



Visibility monitoring Optical transmission

Air quality monitoring to improve safety in tunnels

Features

- Visibility measurement based on optical transmission principle
- Reliable measurement along a path of 10 m parallel to the tunnel axis
- Parametrisation of the sensor via Modbus RTU (EIA-485)
- Max. external cable length of 1000 m to tunnel control system
- Signal output either via analogue and relay outputs or RS485 with MODBUS RTU protocol
- Visible LEDs show sensor status

System setup

- Sensor mounted on tunnel wall parallel to tunnel axis aligned with reflector
- Reflector to reflect the light emitted by the sensor mounted on the tunnel wall in a distance of 10 m from the sensor
- Terminal box to connect the sensor, power and to connect to the tunnel control system

Operation

Visibility monitoring 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.

Visibility is stated in the form of an extinction coefficient that corresponds to the light attenuation caused by air pollution.

The monitoring system consists of a light emitting and receiving sensor and an optical reflector. The sensor determines the light transmission along a 10 m measuring path. Visibility and extinction coefficient are calculated based on the determined transmission.

Advantages

- Specifically developed for application in tunnels
- No separate control unit required
- Influence of contamination of optics on the measuring results is compensated
- Easy configuration
- Corrosion resistant against aggressive tunnel atmosphere
- Sensor and reflector can be replaced quickly, no tools, no realignment required
- Minimised spare requirements
- Extremely low maintenance requirements
- Optional combination with CO sensor

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.

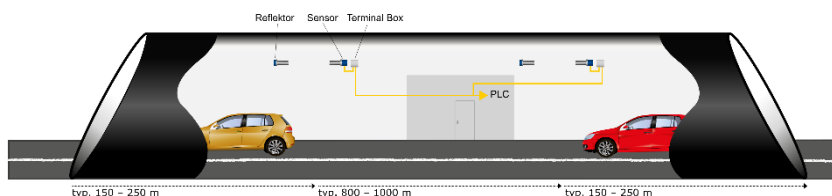
Since 1990 JES Elektrotechnik GmbH develops, installs and maintains systems to monitor air quality and lighting conditions in tunnels. Our systems are robust, durable and resistant against the corrosive atmosphere in a tunnel. They operate reliably and have a high accuracy in measurement.

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, NO₂ (extractive or in-situ)
- Visibility (extractive or in-situ)
- Air speed, direction and temperature
- Luminance (access, threshold and interior zone)
- Illuminance



Visibility monitoring based on optical transmission

Technical Data

Visibility measurement	
Measuring method	Optical transmission of visible light passing the measuring path twice
Measured values	Dust concentration in mg/m ³ Opacity in % Extinction Visibility (Extinction coefficient VIS k)
Measuring range	0 to 0,015 E/m (configurable up to 0,15 E/m) 0 to 97,5 % opacity
Response time	> 2s to 180 s, configurable
Light source	LED green, 530 nm
Measuring path	Distance Sensor – Reflector 9,5 to 11 m Measuring path length 19 to 22 m
Orientation	Parallel to tunnel axis

Outputs	
Analogue outputs	1 x 4-20 mA, 400 Ω, isolated can be assigned any measured value and output range
Output range	configurable, typical: 0 to 0,015 E/m
Contacts	2 x Status (NO) Max. 48 V / 0,5 A
Digital interface	1 x RS-485 MODBUS RTU

Sensor	
Model	D-R 220T M
Operating voltage	24 VDC ± 10 %
Current consumption	Ca. 0,4 A
Service interface	USB 1.1
Temperature range	-20 to 50 °C
Protection class	IP 65
Dimensions	150 x 220 x 140 mm
Weight	Ca. 2,7 kg
Material	Polyamide, approx. RAL5017, Flammability rating: B1 (UL 94 V0)

Reflector	
Model	D-R 220T R3
Protection class	IP 65
Dimensions	150 x 110 x 140 mm
Weight	Ca. 1,6 kg
Material	Polyamide, approx. RAL5017, Flammability rating: B1 (UL 94 V0)

Dust protection tube	
Model	D-R 220T T
Dimensions	280 x 110 x 100 mm
Weight	Ca. 3 kg
Material	Stainless steel 1.4571 / 316Ti



Terminal Box	
Model	D-TB 100T
Operating voltage	90 bis 264 VAC, 48 bis 62 Hz
Power consumption	ca. 30 VA
Protection class	IP 66
Dimensions	160 x 160 x 110 mm
Material	approx. 1,5 kg
Model	Polycarbonate, RAL 7035, Flammability rating: B1 (UL 94 V0)



Conformities	
Electrical standards	2006/95/EC Low voltage directive (LVD) 2004/108/EC Electromagnetic compatibility (EMC) EN 61326-1
Tunnel safety standards	AT: RVS 09.02.22 DE: RABT 2006 CH: ASTRA RL 13001, Fachhandbuch BSA

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