

CODEL

Monitoring Solutions

Tunnel Product Catalogue



ISO 9001:2008
Quality Certification

Monitoring Solutions



www.codel.co.uk

CODEL tunnel sensors are designed exclusively for road tunnel applications. Our range of sensors provide all the essential measurements necessary to monitor and control the tunnel atmosphere.

Available as stand-alone sensors or integrated into a network system, CODEL's tunnel sensors are installed in over 350 road and rail tunnels worldwide.

Due to the nature of tunnels, pollution from vehicles, Carbon Dioxide, Nitric oxide and Nitrogen Dioxide and fine particles, can cause occupants in vehicles a range of respiratory problems especially Nitrogen Dioxide which is very toxic. Fine particles can gather on the lungs but, if they are gathered in dense concentrations, they can reduce visibility considerably producing a significant driving hazard. Road tunnels present operators and regulators with a number of safety issues due to their enclosed nature.

One of the key issues is ventilation as road tunnels contain a number of toxic gases as well fine particulate which are emitted from the tail pipes of vehicles. Operating ventilation systems is a major cost item to tunnel operators and accurate and reliable tunnel atmosphere monitors only trigger systems when they are needed to clear pollution.

The main pollutants monitored in road tunnels are:

- a) Carbon Monoxide
- b) Nitric Oxide
- c) Nitrogen Dioxide
- d) Visibility monitored as K(extinction coefficient)
- e) Flow is also monitored to control air flow
- f) Light Sensors

CODEL offer a number of different options for monitoring tunnel pollutants both single and multi-channel. We also offer an extractive range where the analyser is located outside the tunnel bore.

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Visibility and Cold Smoke Monitors

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CO, NO, Visibility & NO2 Air Quality Monitors

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CO, NO, NO2 & Visibility Electrochemical Cell Monitor

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Cross Tunnel Flow Monitor

TunnelTech 100 Series Sensors are an essential part of any road or rail tunnel safety system ensuring the tunnel ventilation system provides sufficient clean air for drivers to clearly see the road ahead.

Products in this series

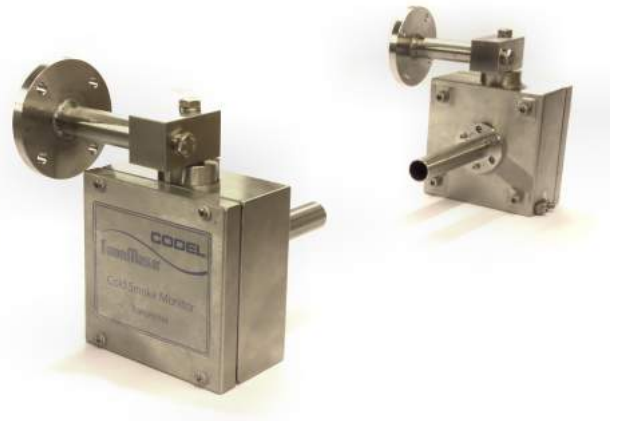
TunnelTech 101 - Visibility Monitor

TunnelTech 102 - Cold Smoke Monitor

The TunnelTech 101 Visibility Monitor (VIS), is an essential part of any road or rail tunnel safety system. Firstly, it monitors the Visibility within the tunnel and ensures that the tunnel ventilation system provides sufficient clean air for drivers to clearly see the road ahead.

Secondly, used in combination with other TunnelTech 101 VIS monitors, the operator can quickly detect the focus of the fire if it is also equipped with the optional PT100 temperature sensor to accurately measure ambient air temperature in a range of -15 to 105°C.

Fully configurable analogue and alarm outputs are exportable to the tunnel data acquisition system to provide real-time visibility data. This data is also exported via the RS 485 serial port along with the temperature data.



- ✓ Continuous measurement of CO, NO and Visibility in road and rail tunnels
- ✓ Class leading Accuracy, Repeatability and Resolution
- ✓ Rugged, corrosion resistant construction
- ✓ Minimal maintenance requirements
- ✓ Optional RS 485 (Modbus) Output

Measurement	Visibility
Units	K factor(M-1) or metres
Measurement Technique	Transmissometry (de Beer Lambert Law)
Measurement Range (Typical)	0 - 0.015m-1
Accuracy	+/- 0.0002 m-1
Resolution	+/- 0.0001 m-1
Averaging Time	From 10 seconds to 2 minutes
Ambient Temperature Range	-20°C to +50°C
Temperature Sensor (Optional)	P100, -15°C to +105°C
Power Supply	24V DC
Construction	Aluminium enclosures
Analogue outputs	1 x 4-20mA isolated current output, 500Ω maximum load, Fully Configurable
Relay Output)	1 x volt-free SPCO contacts, 50V, 1A maximum load, configurable as alarm contacts

The TunnelTech 200 Air Quality Monitors are an essential part of any road or rail tunnel safety system.

Products in this series

TunnelTech 201 - CO · NO · Vis

TunnelTech 202 - CO · Vis

TunnelTech 203 - CO · NO

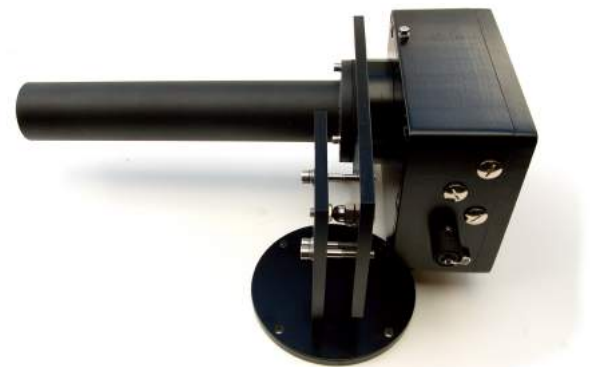
TunnelTech 204 - Vis Only

TunnelTech 205 - NO₂

Firstly, it monitors the atmosphere within the tunnel and ensures that the tunnel ventilation system provides sufficient clean air to protect tunnel users health and for drivers to clearly see the road ahead.

The TunnelTech 200 analysers uses well proven infra-red techniques to determine CO and NO concentrations and optical attenuation to monitor Visibility levels. As there is only one moving part, reliability levels are very high and maintenance requirements are extremely low. The sight tubes have been designed to ensure that airborne dust and contaminants do not reach the optical windows and cause drift.

Fully configurable analogue and alarm outputs are exportable to the tunnel data acquisition system to provide real-time CO, NO and Visibility data .



- ✓ Continuous measurement of CO, NO and Visibility in road and rail tunnels
- ✓ Class leading Accuracy, Repeatability and Resolution
- ✓ Rugged, corrosion resistant construction
- ✓ Minimal maintenance requirements
- ✓ Optional RS 485 (Modbus) Output

Gas Species Options	Single or multi-gas measurements available: CO, NO & Visibility		
Measuring units	ppm for CO & NO, m-1 or m for visibility		
Path Length	3m (6m folded beam)		
Calibration	Automatic zero calibration - manual span check		
Measurement	Carbon Monoxide (CO)	Nitric Oxide (NO)	Visibility
Measurement Technique	Infrared Gas Cell	Infrared Gas Cell	Optical Transmissivity
Measurement range (typical)	0 - 100ppm	0 - 30ppm	0 - 0.015 m-1
Accuracy	+/- 1ppm or 2% of span	+/- 2ppm or 2% span	Vis +/- 0.0002 m-1
Resolution	+/- 1ppm	+/- 1ppm	Vis +/- 0.0001 m-1
Response Time	2 minutes	2 minutes	Vis 10s - 2min Selectable
Ambient Temperature	-20°C to +50°C		
Power supply	12V DC, 20 VA from separate power supply. Optional 24V DC available upon request		
Construction	Corrosion resistant epoxy coated aluminium housing sealed to IP65		

CODEL's industry proven tunnel air flow monitor.

Products in this series

- TunnelTech 301 – 12-24v AFM
- TunnelTech 302 – 12-24v SS AFM
- TunnelTech 303 – 12v AFM with temp & mA
- TunnelTech 304 - 24v AFM with temp & mA
- TunnelTech 305 – 24v SS AFM with temp

Tunnel ventilation systems are designed to enable a sufficient throughput of air to be maintained to ensure a safe operating environment for users. These systems consume large amounts of power and need to be operated as efficiently as possible. To do this it is necessary to know the effectiveness of the system in terms of air flow and direction developed within the tunnel.

Three decades of development, knowledge and practical experience have been utilised to produce the advanced TunnelTech 301 air flow sensor that combines the reliability of ultrasonic technology and delivers superb accuracy and reliability at a very competitive price.

- ✓ Single point ultrasonic measurement technology
- ✓ Unaffected by traffic flow and sound reflections
- ✓ No moving components providing maintenance free operation
- ✓ Designed to withstand the harshest of tunnel environments
- ✓ Measurement precision of +/- 0.2m/sec



Measurement	Air Flow & Direction
Units	m/sec
Measurement Technique	Ultrasonic
Measurement Range (Typical)	-20 to +20 m/sec
Accuracy	+/- 0.2 m/sec
Averaging Time	Fully adjustable from 10 sec to 8 min
Ambient Temperature Range	-20°C to +50°C
Power Supply	12V DC, 20 VA from separate power supply
Construction	Corrosion resistant epoxy coated aluminium housing sealed to IP65
Analogue outputs	2 x 4-20mA current outputs as standard, isolated, 500Ω maximum load, Configurable
Relay Outputs	2 x volt-free SPCO contacts, 50V, 1A maximum load, configurable as alarm contacts
Communications Port	For local connection to laptop PC using RS232 or optional RS485 interface unit
Communications Port	1 x volt-free SPCO contacts, 50V, 1A maximum load, configurable as alarm contacts

Uses the latest Electrochemical Cell Technology for the measurement of CO, NO and NO₂.

Products in this series

- TunnelTech 501 - CO · NO · NO₂
- TunnelTech 502 - CO · NO
- TunnelTech 503 - CO
- TunnelTech 504 - NO
- TunnelTech 505 - NO₂
- TunnelTech 506 - CO · NO₂
- TunnelTech 507 - NO · NO₂

The TunnelTech 500 Series Air Quality Monitor, is an essential part of any road or rail tunnel safety system. Firstly, it monitors the atmosphere within the tunnel and ensures that the tunnel ventilation system provides sufficient clean air to protect tunnel users health and for drivers to clearly see the road ahead.

The TunnelTech 500 Series analyser uses electrochemical cell technology to determine CO, NO & NO₂ concentrations. As there are no moving parts, reliability levels are very high and maintenance requirements are low. The sight tubes have been designed to ensure that airborne dust and contaminants do not reach the optical windows and cause drift.

Data is connected via RS485 serial port delivering a bi-directional modbus interface to the tunnel SCARDA system or optional CODEL TunnelTech 710 remote display panel.

- ✓ Measure CO, NO & NO₂ in one compact sensor
- ✓ Advanced electrochemical cell technology
- ✓ High resolution measurement
- ✓ Minimal maintenance requirements
- ✓ Available in 316 Stainless Steel



Gas Species Options	Single or multi-gas measurements available: CO, NO ₂ , NO & Visibility		
Measuring units	ppm for CO & NO, m ⁻¹ or m for visibility, PPb for NO ₂		
Path Length	3m (6m folded beam)		
Calibration	Automatic zero calibration - manual span check		
Measurement	Carbon Monoxide (CO)	Nitric Oxide (NO)	Nitric Dioxide (NO₂)
Measurement Technique	Electrochemical Cell	Electrochemical Cell	Electrochemical Cell
Measurement range (typical)	0 - 300ppm *	0 - 30ppm	0 - 5/10ppm
Accuracy	1ppm	1ppm	100ppb
Resolution	+/- 1ppm	1ppm	50ppb
Response Time	30 Seconds	30 Seconds	30 Seconds
Ambient Temperature	-20°C to +50°C		
Power supply	24V DC, 30 VA from separate power supply.		
Construction	Corrosion resistant epoxy coated aluminium housing sealed to IP66 Optional 316 Stainless Steel and 316 Stainless Steel TI for heads & Brackets		

Luminance and Illuminance light sensors

Products in this series

- TunnelTech 601 - Luminance
- TunnelTech 602 - Illuminance

The TunnelTech 601 Luminance photometer monitors the average luminance of a tunnel entrance and its surroundings. In accordance with Commission Internationale de l'Eclairage, (C.I.E.), publication 88, 1990 recommendations, the photometer monitors the average luminance within a 20 degree angle over a standard range of 0 - 6,500 cd/m².

The detector is a metal/glass encased silicon diode photocell which is filtered to give a response that mimics the performance of the human eye. The detector is perfectly linear within its measuring range and has an instantaneous response to changing light levels.

According to CIE recommendations luminance should be monitored as the luminance contained within in a conical field of view, subtending an angle of 20°. It is recommended that the luminance photometer is mounted in the tunnel approach road approximately 120 - 200 metres from the portal, depending on the approach speed of the vehicles and their stopping distance.



- ✓ Compliant with Commission Internationale de l'Eclairage, (C.I.E.), publication • 88, 1990
- ✓ Measurement of tunnel entrance luminance - 0 - 6,500 cd/m²
- ✓ Calibrated using standards traceable to UK National Physical Laboratory
- ✓ Metal/glass encased Silicon photodiode, VI filtered to human spectral response
- ✓ Accuracy +/-1%

Measurement	Luminance
Units	candela/metre squared - cd/m ²
Photodetector	metal/glass encased silicon diode photocell
Measurement Range (Typical)	0 - 6500
Accuracy	+/- 1% (-250C to +750C)
Ambient Temperature	-20°C to +50°C
Power supply	220VAC or 24VDC
Construction	Corrosion resistant epoxy coated aluminium housing sealed to IP66
Analogue outputs	1 x 4-20mA current outputs as standard
Calibration	Traceable to NPL Standard Luminant A
Wash/wipe kit (Optional)	Wiper unit, wash bottle
Mounting equipment (Optional)	Pan and tilt facility
EMC	EN61326-1:2006 & EN50270:2006 directive compliant

Uses the latest Electrochemical Cell Technology for the measurement of CO, NO and NO₂.

Products in this series

- TunnelTech 701 - CO · NO · NO₂ · Vis
- TunnelTech 702 - CO · NO · Vis
- TunnelTech 703 - CO · Vis
- TunnelTech 704 - NO · Vis
- TunnelTech 705 - NO₂ · Vis
- TunnelTech 706 - CO · NO₂ · Vis
- TunnelTech 707 - NO · NO₂ · Vis
- TunnelTech 708 - Vis

The TunnelTech 701 Air Quality Monitor, is an essential part of any road or rail tunnel safety system. Firstly, it monitors the atmosphere within the tunnel and ensures that the tunnel ventilation system provides sufficient clean air to protect tunnel users health and for drivers to clearly see the road ahead.

The TunnelTech 701 analyser electrochemical cell technology to determine CO, NO & NO₂ concentrations and optical attenuation to monitor Visibility levels. As there are no moving parts, reliability levels are very high and maintenance requirements are low. The sight tubes have been designed to ensure that airborne dust and contaminants do not reach the optical windows and cause drift.

Data is connected via RS485 serial port delivering a bi-directional modbus interface to the tunnel SCARDA system or optional CODEL TunnelTech 710 remote display panel.



- ✔ Measure CO, NO, NO₂ & Visibility in one compact sensor
- ✔ Advanced electrochemical cell technology
- ✔ High resolution measurement
- ✔ Minimal maintenance requirements
- ✔ Available in 316 Stainless Steel

Gas Species Options	Single or multi-gas measurements available: CO, NO ₂ , NO & Visibility		
Measuring units	ppm for CO & NO, m ⁻¹ or m for visibility, PPb for NO ₂		
Path Length	3m (6m folded beam)		
Calibration	Automatic zero calibration - manual span check		
Measurement	Carbon Monoxide (CO)	Nitric Oxide (NO)	Nitric Dioxide (NO₂)
Measurement Technique	Electrochemical Cell	Electrochemical Cell	Electrochemical Cell
Measurement range (typical)	0 - 300ppm *	0 - 30ppm	0 - 5/10ppm
Accuracy	1ppm	1ppm	100ppb
Resolution	+/- 1ppm	1ppm	50ppb
Response Time	30 Seconds	30 Seconds	30 Seconds
Ambient Temperature	-20°C to +50°C		
Power supply	24V DC, 30 VA from separate power supply.		
Construction	Corrosion resistant epoxy coated aluminium housing sealed to IP66 Optional 316 Stainless Steel and 316 Stainless Steel TI for heads & Brackets		

TunnelTech 801 air flow sensor that combines the reliability of ultrasonic technology and delivers superb accuracy and reliability.

Products in this series

TunnelTech 801 - Cross Tunnel Flow Monitor

The TunnelTech 801 Air Flow Monitor (AFM) is CODEL's industry proven tunnel air flow monitor.

The TunnelTech 801 has been specifically designed for road, rail and civil tunnel and ventilation shaft applications and represents the latest in compact ultrasonic sensor-head design. Ultrasonic time-of-flight measurement across any tunnel delivers a highly accurate airflow value and virtually eliminates traditional high-maintenance measurement techniques.

The TunnelTech 801 provides real-time accurate measurements of air velocity and volumetric airflow under demanding environmental conditions. Unlike other measurement devices, the sensor is not affected by temperature, humidity or dust.



- ✓ Dual sensor, non-contact ultrasonic transit time measurement technology
- ✓ No moving components providing maintenance free operation
- ✓ Ultrasonic time-of-flight measurement across any tunnel
- ✓ Real-time accurate measurements of air velocity and volumetric airflow
- ✓ Signal output by analogue/relay or RS 485 MODBUS
- ✓ Extremely low maintenance requirements

Measurement	Airflow velocity, Volumetric flow, Airflow direction, Temperature
Units	Metric or Imperial units for all parameters
Measurement Technique	Across the tunnel, dual sensor, ultrasonic transit time principle
Measurement Range (Typical)	-40 to +40 m/sec, range is user configurable
Accuracy	±0.1 m/sec*
Resolution	+/- 0.0001 m-1
Averaging Time	1 second to 8 minutes
Ambient Temperature Range	-40 to +85°C
Sensor Junction Box (Optional)	IP65 / NEMA 4X corrosion resistant sensor junction box to allow greater separation
Power Supply	24 VDC supplied by transmitter electronics
Construction	Corrosion resistant IP65 / NEMA 4X enclosure (Kynar® 720)
Analogue outputs	2x 4-20 mA optically isolated output, 500Ω maximum load, Fully Configurable
Relay Output)	2 x Form C SPDT relay, isolated