



## Air flow measurement Ultrasonic

Measurement of air speed and direction  
to control the tunnel ventilation

## Features

- Precise ultrasonic air flow measuring system based on different transition times of ultrasonic pulses
- Measurement of average air-flow over the whole tunnel cross section
- Sensor setup via service interface
- Suitable for tunnel cross sections up to 18 m (Measuring path up to 25 m)
- Connection to tunnel control system either via analogue output and relays or via RS-485 MODBUS RTU
- Visible LEDs to indicate sensor status
- Optional, remote touch operation unit to display measured values and to modify parameters

## System setup

- Two sensors (master & slave) with mounting clamps mounted below the tunnel ceiling in an angle of 30° to 60° to the tunnel axis
- Terminal box for master to connect the power supply and the connections to the tunnel control system and the slave
- Terminal box for Slave
- Optional remote touch operation unit

## Operation

The air flow monitoring system measures the air flow based on different transition times of ultrasonic pulses sent in one or the other direction. This cross section measurement delivers the average air speed more reliable and meaningful than methods that measure only one or two points on the tunnel wall.

Two sensors are mounted below the tunnel ceiling, cross section with an angle of 30° to 60° (usually 45°) such that a vector component of the air flow overlaps the direction of the ultrasonic sound pulses exchanged by the two sensors.

Air flow in the tunnel influences the transition time of the pulses between sender and receiver. Based on the difference in transition times of ultrasonic pulses sent in one or the other direction the measured values are calculated.

Measured values are air speed, air flow rate, direction of air flow and air temperature.

## Advantages

- Specifically developed for application in tunnels
- No control unit required
- Easy configuration
- Corrosion resistant against aggressive tunnel atmosphere
- Sensors can be replaced quickly with no tools and no realignment required
- Minimised spare requirements
- Extremely low maintenance requirements

## Application

Tunnels are important infrastructure elements in road networks and facilitate the connection of regions.

Environmental conditions in tunnels are influenced by fog, particles and emissions and need to be monitored to protect people on their passage through the tunnel from danger and impacts on their health. Accidents in tunnels, and particularly fires, can have dramatic consequences and can prove extremely costly in terms of human life, increased congestion, pollution and repair costs.

At every time people in the tunnel need to be supplied with breathable air and sufficient visibility.

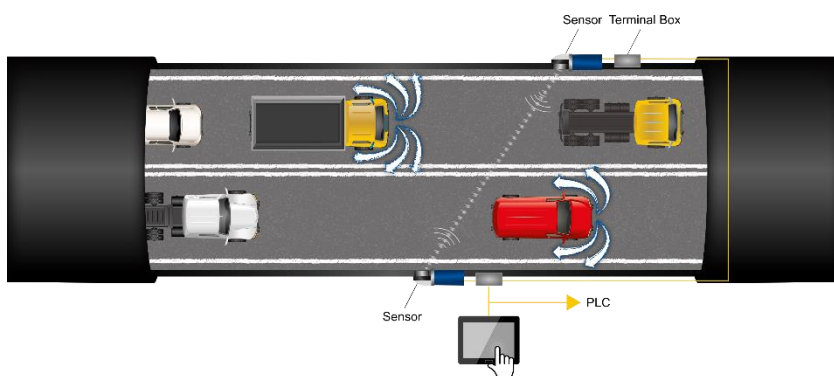
Since 1990 JES Elektrotechnik GmbH develops, installs and maintains systems to monitor air quality and lighting conditions in tunnels. Our systems are robust, durable and resistant against the corrosive atmosphere in a tunnel. They operate reliably and have a high accuracy in measurement.

All systems fulfil the requirements of the EC guideline 2004/54/EC (Minimum safety requirements for tunnels in the trans-European road network) and the more precise national guidelines and provisions:

- Austria: RVS 09.02 Tunnelausrüstung
- Germany: RABT Richtlinien für die Ausstattung und den Betrieb von Straßentunneln
- Switzerland: ASTRA Richtlinien und Fachhandbuch Betriebs- und Sicherheitsausrüstungen (BSA)

Our range of products for tunnel covers systems for monitoring of

- Toxic gases like CO, NO, NO<sub>2</sub> (extractive or in-situ)
- Visibility (extractive or in-situ)
- Air speed, direction and temperature
- Luminance (access, threshold and interior zone)
- Illuminance



System setup in the tunnel

## Technical Data

Air flow measurement	
Measuring method	Determination of direction dependant differential transition times of ultrasonic pulses
Measured values	Air speed Air flow rate Direction of air flow Air temperature
Measuring range	-40 to 40 m/s
Resolution	0.1 m/s, accuracy dependent upon measuring distance, flow profile, installation, typically $\leq \pm 0.2$ m/s at 3 m/s
Response time	> 1s ... 180 s, configurable
Measuring distance	1.2 - 25 m
Alignment	30 - 60° to tunnel longitudinal axis, typically 45°

Outputs	
Analogue outputs	1 x 4-20 mA, 400 $\Omega$ , isolated can be assigned any measured value and output range
Output range	configurable, typically: -20 to 20 m/s
Relay contacts	1 x fault indication (NC) 1 x direction of air flow (NC) Max. 48 V / 0,5 A
Digital interface	1x RS 485 MODBUS RTU to control system, bidirectional 1x Intercom RS 485 master-slave

Sensor	
Model	JES t/FL-US (ex DURAG D-FL 220T M)
Operating voltage	24 VDC $\pm$ 10 %
Current consumption	approx. 1 A
Service interface	USB 1.1
Temperature range	-40 to 70°C
Relative humidity	0 to 100 %
MTBF	> 170.000 h within service life if used within specifications
IP rating	IP 67
Dimensions	270 x 130 x 95 mm
Weight	Sensor approx. 2.2 kg/pcs + wall bracket 1.6 kg
Material	Stainless steel 1.4571 (AISI 316Ti), Polyamide RAL5017, Flammability rating: B1 (UL 94 V0)



Terminal Box	
Model	t/FL-US-TB-SS-A or t/FL-US-TB-SS-B
Operating voltage	90 to 264 VAC, 48 to 62 Hz
Power consumption	approx. 30 VA (for master, for slave only optionally)
IP rating	IP 69K
Dimensions / Weight	160 x 250 x 110 mm (Master) / 3.2 kg 160 x 160 x 110 mm (Slave) / 1.9 kg
Material	Stainless steel 1.4404 (AISI 316L)
Mounting	incl. mounting clamp made from stainless steel 1.4404 for wall mounting



Conformities	
Electrical standards	2014/35/EU Low voltage directive (LVD) 2014/30/EU Electromagnetic compatibility (EMC) IEC 61326-1:2012 IEC 61010-1:2010
Tunnel safety standards	AT: RVS 09.02.22 2010 & ASFINAG PlaPB DE: RABT 2006 CH: ASTRA RL 13001 & FHB BSA

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