CONSUMPTION MEASUREMENT

AVL FUEL BALANCE & FUEL TEMPERATURE CONTROL

Description

The combination of AVL Fuel Balance and AVL Fuel Temperature Control is a high precise fuel consumption measurement and conditioning system, which is used worldwide at almost all engine test beds where engines of a maximum consumption of 150 kg/h are tested.

The AVL Fuel Balance is mainly used where high measuring accuracies and gravimetric measurements are required. The built in calibration device enables calibration of the system under real test bed conditions.

The AVL Fuel Temperature Control is used for fuel temperature conditioning on engine and chassis dyno test beds in research, development and production. As a controlled cooling system it allows the user to set the fuel temperature anywhere within the range of 10 ... 80 °C.

This system is capable to condition fuel consumptions up to 150 kg/h with a typical temperature stability of better than 0.02 °C and thus guarantees highest measurement accuracy when determining the fuel consumption on modern combustion engines.

Reducing the fuel consumption of engines requires the measurement of increasingly small differences in fuel flow. The AVL Fuel Balance allows measuring these slight differences with maximum reliability.

The AVL Fuel Balance with AVL Fuel Temperature Control is based on the principle of gravimetric measurement. The amount of fuel consumption is determined directly by measuring the time related weight decrease of the measuring vessel by means of a capacitive sensor.

Convenient calibration and easy maintenance provide optimum ease of operation. With the FlexFuel option, up to 100% alcohol and biodiesel can be measured.

Function Summary

- Indication of fuel consumption in kg/h and g
- Measurement and indication of the actual fuel consumption at a measurement frequency of 10 Hz (measurement time 0.1 s)
- Average consumption for pre-selected measuring time or pre-selected measuring weight
- Total/interval consumption for determined measuring time
- Running average calculation with additional indication of standard deviation and min./max. values
- Selection of nominal fuel temperature – analogue or via RS232
- Indication of actual fuel temperature – analogue or via RS232
- Continuous evaluation of the temperature gradient in the measuring circle
- Output of warnings to avoid wrong measurements
- Gas bubble separation and monitoring
- Fully automatic built-in accuracy check and calibration
- Fast and efficient fuel change
- Indication of error and status report
- Service interval display
- Monitoring of cooling water supply

Application

The AVL Fuel Balance is used to measure the fuel consumption of engine- and chassis dyno test beds for transient and steady-state measurement where high accurate temperature control of the fuel is needed.

Benefits

- One sensor for the complete measurement range
- High fuel temperature stability
- Built-in accuracy check and calibration routine
- Measurement results absolutely comparable to the AVL Fuel Mass Flow Meter
- Direct mass determination of the fuel
- Eminently suitable for state-of-the-art high-pressure injection systems
- Not sensitive to pressure pulsations from the carburettor system
- Integrated bubble detector and separator

Technical Insight

The complete system consists of an AVL Fuel Balance and an AVL Fuel Temperature Control. The fuel consumption is determined using an appropriate weighing vessel linked by a bending beam to a capacitive displacement sensor.

The mass of fuel consumed is therefore determined gravimetrically, which means that the density does not have to be determined in addition.

The built-in calibration unit is standard scope of supply. It allows calibration and accuracy check according to ISO 9001 which helps to reduce downtimes.

Via the Fuel Temperature Control the fuel is conditioned and pumped to the by-pass near the engine by the fuel pump integrated in the conditioning system. It is cooled by a separate cooling water circuit.

The fuel can be temperature controlled by preselection within the range of 10 … 80 °C. The achievable fuel temperature, however, depends on the cooling water temperature or the amount of heat retained in the engine return fuel.

Because of the high temperature regulation accuracy of the Fuel Temperature Control it is achieved that the determination of the fuel consumption is within the specified accuracy of 0.12% also at low flow rates and short measurement times.

Continuous gas bubble separation ensures that the fuel supply to the engine is free of bubbles. The integrated bubble monitor outputs a warning when gas bubbles occur in the measurement system.

The engine feed pressure can be controlled up to 6 bar (rel.) (pressure control on request). Built-in service interval display of the AVL Fuel Temperature Control enables preventive maintenance which helps to reduce and plan downtimes.

Technical Data

Recommended measuring range:	0 ... 150 kg/h (wider ranges up to 240 kg/h on request)
Vessel capacity:	1800 g can be switched to 900 g/ 450 g/ 225 g
Systematic measurement uncertainty:	U_s = 0.12 %
Maximum measurement frequency:	10 Hz
No. of measurements (running average):	1 ... 99
Ambient temperature:	5 ... 50 °C
Fuel temperature:	-10 ... +70 °C
Fuel supply pressure to the system:	0.1 ... 0.8 bar
Fuel supply flow:	max. consumption + 100 kg/h
Fuel circulation capacity at 50Hz:	standard 240 l/h, optional 450 l/h
Fuels:	Otto (EN228), Diesel (EN590), up to 6% Biodiesel (EN14214) and 20% alcohol With FlexFuel option: up to 100% alcohol and biodiesel
Pressure control (option):	feed pressure: ~0 ... 6 bar (rel.) turn pressure: ~0 ... 0.5 bar (rel.) special ranges available on request
Temperature control range:	adjustable from appr.10 °C* ... 80 °C** * depending on cooling water temperature ** depending on heat return flow of the engine and fuel properties – gas bubble formation has to be avoided
Temperature stability:	better than 0.02 °C
Heating power (option):	1.6 kW
Cooling power:	1.6 kW at 10 °C spread and 0.5 bar cooling water differential pressure
Interfaces AVL 733S:	RS232 (AK compliant) or 733/730 protocol Analog 0 ... 10 V (optional) Digital I/0 (optional)
Interfaces AVL 753C:	2x RS232 (AK compliant) Analog 0 ... 10 V (optional) Digital I/0 (optional)
Power supply:	230 V, 50 Hz 220 V, 60 Hz (option) 100 V, 50-60 Hz (option) 115 V, 60 Hz (option)
Power consumption:	2.25 kW
Dimensions:	770 x 1350 x 345 mm (W x H x D)
Weight (dry):	135 kg

Compatibility

The system of AVL Fuel Balance and AVL Fuel Temperature Control with integrated heating can be combined with the following systems:

- AVL Fuel Filling Pump Module
- AVL Feed Pressure Control Module PR1
- AVL Feed and Return Pressure Control Module PR3PR1
- AVL Return Pressure Control Module PR3

Scope of Supply

Each consisting of:

- AVL Fuel Balance
- Connecting cables
- Operating instructions
- PC-Software

Options/Extensions

- Safety shut off valve
- Electrical control unit 7330.05
- Analogue Interface (Fuel Balance)
- Instrument Controller
- FlexFuel
- Heating
- Trolley
- System flow rate 450 l/h
- Filling pump module
- Fuel filter fine and coarse
- Flame filter
- Engine feed and return pressure controls
- Pressure regulator for fuel supply
- Pressurizing module
- By-pass valve
- Upgrade to AVL Continous Fuel Balance