Applications

- Visibility measurement
- Ventilation control
- Early fire warning

in road and railway tunnels

Features

- Sampling either in-situ or extractive
- Installation in tunnel, in niches or in control room
- Operation locally or centrally with multichannel control
- Highly stable readings thanks to purge air
- Annual check with standard
- Easy zero-point check even in dusty conditions
- Mist problems eliminated by heating

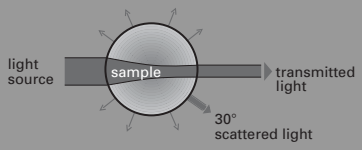
VISIBILITY MONITOR

VISGUARD

SIGRIST
PROCESS-PHOTOMETER

FUNDAMENTALS

Visibility measurement



Visibility, CO concentration, and sometimes also NO concentration are the measurable criteria for assessing air quality in road tunnels. These parameters are therefore used for controlling the ventilation system in order to minimize energy consumption and also for closing down the tunnel whenever preestablished limits are exceeded.

Visibility is stated in the form of an extinction coefficient that corresponds to the light attenuation caused by air pollution. It is possible to use either the level of transmitted light or scattered light as basis of the measuring system, because most of the light attenuation is caused by scatter effects. The scattered light intensity is multiplied by a factor to obtain the extinction coefficient.

Measuring method

The VisGuard measures the scattered light intensity of a sample drawn into the instrument from the tunnel. This configuration permits extremely simple installation without time-consuming adjustment, reliable checking and correction of the zero and reference points without ambient air effects, and the ability to carry out measurement either inside or outside the tunnel cavity. An optional heater at the sample inlet effectively eliminates any troublesome mist effects.

The VisGuard employs a variation of the long-proven SIGRIST dual-beam measuring method. It determines the relation between the light scattered at a 30° angle and the directly transmitted light. This system elegantly eliminates the effects of any light source fluctuations as well as ageing or temperature effects of the electronics.

Early fire warning

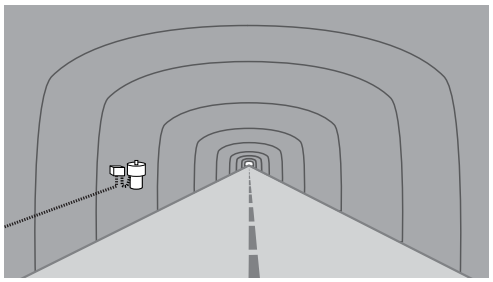
To achieve the earliest possible detection of hot or cold fires producing smoke, a second current output or a limit contact with a much higher threshold value can be set entirely independent of measuring range used for visibility. By detecting fires early, this system opens up new possibilities for improving tunnel safety.

Sample extraction

The tunnel air is extracted by a blower and carried through the flow cell. In the in-situ version the blower is integrated in the sensor. For the extractive arrangement, separate fans are used because more power is required.

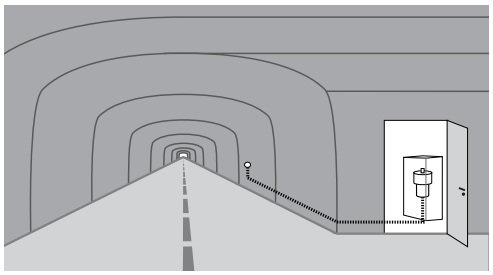
The blower also feeds filtered purge air to the flow cell, thus enveloping the sample in a protective shroud of clean purge air. This effectively keeps the optics clean and minimizes drift caused by fouling.

INSTALLATION ALTERNATIVES



In-situ

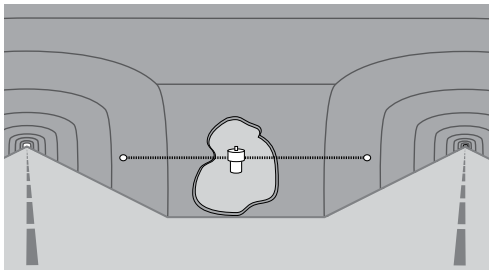
The least costly place to install the VisGuard is right in the tunnel cavity or in an emergency niche. The VisGuard is simply fastened to the wall or ceiling. The integrated blower draws in the ambient air and passes it through the flow cell for measurement. Access to the instrument is required only for the annual adjustment and filter change.



Extractive single sampling

If the operator wants to keep the tunnel as free as possible from technical equipment, or if very easy access to the instrument is desired, the extractive arrangement can be used. In this case a separate fan draws the sample from the extraction point in the tunnel and transports it to the sensor through a sample pipe.

Thanks to its compact design, the VisGuard can be installed close to the tunnel cavity or under it in emergency cabins, transverse tunnels or the equipment gallery with just a few meters of extraction distance, or else in a control room as far as 500 m away.



Extractive multiple sampling

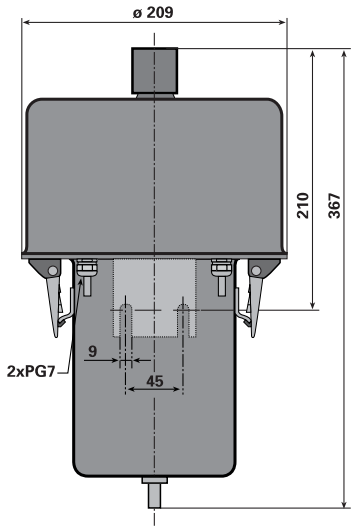
Extractive sampling also opens up the possibiltiy of carrying extraction pipes from up to 8 sampling points via a valve unit to a single sensor. With the multichannel control unit SIBUS, the continuous sample flows from the different extraction points are fed cyclically to the VisGuard. In this case the maximum extraction length is 200 m. This configuration has proven highly effective for more intensive monitoring of certain tunnel sections.

DIMENSIONS AND CONNECTIONS

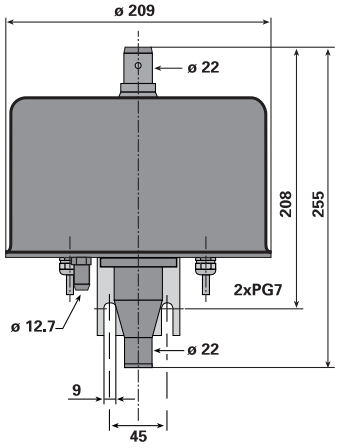
Installation/Mounting

In-situ mounting is a matter of fastening the VisGuard to the wall with 2 screws. The instrument axis must be set at right angles to the tunnel axis. If the sample is withdrawn extractively, the instrument can be installed on a wall or in a suitable cabinet. For installations employing multiple sampling, installation in a cabinet is recommended.

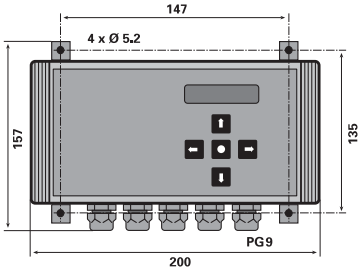
Dimensions

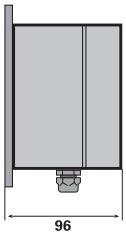


VisGuard In-situ



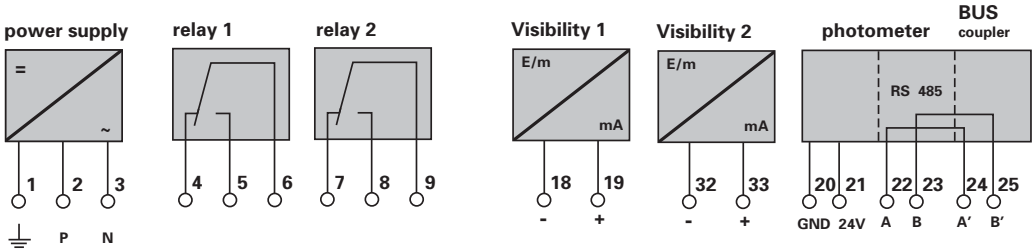
VisGuard Extractive





Control Unit SIREL

Wiring diagram SIREL



OPERATION AND COMMUNICATION

Single control unit SIREL

With its two-line LC display and operating structure with plain-text guidance, SIREL provides extremely easy access to the VisGuard for operation, configuration and servicing. It has two 0/4 .. 20 mA current outputs and two independent relay contacts that can serve as either limit or alarm contacts.

SIREL can be installed remotely up to 100 m away from the VisGuard. The SIREL robust version, with covered display and keypad, is available for installation right in the tunnel.

An optional BUS coupler is available for connection to PROFIBUS DP. It allows direct data transmission and ventilation control via the digital interface.

Multichannel control unit SIBUS

As many as 8 detection points can be queried and configured centrally from the control room with SIBUS. The advantage over individual control units at the instruments is that, in addition to the readings, status signals are also available at all times so that instrument parameters can be altered as required.

In this case a SITRA transmitter located right at the VisGuard provides the connection to an RS 485 bus, takes care of the power supply, and conditions the bus signal.

Additional sensors, e.g. for measuring CO, NO or wind velocity, can be connected to analog inputs on SIBUS, so that all of the important information for controlling tunnel ventilation is available right at one spot. Furthermore, it is possible to connect an analog signal to the Visguard and to transmit it with the others via the bus to SIBUS.

Detailed information on SIBUS capabilities is given in a separate Data Sheet.

Calibration

Calibration of the SIGRIST VisGuard is carried out at the factory using PLA (polystyrene-latex aerosol) as the defined medium. For visibility measurement, the PLA value is converted to the extinction coefficient.

For the annual calibration check, a checking rod is available that permits correction of the instrument in a matter of seconds. If necessary, the zero point can be checked at the same time by interrupting the air supply.

SPECIFICATIONS

Visibility measurement	**Measuring principle:**	30° scattered light measurement
	Measuring span:	0 .. 100 PLA
	Measuring ranges:	0 .. 15 · 10^{-3} E/m; 7 additional freely configurable ranges
	Resolution:	< ± 0,25 % of full scale value
	Meas. wavelength:	880 nm
Photometer VisGuard	**Enclosure material:**	stainless steel 1.4435 (316 L)
	Sample temperature:	–20 °C .. +50 °C
	Flowrate:	5 l/min (In-situ) / 25 .. 30 l/min (Extractive)
	Ambient temperature:	–20 °C .. +50 °C
	Ambient pressure:	±3000 Pa (±30 mbar)
	Protection type:	IP65
	Weight:	6.5 kg (In-situ) / 5.0 kg (Extractive)
	Depth from wall:	235 mm
	Heater (optional):	230 V AC; 25 W
Control Unit SIREL	**Power supply:**	85 .. 264 V / 47 .. 440 Hz
	Power input:	20 W
	Current output:	0/4 .. 20 mA; burden max. 600 Ω
	Contacts:	2 separately configurable relay contacts 250 V AC, 4 A
	Protection type:	IP65
	Weight:	1.5 kg
	Connection to VisGuard:	4-core cable, up to 100 m
Sampling system 0 .. 30 m	**Blower type:**	SE12
	Power supply:	115 V or 230 V / 50 or 60 Hz
	Power input:	90 W
	Ambient temperature:	–20 °C .. +40 °C
	Degree of protection:	IP54
	Weight:	7 kg
	Heater (optional):	230 V AC; 40 W
Sampling system 30 .. 500 m and multiple sampling	**Blower type:**	SE4n/SD4n
	Power supply:	230/400/440 V / 50 or 60 Hz
	Power input:	950 W
	Ambient temperature:	–20 °C .. +40 °C
	Degree of protection:	IP54
	Weight:	22 kg
	Heater (optional):	230 V AC; 40 W

Represented by:

SIGRIST
PROCESS–PHOTOMETER

SIGRIST-PHOTOMETER AG • Hofurlistrasse 1 • CH-6373 Ennetbürgen
Phone +41 (0) 41 624 54 54 • Fax +41 (0) 41 624 54 55
www.photometer.com • e-mail info@photometer.com