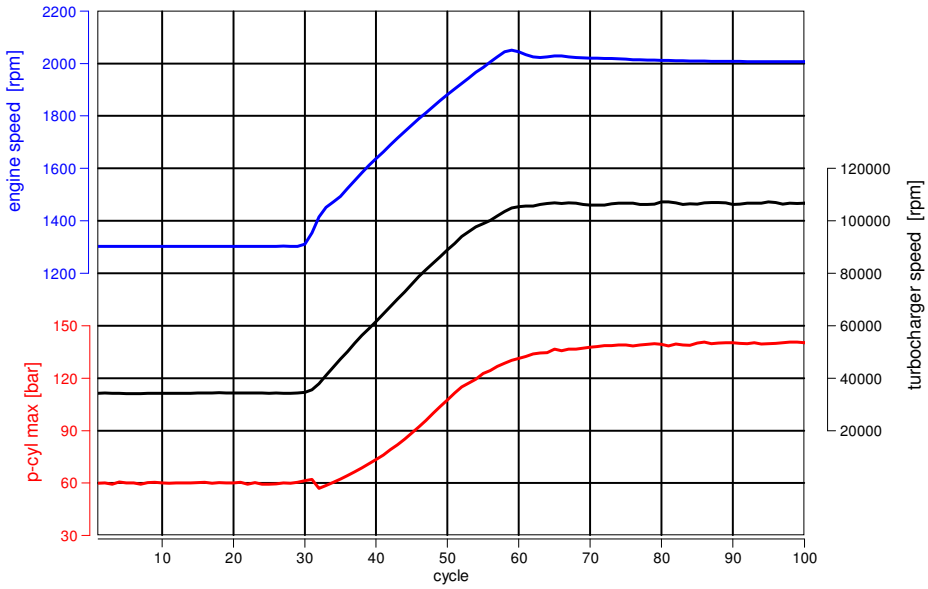


Application-Example Transient Test:

As far as changes in the European test cycles for Heavy Duty Vehicles have been introduced in Euro III standard this year the old steady state engine test cycle ECE R-49 is replaced by two cycles. These cycles are the European Stationary Cycle and the European Transient Cycle. Smoke opacity is measured by the European Load Response test.

A bus-engine which is planed to be used in local public services has to be optimised at the test stand regarding emissions (ELR). Besides modification of the injection system there are certain parameters at the turbocharger which are to be adjusted. On the one hand the turbocharger's speed is acquired for reasons of control because the manufacturer prescribes a maximum speed due to strength reasons - on the other hand the indicating diagram shows responses to this load change of turbo charger's speed and maximum cylinder pressure in addition to the engine speed.

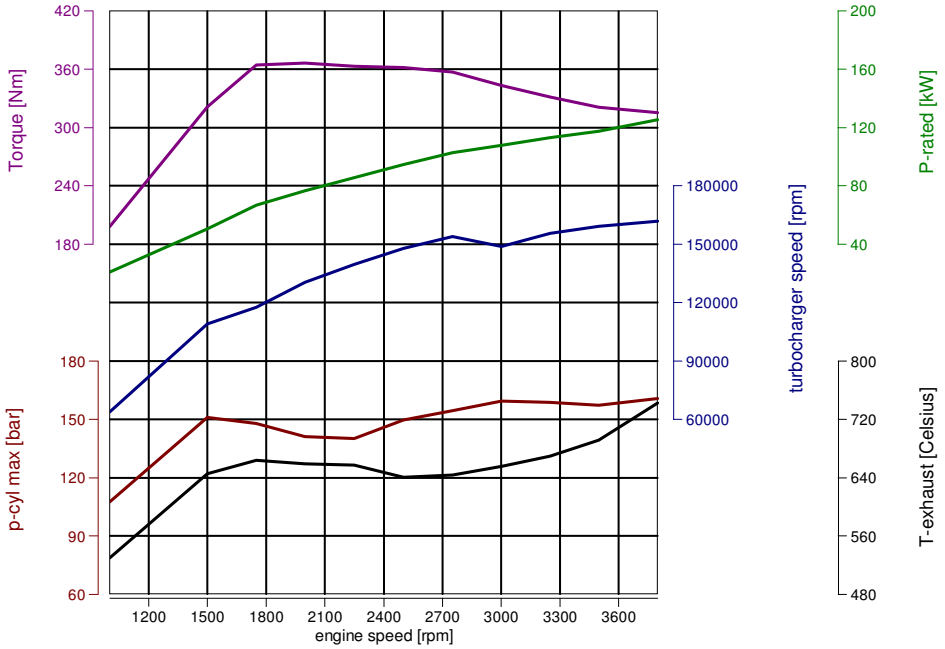
At a given load-change from 20% load and speed of 1300 rpm to 80% load and speed of 2000 rpm not only common engine data are required but also turbocharger's speed is included.



Application-example Stationary Test:

With the current trend to high specific power of Diesel-engine-vehicles (≥ 50 kW/l), several contradictory conditions with regard to rated power need to be considered:
Today the turbine speed and thus the air quantity can easily be changed in the engine map by modern **V**ariable **T**urbine **G**eometry equipment. For reasons of durability, however, the max. permissible turbine speed must not be exceeded. The exhaust temperature at turbine intake is limited. The peak Cylinder Pressure is limited.

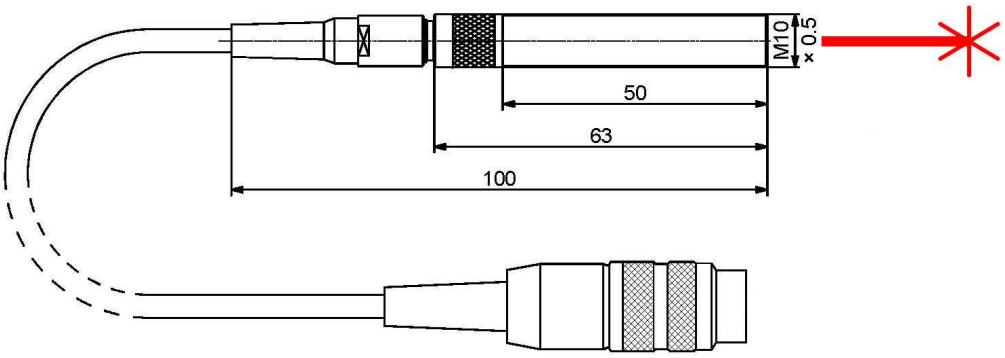
With due consideration to the engines rated power, the combustion must now be set in such a manner, that the a.m. limits are met, still achieving further targets (e.g. emission).
Increasing the air quantity i.e. the turbine speed will lower the turbine intake temperature but it must be ensured that neither the max. permissible turbine speed nor the permissible cylinder pressure are exceeded.



Also in this application special importance is attached to AVL´s Turbo-Speed-Sensor TS350.

Technical specification of Turbo-Speed-Sensor:

The main advantage of the sensor is based in the principle of contactless measurement. The charger's housing or the wheel itself needn't be machined or dismounted. The special reflecting paint has to be applied to the wheel's nut by means of a brush. Mounting and adjustment of the sensor are done by means of eccentrics.



<u>Sensor TS350</u>	
Speed range	6.000 rpm ... 200.000 rpm, (100 Hz ... 3.300Hz)
Sensor material	stainless steel body with cable (1.5m)
Temperature range	operation: -10°C ... 70°C storage: -30°C ... 85°C

<u>Laserbeam</u>	
Wavelength	645nm (red, visible)
Output	0,9mW ± 0,1mW
Cross-section distance	elliptical, app. 3mm • 6mm in 100mm
<u>Input-/Output specification</u>	
Power supply	+5V ± 0.5%, app. 100mA (e.g. by TB350)
Signal range	0V ... +5V
Quiescent signal	+2,5V ±10%
<u>Trigger-Box TB350</u>	
Power supply	24V DC, app. 50mA (Selectable 5V DC, app. 100mA)
Digital Signal TTL	for counter, open collector, 5V, 1kOhm,
low:	≤ 50mA sink current for ≤ 0,4V
Analog Signal	for monitoring purposes: 0V ... +5V via 1kOhm series resistant
Dimensions	78mm • 40mm • 11.7mm provided for Snap-On mounting