



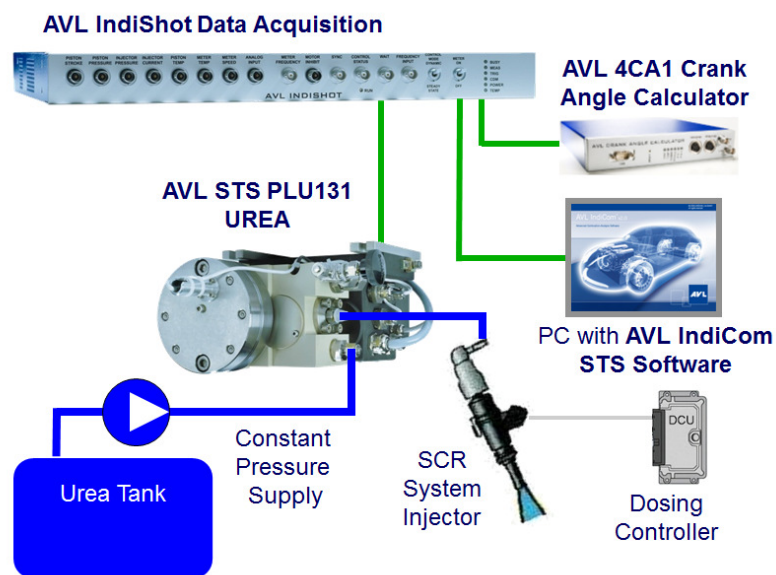
UREA INJECTION TESTING

AVL SHOT TO SHOT™ PLU 131 UREA FLOW MEASURING SYSTEM

Function Summary

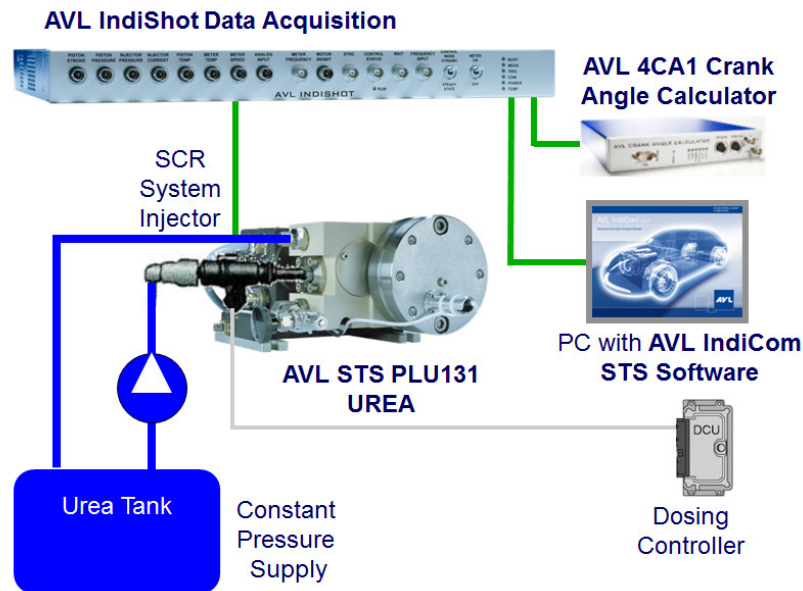
The AVL Shot To Shot™ (STS) PLU 131 UREA flow measuring system is based on the well-proven PLU 131 flow metering technology originally introduced for the purpose of dynamic flow measurement in the field of fuel injector calibration and the AVL Indicating technology.

The AVL Indicating product family provides a series of leading high-speed data acquisition systems for combustion analysis. The AVL IndiShot with AVL IndiCom STS software has been optimized for the Shot To Shot™ PLU 131 UREA flow measuring System.



Schematics of STS System setup in Upstream configuration

The AVL Shot To Shot™ PLU 131 UREA flow measuring system stands for high-resolution UREA injection rate analysis and accurate injection quantity measurement on the injector inlet side (upstream) or injection outlet side (downstream). With quantitative analysis down to extremely small injection volumes under realistic operating conditions it is best suited for characterization of SCR injectors and injection systems (SCR = selective catalytic reduction).



Schematics of STS System setup Downstream configuration

Functional Description

The AVL Shot To Shot™ PLU 131 UREA Flow Measuring System is used primarily for dynamic flow measurement in SCR injector and injection system development and production. Typical applications are component test benches for UREA injector characterization.

The sensor's dual measuring principle, a combination of a translational and a rotational displacement flow sensor, enables a simultaneous high-speed / high resolution dynamic flow rate recording and precise volumetric shot measurement. The STS PLU131 Flow Sensor also includes pressure, temperature and current transducers for comprehensive data analysis leading to flow rate (l/h), shot volume (mm³), injection rate, injector current, injector opening and closing delays, relevant pressure and temperature data.

Shot to Shot™ Flow Sensor application in UPSTREAM configuration on the high-pressure injector side offers the unique capability of SCR injection characterization under realistic operating conditions. This is the favorite setup in development and series production testing applications. Several standard flow sensors models have been optimized for upstream configuration.

Shot to Shot™ Flow Sensor application in DOWNSTREAM configuration on the low-pressure injector side is available for specific tasks like injection rate analysis or testing of unit injector type SCR dosing modules. Currently one flow meter model is available for downstream application.

In both configurations a preferably short tube connection with minimized volume between PLU sensor and UREA injector allows for precise measuring results down to very small shot volumes.

The AVL IndiShot™ enables high-speed data acquisition. The AVL IndiCom™ STS software package has been tailored to the UREA injection analysis requirements. It assists the user in the parameterisation of the measurement, in the fast and direct data acquisition and data evaluation, with minimum training efforts. For detailed and convenient offline data analysis the post processing software IndiCom-Offline is recommended as an option. The data format is compatible to the AVL



data post processing software CONCERTO-I or Top-CONCERTO.

The sum of these features makes the AVL Shot To Shot™ PLU 131 UREA Flow Measuring System an indispensable instrument for a variety of applications ranging from UREA injector and spray characterization to injection system validation to quality check in series production.

Benefits

- Relevant results: Injection quantity measurement on low pressure injectors on the inlet side of injector (upstream) under realistic operating conditions.
- Valid results: No interference with injection system performance due to PLU principle ($\Delta p = 0$).
- Development safety: High level of measurement accuracy over a large measurement range with one single instrument.

Component Description

AVL Shot To Shot™ PLU 131 UREA Flow Measuring System for UREA test bench setup consists of a Shot to Shot™ Flow Sensor, an IndiShot™ Data Acquisition System with dedicated IndiCom™ STS Software inside:

Description	Specification	Part number
UPSTREAM configuration		
AVL Shot to Shot™ PLU131-10-10-10-F-AD	Flow Measuring Range: 0.01 ... 10 l/h Single Shot Volume Range: 0.1 ... 200 mm³ Operating Pressure: 0.01 ... 10 bar	TNS310F10A.01
AVL Shot to Shot™ PLU131-10-10-17-F-AD	Flow Measuring Range: 0.01 ... 10 l/h Single Shot Volume: 0.3 ... 600 mm³ Operating Pressure: 0.01 ... 10 bar	TNS310F17A.01
AVL Shot to Shot™ PLU131-20-10-17-F-AD	Flow Measuring Range: 0.02 ... 20 l/h Single Shot Volume Range: 0.3 ... 600 mm³ Operating Pressure: 0.01 ... 10 bar	TNS320F17A.01
DOWNSTREAM configuration		
AVL Shot to Shot™ PLU131-10-10-17-A-AD	Flow Measuring Range: 0.01 ... 10 l/h Single Shot Volume Range: 0.3 ... 600 mm³ Operating Pressure: 0.01 ... 10 bar	TNS310A17A.01
AVL IndiShot™ Data Acquisition System	(IndiCom STS software included)	TNSINDSW.01

Available AVL system integration support:

STS commissioning	TNSCOMM.01
STS system integration / initial application	TNSAPPL.01



Technical Insight

Measurement ranges:	Q-type 10: 0.01 ... 10 l/h Q-type 20: 0.02 ... 20 l/h	Nominal mean flow rates (Other ranges upon request)
	D-type 10: 0.1 ... 200 mm ³ D-type 17: 0.3 ... 600 mm ³	Nominal single shot volume range
Flow meter density range:	0.99 ... 1.19 g/cm ³	Further density ranges on request
Measuring uncertainty:	0.1%	For calibration factors of mean flow rates *
Total measuring uncertainty: **	1%	For mean shot quantities above 10 mm ³ at 4Hz injection rate
	2%	For mean shot quantities at 3 mm ³ at 4Hz injection rate
Cycle rate:	1...10 Hz max.	Higher cycle rates up to 150Hz on request
Operating Temperature:	Media: +10 ... +60 °C Environment: +10 ... +60 °C	Extended temperature range on request
Measurement parameters:	Mean flow rate (l/h), shot volume (mm ³), injection specific parameters (injection rate, injector current, injector opening and closing delays, relevant pressure and temperature).	
Measurement configuration:	Upstream or Downstream calibration according to measurement configuration.	
Operating pressure range:	0.01 ... 10 bar	Extended pressure range on request
Injected Media:	UREA (aqueous urea solution according DINV70070 / AdBlue [®])***, de-ionized water with minimum 1% Prevox content ****	
Safety:	CE	
Calibration:	Traceable to National Institute of Metrology (PTB)	

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

** Total measuring uncertainty according to GUM (*Guide to the Expression of Uncertainty in Measurement*) for an optimized injection system.

*** AdBlue[®] is a trade mark of VDA (Verband der Automobilindustrie) for the official designation Urea AUS 32 according to DIN70070

**** P3-Prevox 7400

Compatibility

Shot To Shot[™] Flow Sensor is also compatible to AVL IndiAdvanced, IndiModul, IndiSet and IndiMaster Data Acquisition Systems with appropriate licensed IndiCom[™] STS Software version.

Options/Extensions

Data recording timing signal generator for IndiAdvanced data acquisition systems:



AVL 4CA1 Crank Angle Calculator		TI04CA1A.01
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External Pressure Sensor and Runtime Tube for optimized pressure pulsation compensation:

STS Pressure Sensor Injector 20bar extern		TNSPSEN20.01
STS Runtime Tube		TNSRUNTI18.01

Additional calibration of inverse flow direction for upstream configuration available on request.