



# Air quality monitoring Visibility & gas measurement

Visibility and gas monitoring to improve tunnel safety

## Air quality monitoring



#### **Features**

- Smart IoT enabled visibility and gas sensor
- Scattered light visibility sensor with dual beam method to compensate soiling and ageing
- Optional up to 3 electrochemical gas sensor modules (CO, NO, NO<sub>2</sub>)
- Installation in-situ (in the tunnel's driving area) or with suction line up to 10 m
- Active extraction of sample air by integrated fan
- · Integrated purge air system
- Optional sample heater to eliminate fog from measurement
- Stainless steel housing 1.4404 (AISI 316L)
- IP rating IP 69K
- Connection to tunnel control system by
  - o MODBUS RTU (RS-485)
  - o MODBUS/TCP (Ethernet)
  - o Analogue and relay outputs
  - Web service (Ethernet)
- Integrated web server for visualisation, configuration, data logging, remote maintenance (Ethernet option only)
- Optional smart/HUB IoT operating and control unit with touch display

#### System setup

- smart/AQM sensor to be mounted either
  - in-situ (directly in the tunnel's driving area or
  - extractive in a niche, crosscut, etc.
- Terminal box with 24 VDC power supply for connection of supply and signal cables
- System cable with quick connectors between sensor and terminal box for easy exchange
- Optional smart/HUB with touch display

#### **Operation**

Visibility and gas monitoring during normal operation is used to control the tunnel ventilation at normal operation. If and with how much power artificial ventilation by jet fans is operated depends on the measured visibility and gas concentration.

Visibility is expressed by the extinction coefficient, which describes the light attenuation caused by particles in the air. The sensor extracts air from the tunnel by an integrated fan and feeds it into the measuring cell which detects the intensity of light scattered by this sample, sets it into relation with the light passing through and calculates the extinction coefficient.

Optional electrochemical gas sensor cells induce currents proportional to the prevailing gas concentration. With these currents and the measured temperature, the gas sensor modules calculate the gas concentrations

#### **Advantages**

- Specifically designed for application in tunnels
- Single sensor instead of transmitter/receiver pair requiring exact alignment
- Effective fog elimination by optional heater
- Easy recalibration by calibration plug
- Internally generated purge air keeps optics clean and prevents long-term drift
- Low maintenance requirements, stable, accurate
- Smart IoT enabled solution from sensor over hub to asset management
- Condition monitoring
- Remote maintenance
- Flexible integration into tunnel control system
- Pre-calibrated gas sensor modules for easy exchange

#### **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.

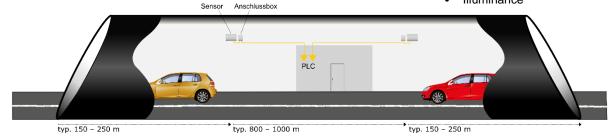
Since 1990 JES Elektrotechnik GmbH develops, installs and maintains systems to monitor air characteristics and lighting conditions in tunnels. Our systems are robust, durable and resistant against the corrosive atmosphere in a tunnel. They operate reliably and have a high accuracy in measurement.

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 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 Betriebsund 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 velocity, direction and temperature
- Luminance (access, threshold and interior zone)
- Illuminance



# Air quality monitoring



### **Technical Data**

Visibility measurement		
Measuring method	30° scattered light intensity	
Measured value	Scattered light	
Measuring range	0 15 / km	
Resolution	0.001 / km	
Accuracy	0.01/ km	
Temperature range	-40 +60 °C	
Humidity range	0 100% relative humidity (non-condensing)	

Gas measurement (optional)	
Measuring cells	up to 3
Measuring method	Electrochemical gas analysis
Measured value	Gas concentration in ppm
Measuring range Resolution Accuracy	Depending on installed cell Typical ranges according to draft of EN50545-2:  0 300 ppm CO / 0.1 ppm / ± 2 ppm or 2 % reading  0 25 ppm NO / 0.01 ppm / ± 0.5 ppm or 2 % reading  0 2 ppm NO <sub>2</sub> / 0.01 ppm / ± 0.05 ppm or 4 % reading
Long term drift	< 2 % per month
T90 time	< 40 s
Temperature range	-40 +60 °C (temperature compensated)
Pressure range	900 1100 hPa
Humidity range	15 95% relative humidity (non-condensing)

Sensor	
Model	JES smart/AQM
Power supply	24 VDC
Material	Stainless steel 1.4404
Protection class	IP 69K
Dimensions	300 x 220 x 100 mm
Weight	approx. 6.5 kg
Digital interfaces	MODBUS RTU (RS-485) MODBUS/TCP (Ethernet) Webserver for configuration (Ethernet)
Analogue outputs	3 x 4 – 20 mA (up to 6 on request)
Digital outputs	3 x relay (up to 6 on request)



Terminal Box	
Model	JES smart/AQM-TBX
Operating voltage	90 to 264 VAC, 48 to 62 Hz
Power consumption	approx. 30 VA
Protection class	IP 66
Dimensions	250 x 160 x 110 mm
Weight	approx. 3.2 kg
Material	Stainless steel 1.4404 (AISI 316L)
Fastening	Including mounting brackets made of stainless steel  1.4404 to fasten the housing to the wall



Operating unit with touch display (optional)		
Туре	JES smart/HUB	
Power supply	24 VDC	
Display	7" graphic TFT with touch operation	
Digital interfaces	MODBUS RTU (RS-485) MODBUS/TCP (Ethernet) Webserver for configuration (Ethernet)	
Analogue outputs	2 x 4 – 20 mA per I/O module	
Digital outputs	3 x relay per I/O module	



## Air quality monitoring



Conformities	
Electrical standards	2014/35/EU Low Voltage Directive (LVD) 2014/30/EU Electromagnetic compatibility (EMC) EN IEC 61000-6-2:2019 Immunity standard for industrial environments EN IEC 61000-6-3:2007 + A1: 2011 Emission standard for residential, commercial and light-industrial environments EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use EN 61326-1 Electrical equipment for measurement, control and laboratory use - EMC requirements
Tunnel safety standards	AT: RVS 09.02.22 DE: RABT 2006 CH: ASTRA RL 13001, Fachhandbuch BSA
Gas monitoring	EN 50545-1 AT: ÖNORM M9418, ÖNORM M9419 DE: VDI 2053

#### Contact

JES Elektrotechnik GmbH Wiestal Landesstraße 37 5400 Hallein Austria

Phone +43 (6245) 81785 Fax +43 (6245) 81785-600 Email info@tunnelsafety.at Web www.tunnelsafety.at