

CONSUMPTION MEASUREMENT TECHNOLOGIES

AVL PLU 131U FLOW METER

AVL PLU131 UREA FLOW MEASUREMENT SENSORS

Function Summary

The AVL PLU 131U-020 Flow Sensor has been designed for transient flow rate measurement of aqueous urea solutions in measuring ranges of up to 40l/h momentary flow rate, up to 10bar media pressure and up to 60 °C media temperature.

Main applications are SCR dosing system testing on component test benches and urea consumption measurement on engine test beds or in vehicles, where accurate total consumption as well as precise momentary flow measurement are required.

Functional Description

The PLU 131U flow sensor features a unique dynamic flow measurement capability which is required for successful urea dosing strategy development and for actual AdBlue® dosing quantity monitoring in SCR system application in Diesel engine exhaust aftertreatment.

The PLU measurement principle allows for sensor operation on the inlet or pressurized side of the dosing module without interference ($\Delta p=0$) with the SCR system under investigation.

As part of the AVL PLUrea™ Urea Consumption Measurement System the PLU 131U provides for accurate flow rate measurement of pulsating urea flow under stationary conditions as well as during highly transient emission test cycles. The PLU sensor dual measuring principle provides fast momentary flow rate measurement as well as a precise cumulative injection quantity over long measuring periods.

Within the AVL PLUrea™ Consumption Measurement System the PLU 131U flow sensor offers optimized conditions for stand-alone functionality and comfortable, efficient use in SCR engine application.

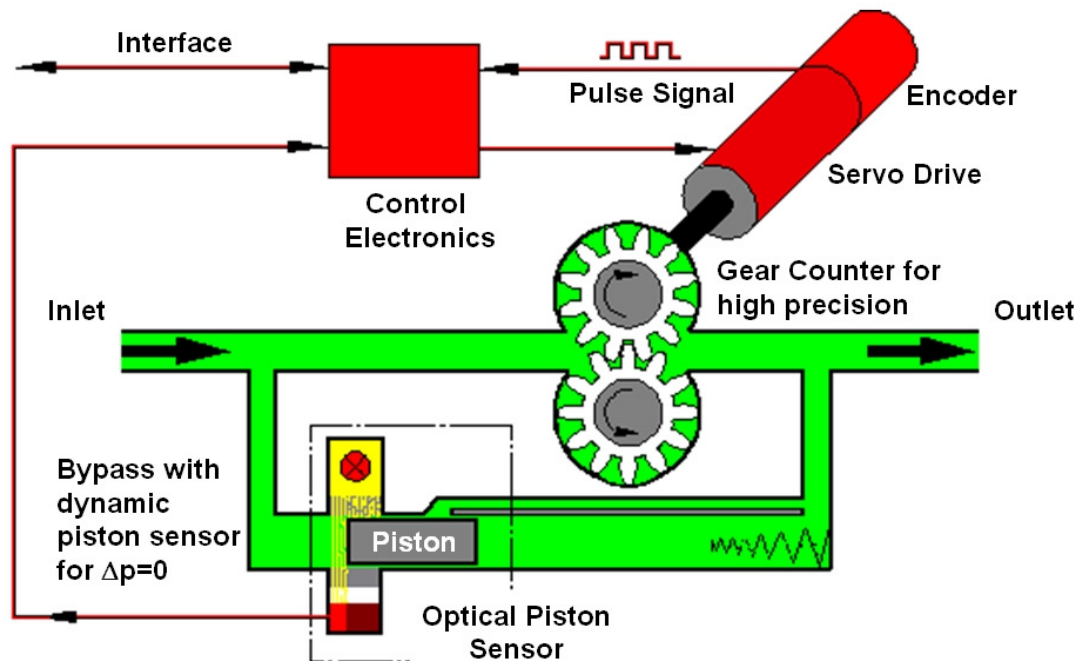
The PLU positive displacement measurement principle combines a servo-controlled gear counter with a highly sensitive dynamic piston sensor. A high-precision gear meter driven by a servo motor with encoder defines a geometric volume to pulse frequency relation when the gear rotation is properly adjusted to external flow.

Correct adjustment will cancel out pressure difference between inlet and outlet ($\Delta P=0$) and thereby avoid leakage alongside the gears.

In a bypass to the gear counter a piston with a density similar to the liquid (no friction) immediately reacts to flow changes with displacement in either direction. This maintains zero pressure difference between inlet and outlet. An optical sensor detecting the piston position provides a fast feedback signal to the servo drive controller keeping the piston in nominal position by adjusting gear speed.

This concept provides an extremely reliable and robust flow sensor calibration in a very large measuring range.

PLU Principle: Servo-controlled displacement meter ($\Delta p=0$)



Application

Efficient NO_x reduction with an SCR system requires accurate urea dosing strategy development. An individual dosing calibration is required for each specific engine and catalyst combination. Successful emissions compliance testing requires the highest NO_x conversion ratios while avoiding ammonia slip.

The reducing agent AdBlue® must be dosed in exact amounts in all relevant operational engine states (load / speed engine map). Online urea flow is an important parameter to be measured on an engine test bed. Accurate results are required under stationary conditions as well as during highly dynamic test cycles with transient flow rates. Extremely low urea flow rates, about 10g/h, must be measured under pulsating pressure conditions. Minimizing temperature influence requires accurate urea consumption measurement in close vicinity to the



injector. The unique PLU measuring principle is ideally applicable to this condition with pressure pulsation caused by the low frequency urea injection.

Benefits

- Efficient dosing strategy development due to precise flow rate measurement under stationary as well as highly dynamic conditions.
- High flexibility due to pulsating urea flow compatibility and extremely large measuring ranges
- Reliable results with upstream measurement (high-pressure side) and non-interference between meter and dosing system ($\Delta p=0$)
- Fast detection of dosing deviations or SCR system malfunction and exact identification of corresponding operational conditions

Component Description

Available models of AVL PLU 131U Flow Meter:

Description	Flow Range Specification	Part number
AVL PLU131U-010	0.05 ... 10 l/h	TN131U010.01
AVL PLU131U-020	0.05 ... 20 l/h	TN131U020.01
AVL PLU131U-040	0.1 ... 40 l/h	TN131U040.01

Technical Data

Measurement parameters:	Momentary flow rate	
	Total consumption, gravimetric data, statistical data, pressure temperature	in combination with AVL PLUrea Measuring Cart
Flow measurement ranges:	Type -010: 0.05...10l/h	Specified calibration ranges
	Type -020: 0.05...20l/h	
	Type -040: 0.1...40l/h	
Measurement resolution:	Type -010: 0.021mm ³	48.000pulses/cm ³
	Type -020: 0.042mm ³	23.800pulses/cm ³
	Type -040: 0.078mm ³	12.900pulses/cm ³
Measurement uncertainty: *)	0.2%	For sensor calibration factors of average flow rates
Total measurement uncertainty: **)	0.3%	For total consumption of 3g to 3kg over dynamic cycle
Dynamic response time:	<100ms	Acc. to ISO 16183 (T ₁₀ ... T ₉₀)
Operating temperature:	Media: +10...+60 °C	Condensation to be avoided with media temperatures below
	Environment: +10...+60 °C	



		environment temperature
Operating pressure:	P-type 10: 0.01...10 bar	
Media:	Aqueous urea solution acc. to ISO22241 2008/9 (AdBlue®) ***, water with 1% Prevox 7400 content	
Media density:	0.99...1.19 g/cm ³	Further density ranges on request
Interface:	Frequency output (max. 150kHz)	Differential pulse signals according to RS485 standard
Supply voltage:	24 V DC +20%/-10%	
Power consumption:	40 Watt	
Dimensions:	330mm x 216mm x 133mm (W x D x H)	Permitted mounting angle variation: max. 3°
Weight:	16kg	
Safety:	CE	
Calibration:	Traceable to National Institute of Metrology (PTB)	

*) Measurement uncertainty of flow meter calibration factors within nominal measuring range under repeatable conditions with medium HAKU at 20 °C and 1 bar pressure.

**) Dynamic test cycle extracted from typical transient emission test cycles in optimized SCR system test setup.

***) AdBlue® is a trade mark of VDA (Verband der Automobilindustrie) for the official designation Urea AUS 32 according to ISO22241 2008/9

Compatibility

Specific measuring ranges, temperature ranges and pressure ranges etc. upon request. For application specific system option selection please use appropriate configuration guide.

Scope of Supply

Each consisting of:

- 1 AVL PLUrea™ Flow Sensor PLU 131U
- 1 AVL PLUrea™ Manual CD
- 1 Calibration report PLU131U

Options/Extensions

Available options for AVL PLU 131U:

Description	Specification	Part number
AVL PLUrea™ Measuring Cart	Mobile cart including data acquisition and control electronics with automated system filling and air purge functions, communication interface, PUMA driver, service software, etc.	TNPLUREAMC.01
AVL PLUrea™ Density	Density sensor for gravimetric flow measurement	TNPLUREADM.01



Meter	data	
AVL PLUrea™ Back Flow System	Compact media conditioning module for single sensor urea consumption measurement on SCR systems with urea back flow	TNPLUREABF.01
AVL PLUrea Adaptation NW1/4"-6mm; 0.5m	Flexible, inelastic adaptation hose for SCR systems with NW1/4" quick coupling; Length 0.5m	TNPLADPC05.01
AVL PLUrea Adaptation NW1/4"-6mm; 2m	Flexible, inelastic adaptation hose for SCR systems with NW1/4" quick coupling; Length 2m	TNPLADPC20.01
AVL PLUrea Adaptation NW5/16"-6mm; 0.5m	Flexible, inelastic adaptation hose for SCR systems with NW5/16" quick coupling; Length 0.5m	TNPLADH605.01
AVL PLUrea Adaptation NW5/16"-6mm; 2m	Flexible, inelastic adaptation hose for SCR systems with NW5/16" quick coupling; Length 2m	TNPLADH620.01
AVL PLUrea Adaption HD Ext. 6-6mm; 4m	Flexible, inelastic hose extension HD with 6mm standard fitting; Length 4m	TNPLADHE40.01
AVL PLUrea Adaptation NW3/8"-8mm; 0.5m	Flexible, inelastic adaptation hose for SCR systems with NW3/8" quick coupling; Length 0.5m	TNPLADH805.01
AVL PLUrea Adaptation NW3/8"-8mm; 2m	Flexible, inelastic adaptation hose for SCR systems with NW3/8" quick coupling; Length 2m	TNPLADH820.01
AVL PLUrea Adaption PC Ext. 6-6mm; 4m	Flexible, inelastic hose extension PC with 6mm standard fitting; Length 4m	TNPLADPE40.01

Available AVL system integration support:

AVL PLUrea™ system integration support	Customer specific system integration support for urea flow measurement applications on specific dosing systems.	TNPLUREAAP.01
--	---	---------------