

# JES t/FL-USX Air Flow Monitoring System

## 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 smart/HUB touch operation unit to display measured values and to modify parameters

## System setup

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• 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 smart/HUB touch operating unit

## Operation

The air flow monitoring system measures the air flow based on different transmission times of ultrasonic pulses sent in one or the other direction. This cross section measurement delivers the average air speed more reliable and mean-ingful 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 be-tween 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.

## Advantanges

• 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 re-alignment 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 characteristics 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 detailed 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
• Visibility (extractive or in-situ)
• Toxic gases like CO, NO, NO2 (extractive or in-situ)
• Air velocity, direction and temperature
• Luminance (access, threshold and interior zone)
• Illuminance

# Technical Specifications

| Air flow measurement | |
|---|---|
| Type | JES t/FL-USX |
| Measuring method | Determination of direction dependant differential transi-tion times of ultrasonic pulses |
| Measured values | Air speed<br>Air flow rate<br>Direction of air flow<br>Air temperature |
| Measuring range | -40 .. 40 m/s |
| Resolution | 0.1 m/s, accuracy depending on measuring distance, flow profile, installation, typically <±0.2 m/s at 3 m/s |
| Response time | > 1s ... 180 s, configurable |
| Measurement path length | 1.2 - 25 m |
| Alignment | 30 - 60° to tunnel longitudinal axis, typically 45° |

| Outputs | |
|---|---|
| Analogue output | 1 x 4-20 mA, 400 Ω, isolated<br>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)<br>1 x direction of air flow (NC)<br>(max. 48 V / 0.5 A) |
| Digital interfaces | 1x RS 485 MODBUS RTU to control system, bidirectional<br>1x Intercom RS 485 master-slave |

## Ultrasonic transceiver (sensor)

| Sensor | |
|---|---|
| Type | DURAG D-FL 220T M |
| Operating voltage | 24 VDC ± 10 % |
| Current consumption | 1 A |
| Appliance class | Class III |
| Service interface | USB 1.1 |
| MTBF | > 170.000 h within service life if used within specifications |
| Material | Sensor housing: Polyamide RAL5017,<br>Flammability rating: B1 (UL 94 V0)<br>Wall bracket: Stainless steel 1.4404 (AISI 316L) or 1.4571 (AISI 316Ti) |
| IP rating | IP 69 |
| Dimensions | 270 x 130 x 95 mm |
| Weight | Sensor 2.2 kg<br>Wall bracket 1.6 kg |
| Indoor/Outdoor use | Indoor use (tunnel) |
| Altitude | up to 2,000 m |
| Temperature range | -40 .. +70 °C |
| Humidity range | 0 .. 100% relative humidity (non-condensing) |
| Pollution degree | 4 (intended environment) |

## t/FL-USX-TBX terminal boxes

| Terminal box A - JES t/FL-USX-TBX-A | |
|---|---|
| Type | t/FL-USX-TBX-A |
| System cable port | 1 (for D-FL 220 T M Sensor A) |
| Power supply | 100 to 240 VAC, 50/60 Hz |
| Supply voltage fluctuations | ± 10 % |
| Overvoltage category | II |
| Power rating | 60 W |
| Appliance class | Class I |
| Material | Stainless steel 1.4404 (AISI 316L) |
| Mounting | incl. mounting clamp made from Stainless steel 1.4404 for wall mounting |
| IP rating | IP 69 |
| Dimensions | 250 x 160 x 110 mm |
| Weight | approx. 3.2 kg |
| Indoor/Outdoor use | Indoor use (tunnel) |
| Altitude | up to 2,000 m |
| Temperature range | -40 .. +60 °C |
| Humidity range | 0 .. 100% relative humidity (non-condensing) |
| Pollution degree | 4 (intended environment) / 2 (when cover removed) |

| Terminal box B - t/FL-USX-TBX-B | |
|---|---|
| Type | t/FL-USX-TBX-B |
| System cable port | 1 (for D-FL 220 T M Sensor B) |
| Power supply | 24 VDC ±10 % |
| Current rating | 1 A |
| Appliance class | Class III |
| Material | Stainless steel 1.4404 (AISI 316L) |
| Mounting | incl. mounting clamp made from Stainless steel 1.4404 for wall mounting |
| IP rating | IP 69 |
| Dimensions | 160 x 160 x 110 mm |
| Weight | approx. 1.9 kg |
| Indoor/Outdoor use | Indoor use (tunnel) |
| Temperature range | -40 .. +60 °C |
| Humidity range | 0 .. 100% relative humidity (non-condensing) |
| Pollution degree | 4 (intended environment) / 2 (when cover removed) |

## smart/BOX-S-FL-USX gateway (instead of t/FL-USX-TBX-A for Ethernet connection)

| smart/Architecture gateway for t/FL-USX - smart/BOX-S-FL-USX | |
|---|---|
| Type | smart/BOX-S-FL-USX |
| System cable port | 1 (for D-FL 220 T M sensor) |
| Power supply | 100 to 240 VAC, 50/60 Hz |
| Supply voltage fluctuations | ± 10 % |
| Overvoltage category | II |
| Power rating | 60 W |
| Appliance class | Class I |
| Digital interfaces | MODBUS RTU (RS-485)<br>MODBUS/TCP (Ethernet)<br>Webserver for configuration (Ethernet) |
| Material | Stainless steel 1.4404 (AISI 316L) |
| Mounting | incl. mounting clamp made from Stainless steel 1.4404 for wall mounting |
| IP rating | IP 69 |
| Dimensions | 250 x 160 x 110 mm |
| Weight | approx. 3.2 kg |
| Indoor/Outdoor use | Indoor use (tunnel) |
| Altitude | up to 2,000 m |
| Temperature range | -40 .. +60 °C |
| Humidity range | 0 .. 100% relative humidity (non-condensing) |
| Pollution degree | 4 (intended environment) / 2 (when cover removed) |

## Conformities

| Conformities | |
|---|---|
| Markings | |
| Electrical standards | 2014/35/EU Low Voltage Directive (LVD)<br>2014/30/EU Electromagnetic compatibility (EMC)<br>EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use<br>EN 61326-1 Electrical equipment for measurement, control and laboratory use - EMC requirements |
| Tunnel safety standards | Austria: RVS 09.02.22<br>Germany: RABT 2006<br>Switzerland: ASTRA RL 13001, Fachhandbuch BSA<br>Norway: Norwegian Public Roads Administration Handbook No. 021 Road Tunnels<br>International: ISO 23431 Measurement of road tunnel air quality |