



## FUEL CONSUMPTION MEASUREMENT

# AVL FUEL MASS FLOW METER & FUEL TEMPERATURE CONTROL

### Description

The combination of AVL Fuel Mass Flow Meter and AVL Fuel Temperature Control is a high precise and continuous fuel consumption measurement and conditioning system, which is used worldwide at almost all engine test beds where engines of a maximum consumption of 125 kg/h are tested. The system stands out for high accuracy and excellent temperature stability.

The system stands out for a very high accuracy and because of the modular design it can be combined with existing conditioning systems.

The fuel measurement system AVL Fuel Mass Flow Meter together with AVL Fuel Temperature Control enables a high precise fuel consumption measurement also at low flow rates and short measurement times.

With a high accuracy mass flow sensor the fuel consumption is determined continuously and via direct mass flow measurement in kg/h. The density does not have to be determined in addition to the direct determination of the gravimetric or specific fuel consumption like in volumetric measurement methods.

The fuel consumption can thus be determined to an accuracy of 0.12% for the whole system under real test bed conditions.

With the FlexFuel version, up to 100% alcohol and biodiesel can be measured.



## Function Summary

- Indication of fuel consumption in kg/h, l/h, l/h (API)
- Indication of fuel density in g/cm<sup>3</sup>
- Measurement and indication of the actual fuel consumption at a measurement frequency of max. 20 Hz
- 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 measurement uncertainty
- 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
- Full automatic accuracy check and calibration with option: calibration unit
- Fast and efficient fuel change
- Indication of error and status report
- Service interval display
- Monitoring of cooling water supply
- Automatic fuel venting

## Application

The fuel system AVL Fuel Mass Flow Meter enables high precise, temperature controlled, continuous mass-flow measurements also at low flow rates and short measurement times.

## Benefits

- Measurement accuracy of 0.12% through direct mass flow measurement and highest temperature stability of the fuel conditioning system
- Open continuous measurement system (no additional pressure increase in the measurement circuit e.g. due to temperature changes, ...)
- Rapid measurements even at the lowest levels of consumption
- The highest level of reliability and universal suitability to the requirements of modern measurement methods and injection systems
- From a single cylinder through to a 600 kW large engine with one sensor and measuring unit
- Built-in accuracy check and calibration according to ISO 9001 with option: calibration unit



## Technical Insight

The complete system consists of an AVL Fuel Mass Flow Meter and an AVL Fuel Temperature Control.

The measurement system stands out for simple installation at all gasoline or diesel injection systems and is therefore universally applicable. This is achieved through the use of a specially developed pressure control system that makes vehicle-like conditions possible on the test bed.

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The measurement range from 0 to 125 kg/h covers all engine types from a single cylinder through a 600 kW large engine with one sensor and measurement system.

The high dynamic AVL Fuel Mass Flow Meter has a calibration interval of minimum three years and is therefore designed to provide a permanent availability for the test bed. In addition it features a built-in accuracy check and calibration (see option calibration unit) according to ISO 9001 which can be performed at any time during running engine and with the original fuel.

The AVL Fuel Temperature Control with its high accurate and stable temperature regulation is an unchallenged market leader in the field of fuel conditioning systems.

The fuel temperature can be pre-selected 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.

The high precise temperature control provides a constant pre-set fuel temperature at the engine and guarantees the high measurement accuracy of the whole test system.

Continuous gas bubble separation ensures that the fuel supply to the engine is free of bubbles. The integrated 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 displays enable preventive maintenance which helps to reduce and plan downtimes.



## Technical Data

Recommended measuring range:	0 ... 125 kg/h, 0 ... 165 l/h (at 0.75 g/cm <sup>3</sup> )
Systematic measurement uncertainty:	Us = 0.12%
Density measurement uncertainty:	≤ 0.0005 g/cm <sup>3</sup>
Step response according to ISO16183:	T10 ... T90 < 125 ms
Maximal measuring frequency:	20 Hz (analogue output)
No. of measurements (running average):	1 ... 99
Ambient temperature:	5 ... 50 °C
Fuel supply pressure:	0.1 ... 0.8 bar
Fuel supply flow:	max. consumption + 20 kg/h
Fuel supply temperature:	-10 ... +40 °C
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% alkohol With FlexFuel option: up to 100% alkohol and biodiesel
Pressure control (option):	feed pressure: ~0 ... 4 bar (rel.) return pressure: ~0 ... 0.5 bar (rel.) special ranges available on request
Cooling power:	1.6 kW at 10 °C spread and 0.5 bar cooling water differential pressure
Heating power (optional):	1.6 kW
Temperature control range:	adjustable from appr.10 °C* ... 80 °C** * depending on cooling water temperature ** depending on heat return flow of the engine
Option special temperature ranges:	-8 °C ... 70 °C -30 °C ... 80 °C
Temperature stability:	better 0.02 K
Electrical interfaces:	2x RS232 (AK protocol) analog 0 ... 10 V digital I/O
Power supply:	230 V, 50 Hz 220 V, 60 Hz (option) 100 V, 50-60 Hz (option) 115 V, 60 Hz (option)
Power consumption (with heating option):	2.25 kW
Dimensions:	770 x 1630 x 345 mm (W x H x D)
Weight (dry):	165 kg



### **Compatibility**

The AVL Fuel Mass Flow Meter and AVL Temperature Control 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:

- 1x AVL Fuel Mass Flow Meter
- 1x AVL Fuel Temperature Control with integrated heating
- 1x Set connecting cables 15m
- 2x Connecting hoses
- 1x Set operating manuals
- 1x PC Software
- 1x Documentation CD

Note: Cable for power supply is not included in scope of supply



### Options/Extensions

- AVL Instrument Controller for remote display and operation of the AVL Fuel Mass Flow Meter
- Filling pump module for quick refilling of the measurement system
- Version FlexFuel: methanol / ethanol and biodiesel up to 100%
- Heating
- Calibration unit
- Increased cooling power
- Trolley for Fuel Meter and Temperature Control
- System flow rate 450l/h
- Return temperature control
- Shut-off-valve
- Fuel filter: coarse and fine
- Flame Filter
- PUMA Task Installer