Continuous integrated building and installation monitoring

Technical information and product data

osmos

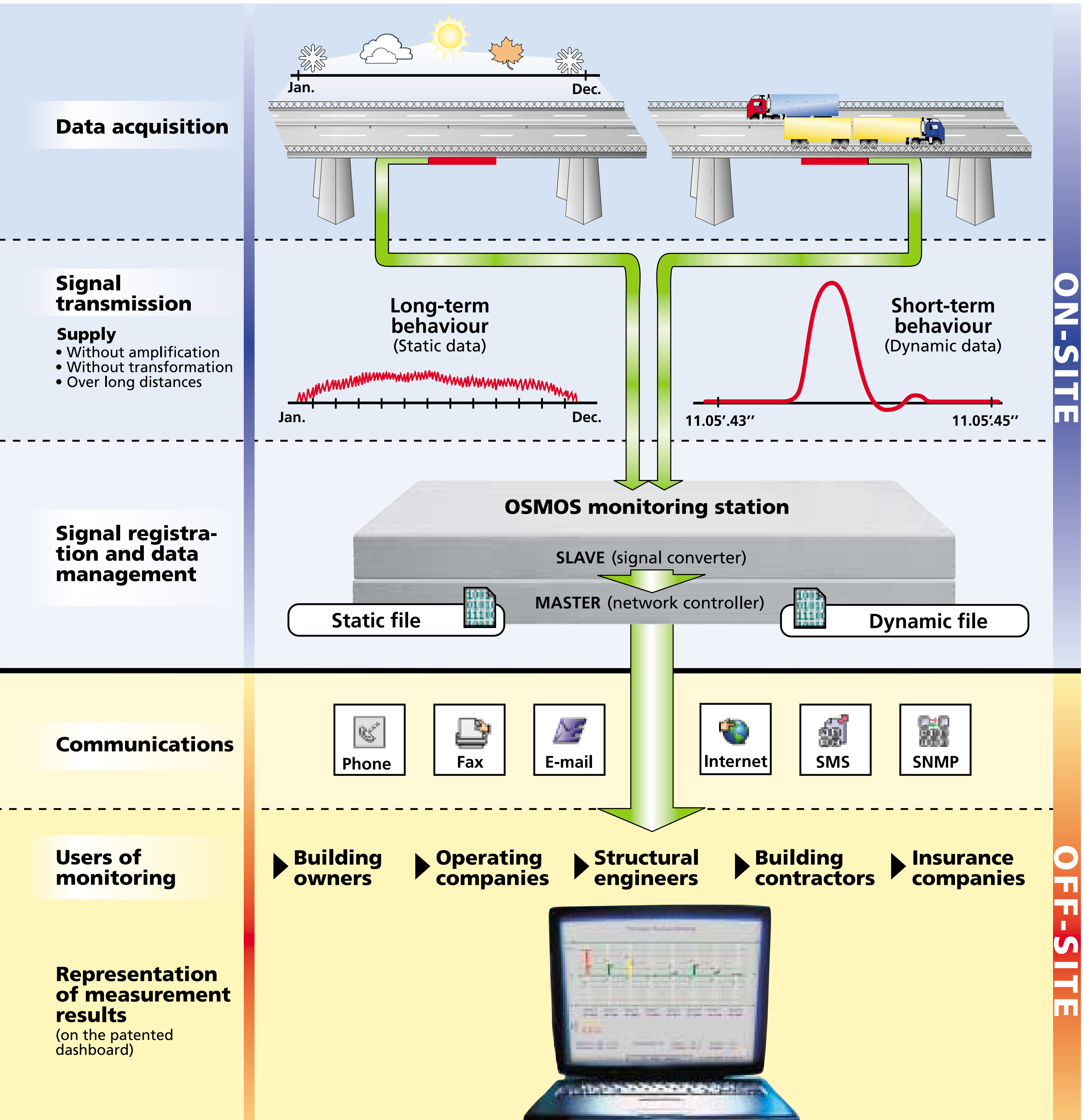
Integrated safety for structures

OSMOS system

A tried and tested method of structural diagnostics

The sensor-aided system for building and installation monitoring developed by OSMOS allows a long-term registration of all structural changes through an integration of components into or onto the structure which needs to be inspected.

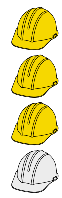
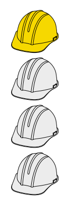
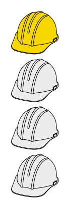
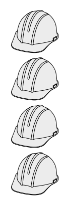
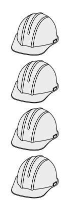
This system is used to measure static and dynamic loads as well as the resulting effects on material and buildings / installations. Changes in shape and position can be monitored to the highest degree of precision, making it possible to forecast the behaviour of the structure being inspected. For this purpose, all the data can be saved, evaluated on requirement and displayed in real time.



OSMOS has harnessed optical-waveguide technology to allow measurements of structural changes. The OSMOS measuring system is based on the principle of intensity modulation with analog attenuation measurement, which was selected following an examination of all fiber-optic techniques of detecting changes in shape and position. This technique provides extremely stable and reliable solutions with an optimized price/performance ratio and minimized requirements for electronic and mechanical components.

A measuring technique adapted ideally to the requirements of the construction industry and systems engineering

Overview of the examined optical measuring techniques

Modulation parameter	Physical principle	Measuring technique	Advantages / disadvantages	Adaptation to the construction industry	Cost index
Light intensity	Changes in transmission properties resulting from changes in absorption, emission and refraction conditions	Analog attenuation measurement	• Permanent presence of light (infrared, 850 nm) in the optical-waveguide cables • Rapid sensor response (dead time = 0); ideal for dynamic measurements • No complex signal processing; the opto-electronics are restricted to attenuation measurements • The infrared light technology used has been commercially available for many (> 40) years • The sensor exhibits an integrative transient response and is thus invulnerable to power failures > Inexpensive evaluation electronics, interference-proof and durable		
Wavelength	Changes in wavelength resulting from non-linear effects	Comparison of the intensities of two wavelengths (spectrometer)	• A reference is required for every sensor • Complex signal processing = complex evaluation electronics more vulnerable to interference (elaborate protection measures) • A higher overall price makes permanent installation too expensive; thus the standard for the market cannot be attained • Dynamic measurements are possible with small elements (1 cm), laboratory test • Projects so far have served as pilot projects		
Signal delay	Dependence of signal delay time on changes in signal path	Time-resolved pulse measurement (OTDR)	• High-grade devices for precise time measurements (10^{-12} s); these devices are delicate, sensitive and very expensive • Measurement results are heavily dependent on handling by personnel • Dynamic measurements are not possible • Very expensive measurement evaluations		
Phase	Interference between various propagation modes on a fiber-optic route	Interference-fringe measurement, phase measurement (interferometer)	• Very complex measuring technique • Tested almost exclusively in the laboratory; hardly any verified on-site performances • Dynamic measurements are not possible • Very expensive measurement evaluations		
Polarization	Changes in optical double refraction	Analysis of polarization states and intensity comparisons	• Complex signal processing = complex evaluation electronics more vulnerable to interference (elaborate protection measures) • Measurement results are heavily dependent on handling by personnel		

Comparison of measuring systems

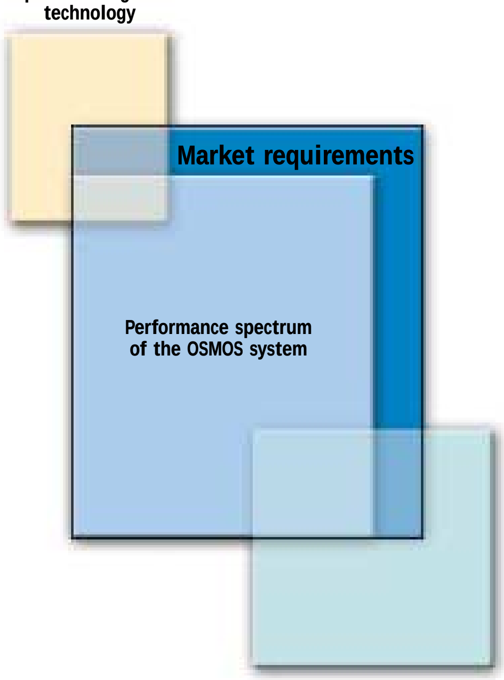
+ = Meets requirement
o = Does not meet requirement
– = Irrelevant
+/o = Requirement met partially

	Effect sensors										Cause sensors and surveying equipment										OSMOS systems			
	Extensometer	·Vibrating strand	·Strain gauge	·Tension monitor	·Bar extensometer	·Fissure width sensor	Accelerometer	Impact detector	Acoustic methods	Photogrammetry	Temperature sensor	Anemometer	Hygrometer	Corrosion sensor	Infrared thermal camera	Inclinometer	Surveying and geodesy	·Leveling	·Autom. theodolitic measurements	·GPS monitoring	Optical extensometer	Optical Strand	X-Trigger	
Permanent contact with building points considered critical or decisive		+	+	+	+	+	+	+	+	o	+	+	+	+	o	+		o	o	o	+	+	+	
Distributed measurement possible (long measuring range)		o	o	o	+/o	o	o	o	o	+	o	-	-	-	+	-		+	+	o	+/o	+	+	
Monitoring of slow processes		+	+	+	+	+	+	o	o	o	+	+	+	+	+	+		o	+	+	+	+	+	
Monitoring of dynamic processes (also those of a high frequency)		o	+	+	o	o	+	+	+	o	-	+	-	-	-	o		o	o	o	+	+	+*	*one-time, followed by re-adjustments
Same reference values for static and dynamic operation		o	+	o	o	o	o	o	o	-	-	+	-	-	-	o		-	-	-	+	+	+	
High chronological stability		+/o	+	o	+	+/o	-	-	o	-	+	+	o	o	+	+		+	+	-	+	+	+	
100% electro-magnetic neutrality		o	o	o	o	o	o	o	o	-	o	o	o	o	+	+/o		-	-	-	+	+	+	
100% interference-free coupling of the measurement network with the evaluation system		o	o	o	o	o	+/o	+/o	+	-	o	o	o	o	+	+/o		-	-	-	+	+	+	
No impediment to normal utilization of the structure		+	+	+	o	+	o	+	+	+	+	+	+/o	o	+	o		o	o	+	+	+	+	
Easy assembly		o	+	o	o	o	+	+	o	-	+	+	+	o	+/o	o		-	o	+	+	+	+	
Long service life (several decades of operation)		+/o	o	o	o	o	+	+	+/o	-	+/o	o	o	o	+	+		-	-	+	+	+	+	
Price/performance ratio		o	+/o	+/o	o	o	o	+/o	o	o	+	+	+/o	o	+/o	+/o		+/o	+/o	o	+	+	++	

The OSMOS system is more reliable and more robust than conventional measuring systems which are equipped with cause or effect sensors and which do not make use of fiber-optics. It also offers a possibility of full-scale monitoring.

The OSMOS system fulfills more than 90% of the market requirement profile.

No other technology currently provides this performance.



- The OSMOS system is designed for long-term integration into structures.
- System components are made of extremely durable materials with constant properties: high-grade steel, silicone, teflon.

- Average deformation value.
- The OSMOS system allows a monitoring of complex structures even with a relatively small number of sensors.

- The fiber-optic sensors and optical extensometer of the OSMOS system are designed for continuous operation.
- The static data storage function permits a monitoring of structural characteristics over very long periods of time.

- The fiber-optic sensors and optical extensometer of the OSMOS system are designed to also respond to extremely brief events.
- The dynamic data storage function permits a registration of dynamic processes, even those occurring at very high frequencies.

- The OSMOS system allows a comparison of slow and fast processes on the basis of the same reference value.
- A failure of the power supply to the monitoring station (even for long periods of time) does not affect the reference value.
- The reference values are specified via the individual optical-waveguide fibers and not included in signal processing.

- The OSMOS system is highly stable over time.
- A drift value approximating zero was ascertained in a series of investigations.
- This stability is also indicated by OSMOS reference applications dating back since 1992.

- No electrical current flows through the fiber-optic sensors or optical extensometers.
- They are thus insensitive to electromagnetism caused by thunderstorms, electrical stray fields, ultra-high frequencies, proximity to high currents, etc. This allows them to be used in explosion-endangered areas.

- The network linking the fiber-optic sensors and optical extensometer with the monitoring station simply routes their output signals without processing or amplifying them.
- Signals routed through interference-prone and hazardous areas (for example, explosion-endangered areas) to the monitoring station do not suffer losses in quality.

- Easy attachment.
- Simple logistics for assembly on structures.
- OSMOS system components have a robust and practical design.
- The automatic function of the monitoring station.
- Compact, space-saving design of the optical strand, optical extensometer and X-Trigger.

- OSMOS system components can be assembled easily without any problems.
- Intensive research and careful selection of materials.

- The system guarantees a long, almost maintenance-free service life through the use of extremely durable components.

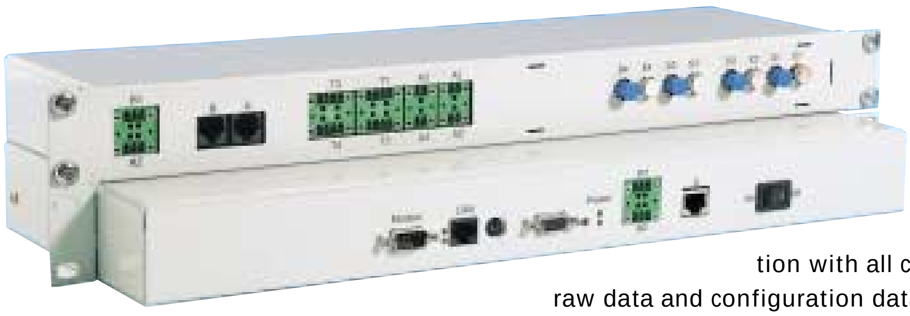
- OSMOS offers a requirement-oriented system with an ideal price/performance ratio allowing, for instance, cost-optimized repairs and extended service life.
- Inexpensive sensor equipment permits permanent monitoring – even of complex structures.

Monitoring station

Connecting the sensors via standard optical cables permits measurement signals to be transmitted over long distances without the need for conversion or intermediate amplification.

OSMOS developed the monitoring station for precise registration of the signals supplied by the fiber-optic sensors. This station consists of a master unit, which performs all the necessary network functions, and a slave unit, which performs data measurement. The measured data are fetched and managed by the master unit. The connection between the master and slave is established via a bus (RS 485).

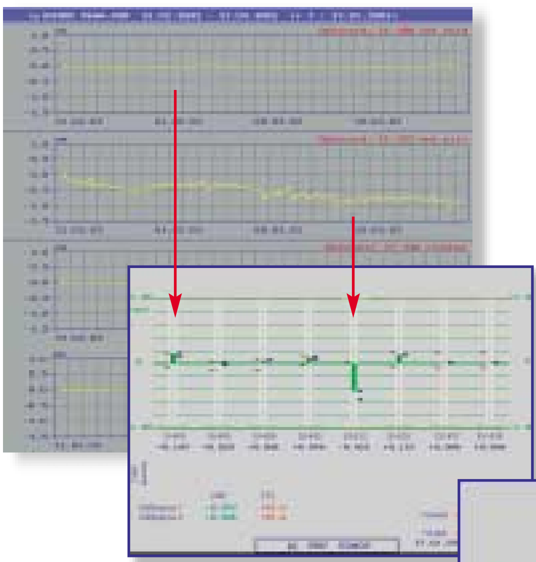
The entire system can be configured online via a web server, or offline by means of an editor. A database server establishes a modem connection with all configured measurement points and archives all raw data and configuration data accumulated since the previous connection. With the help of the configuration data, all raw data on the database server are converted into measurement data and visualized. Access is controlled by means of a password.



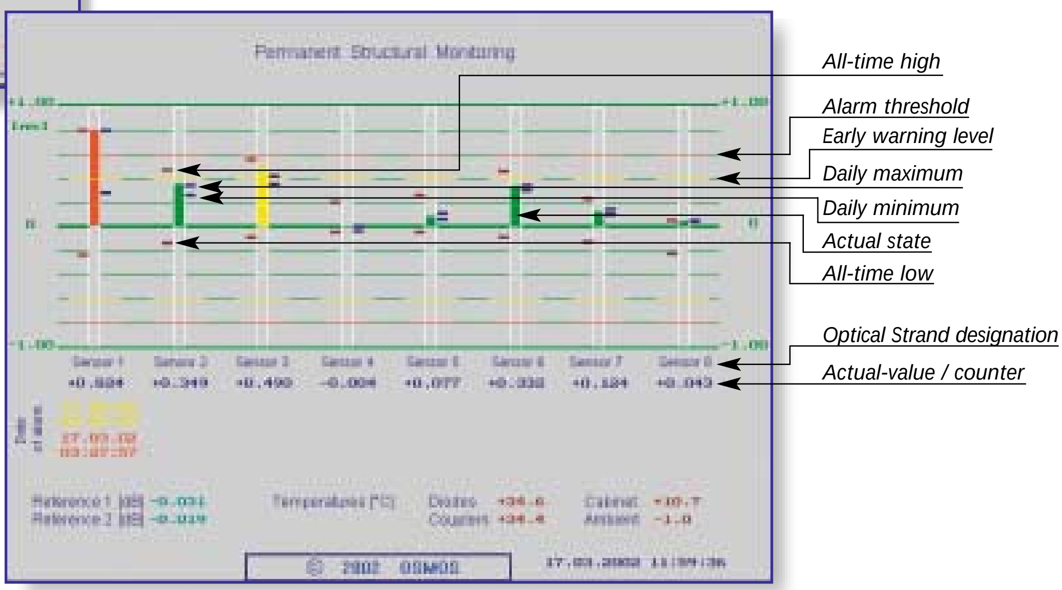
Monitoring station

Visualization of measured values as:
• X-Y graphs
• Polar graphs
• Tabular representations
• Bar charts / dashboards

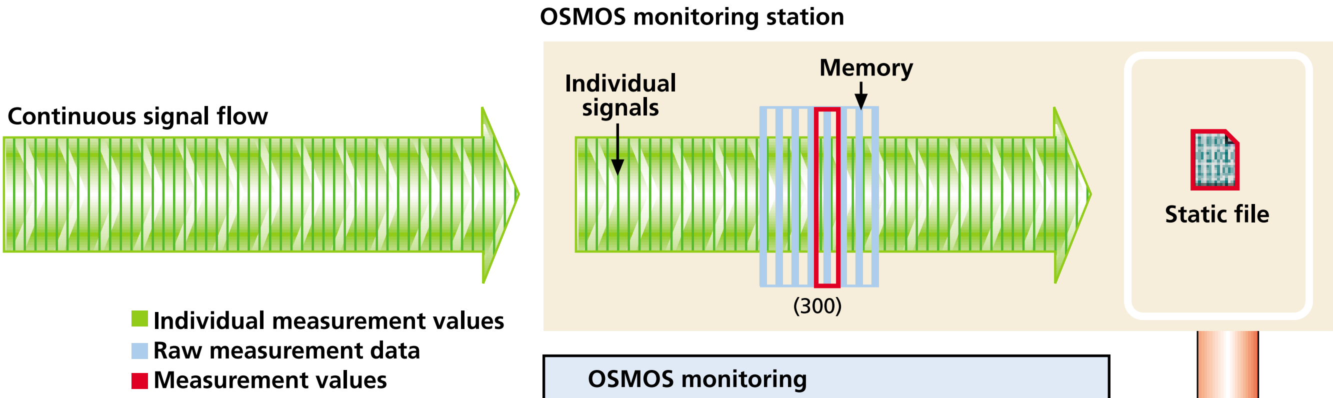
Measured values can be displayed on X-Y graphs or as dashboards (threshold values with alarm levels). Maximum and minimum values for each day and since commencement of the current measurement are displayed. The measured data can also be exported for further processing (jpeg, bmp, table -> ASCII).

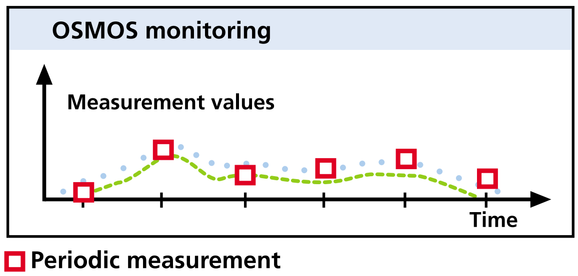


Dashboard display



The patented dashboard displays all the required information concerning the state of the monitored structure on the computer monitor. Raw data are represented clearly and graphically. Operational statuses range from green (all OK) through yellow (warning) to red (action needed).





Static measurement

Individual measurement values are scanned at a rate of 100 Hz.

An average value – the raw measurement value – is formed from these individual values over a configured measurement interval of 10 ms to 1000 ms and saved in a memory with a depth of 300 locations. The raw measurement data thus determined form the basis for calculating measurement values.

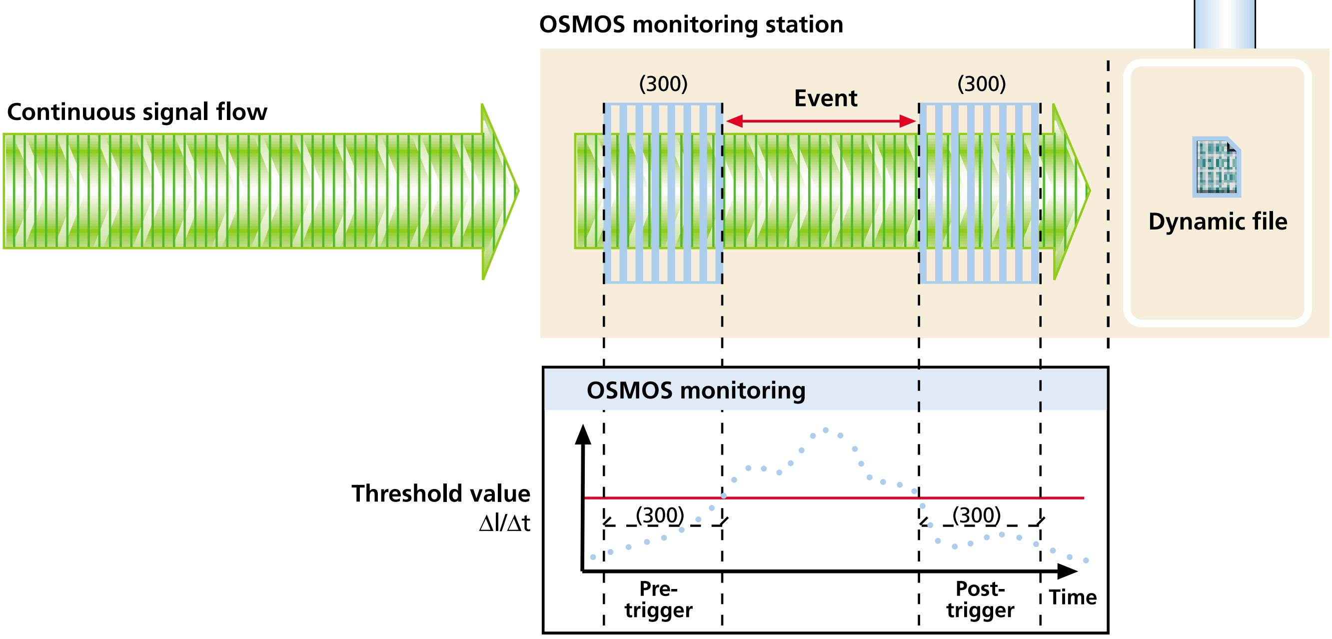
The memory contains raw measurement data (attenuation and temperature) as well as measurement values (expansion and displacement). These values are used to continuously form the static average value. The static interval can range from 100 seconds to one day.

Daily static average values are saved in a file.

Dynamic measurement

A dynamic threshold value ($\Delta l/\Delta t$) is specified to the system for dynamic measurements. If a measured value exceeds this dynamic threshold value, the instantaneous contents of the memory, the raw measurement values until limit undershoot as well as the next 300 raw measurement values are saved in a file.

If a measurement value exceeds or falls short of the corresponding thresholds, messages can be generated via SMS, e-mail, fax or SNMP traps on request.



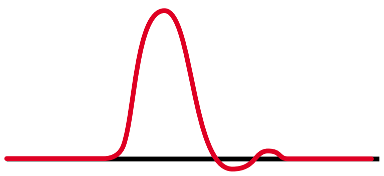
Dynamic and static monitoring

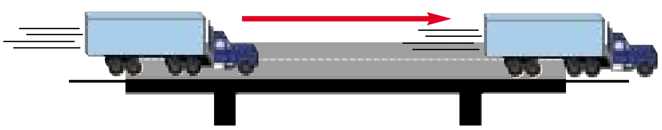
Dynamic data on structural changes in monitored buildings are registered continuously by the OSMOS system and saved for evaluation on reaching specified threshold values. Static data are averaged on the basis of these dynamic data and saved.

Static behavior is consequently the integral function of dynamic behavior.

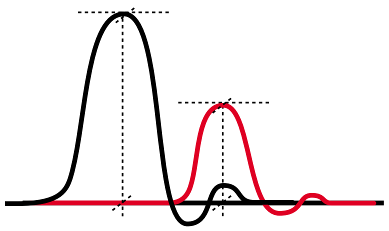
This permits a formulation of multi-functional statements concerning objects to be monitored.

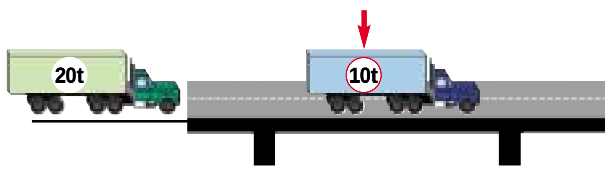
1. Verification of the elastic behaviour of a monitored structure



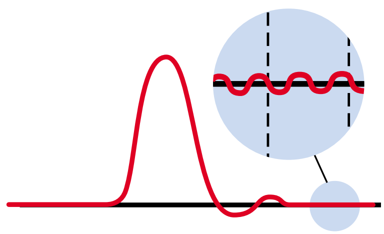


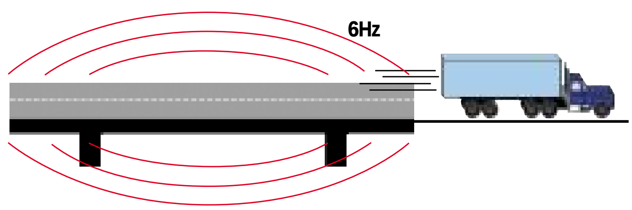
2. Amplitude of the event (for instance, weight or intensity)



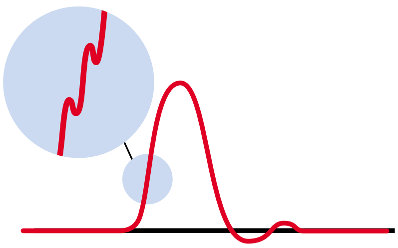


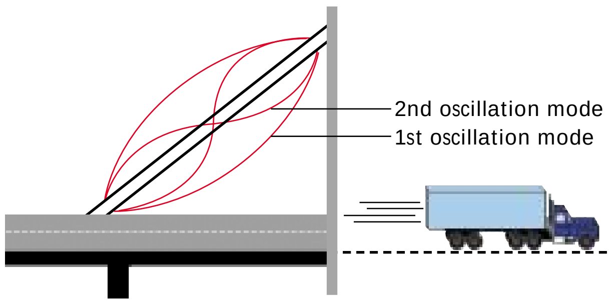
3. Natural period of the structure



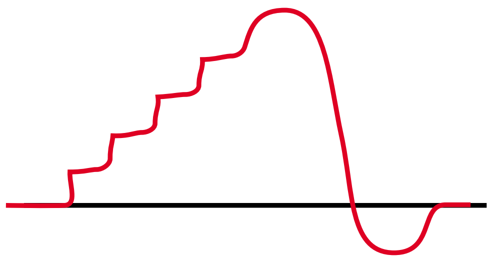


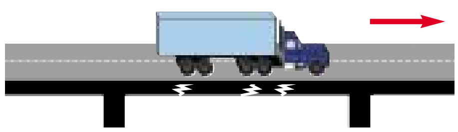
4. Oscillatory state



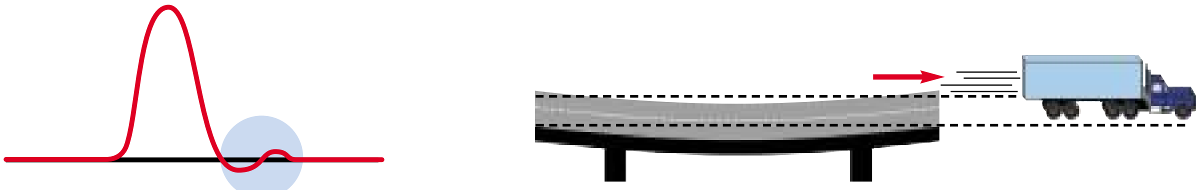


5. Detection of impacts and internal hairline cracks

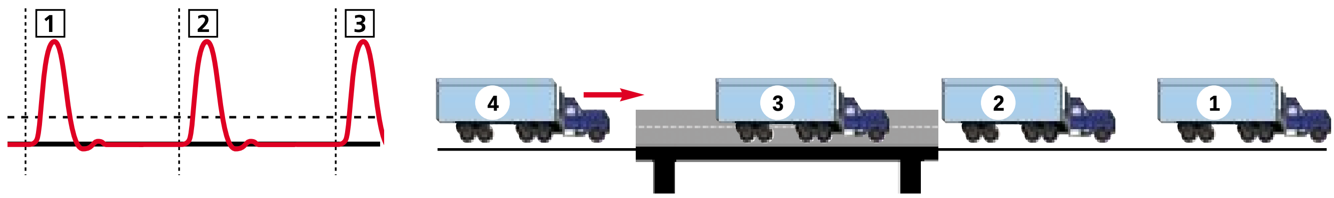




6. Visco-elastic behaviour

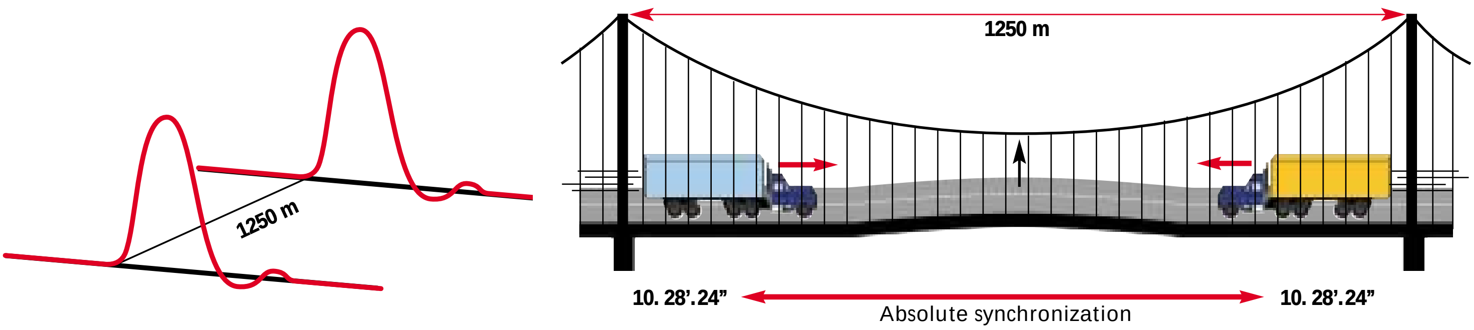


7. Counting (recurrent events)

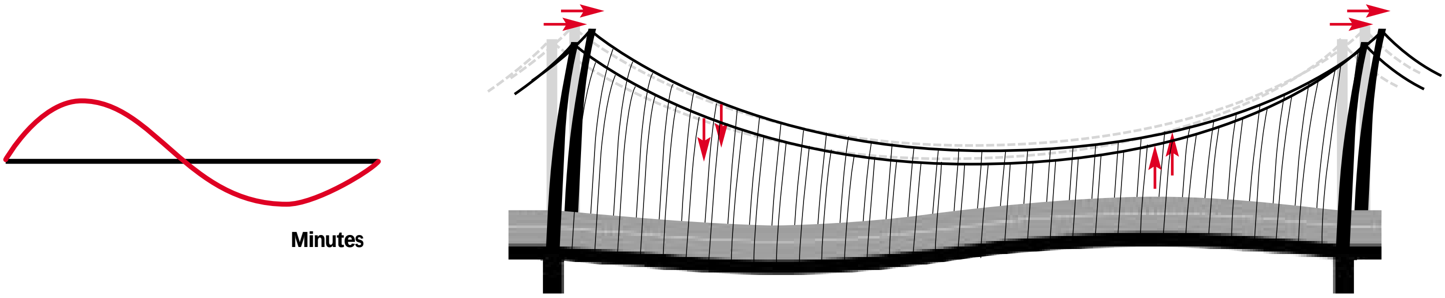


8. Event speed

9. Absolute synchronization of remote measuring points

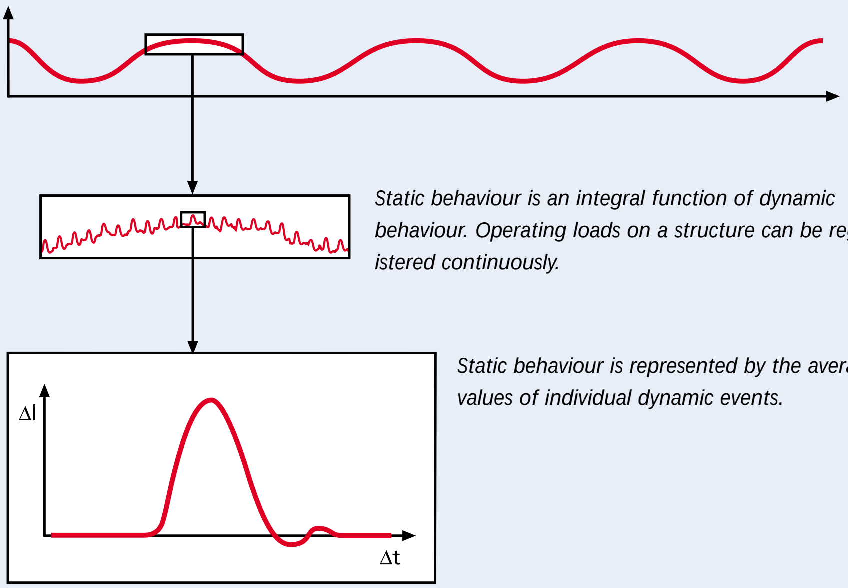


10. Detection of extremely low frequencies (ELF)



Advantages of continuous monitoring

A monitoring of long-term cycles permits complete descriptions of the history of structures. Individual dynamic events as well as normal structural behaviour over periods of several years are registered.

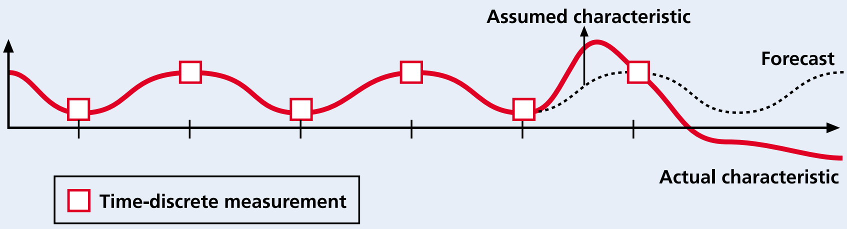


Static behaviour is an integral function of dynamic behaviour. Operating loads on a structure can be registered continuously.

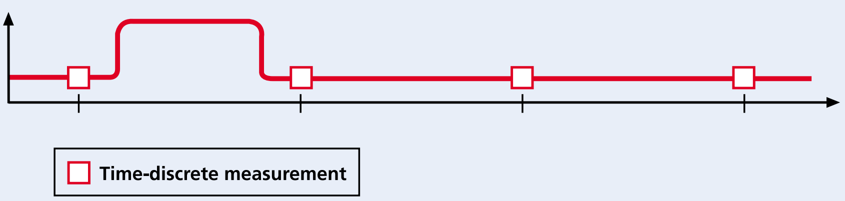
Static behaviour is represented by the average values of individual dynamic events.

Forecasting through continuity

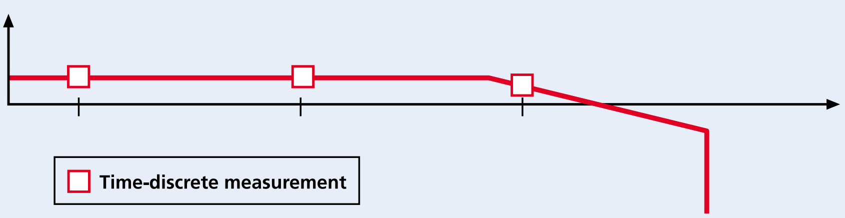
Only continuous monitoring permits reliable forecasts of the future behaviour of structures. Periodic measurements simply provide fragmentary information on structural characteristics, thus often resulting in false forecasts.



Decisive events, for example, structural overloading and related reductions in service life are not necessarily registered.



Deteriorations are detected very late and inaccurately.



Due to a lack of suitable process technology, insufficient consideration has been paid to the time factor during monitoring of structures.

Time cycles such as seasons, weekdays, daytime, nighttime, high and low tides, drive-shaft rotation and natural oscillations impose periodic loads structures. These cycles can range in duration from a few fractions of second to several years, and usually overlap.

The OSMOS system is the first of its kind to permit complete and continuous structural diagnostics: It registers the entire history of a structure to allow comprehensive analyses. This is achieved through continuous recordings of static and dynamic stress cycles such as tensions, deformations and displacements. Even in the event of a power failure, the integrated reference variable prevents a loss of orientation; thus permitting a correct resumption of recording of measured data following a restoration of power.

Sporadic measurements on structures provide data at ‘apparently’ important points in time. These random data acquisitions are used as a basis for drawing conclusions which can be highly erroneous. Consequently, this type of data acquisition is not suitable for reliable forecasts concerning structural behaviour.

A knowledge of the entire history of a structure makes it possible to identify and analyze periodic events. This permits a better evaluation of the acquired data. As the period of observation lengthens, an increasing amount of knowledge becomes available to the user, thus resulting in a continuous learning curve. This allows qualified forecasts of future structural behaviour as well as precise risk estimates. Structures can be observed objectively.

Only a continuous monitoring of structural loads and stress cycles reflects actual structural characteristics.

Monitoring station

osmos

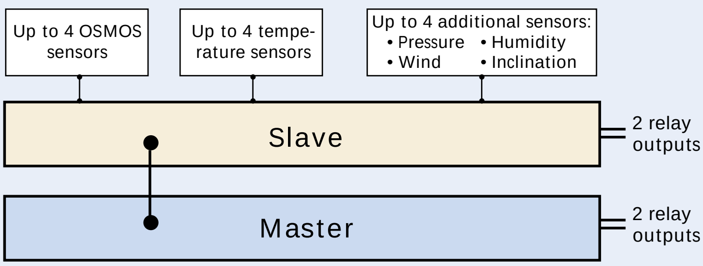
Monitoring station in a cabinet. *Monitoring station, wired.*

Description

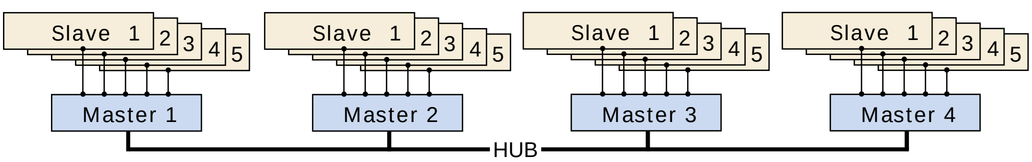
A specially developed signal processing unit is used for measuring, evaluating and displaying signals from the OSMOS fiber-optic sensors. It has a modular design and consists of two components: master and slave. The slave registers measurement values from the sensors, while the master processes and displays signals and performs communications with peripheral devices. Up to four OSMOS fiber-optic sensors, four temperature sensors and four analog signal transducers can be connected to a slave. Up to five slaves can be connected to a master via a bus (RS 485). Up to four masters can be networked together, thus allowing a measurement and evaluation of up to 20 slaves with a total of 80 fiber-optic sensors, 80 temperature sensors and 80 additional sensors for variables such as pressure, humidity, wind and inclination.

Applications

Minimum configuration of the monitoring station



Maximum extension stage of the monitoring station



Technical specifications

Master and Slave

Ambient temperature:	-20 °C to +50 °C, without air conditioning
Service life:	> 10 years
Emergency power supply:	24 V, 1.6 A, with charge control for an external battery
Specification:	EN61010
Housing:	19" plug-in module, one rack unit

Master

Operating voltage:	100 V to 260 V AC or 24 V DC, 30 W power consumption
Outputs:	24 V, 1.6 A for a slave 10/100 Base T Ethernet interface RS 232 serial interface Analog modem 2 relays, 24 V, 0.1 A changeover
Signal processing:	Connection of up to five slaves Dynamic average values, 10 ms to 1 s interval, configurable Toroidal-core memory for 300 dynamic average values, 3 s to 300 s Static average values, 100 s to 86,400 s (1 day), configurable
Alarms:	Dynamic (ΔI/ΔT), static with 4 thresholds, configurable Information supply locally via a relay or externally via e-mail, SMS, fax, SNMP trap, configurable
Storage:	Dynamic average values if required, or transgression of threshold values Static average values as standard
Display:	Dashboard, X-Y graph, polar graph, table
Communications:	With up to 3 further masters and 5 slaves http, telnet, SNMP, SMTP, FTP, TCP/IP, PPP, SMS, Fax
Disc storage capacity:	20 GB - During dynamic measurements + Master's maximum extension sufficient for 10 days. - During static measurements (1 value / hour)+ Master's maximum extension sufficient for 9500 years.

Slave

Operating voltage:	24 V DC, 1.6 A
Inputs:	4 fiber-optic sensors, 2 to 39 dB, 25 dB dynamics, 0.001 dB resolution, 0.005 dB accuracy, 100 Hz scanning rate 4 temperature sensors, Pt1000, 0.1 °C resolution, ΔT 0.1 °C accuracy, 0.5 °C absolute, 10 Hz scanning rate 4 voltage inputs for additional sensors, 0 V to 10 V DC, 16 bit resolution, 100 Hz scanning rate
Outputs:	RS 485 interface, 2 relays, 24 V, 0.1 A changeover

Order

Please fill out the spaces below. Select an underscored letter or value for each of the option fields provided.

Quantity: [ ]

Type: [M] Master

[ ] with Relais / without Relais (Ø)

Example:

Quantity: 1

Type: M

R

Quantity: [ ]

Type: [S] Slave

[ ] with Relais / without Relais (Ø)

Example:

Quantity: 1

Type: S

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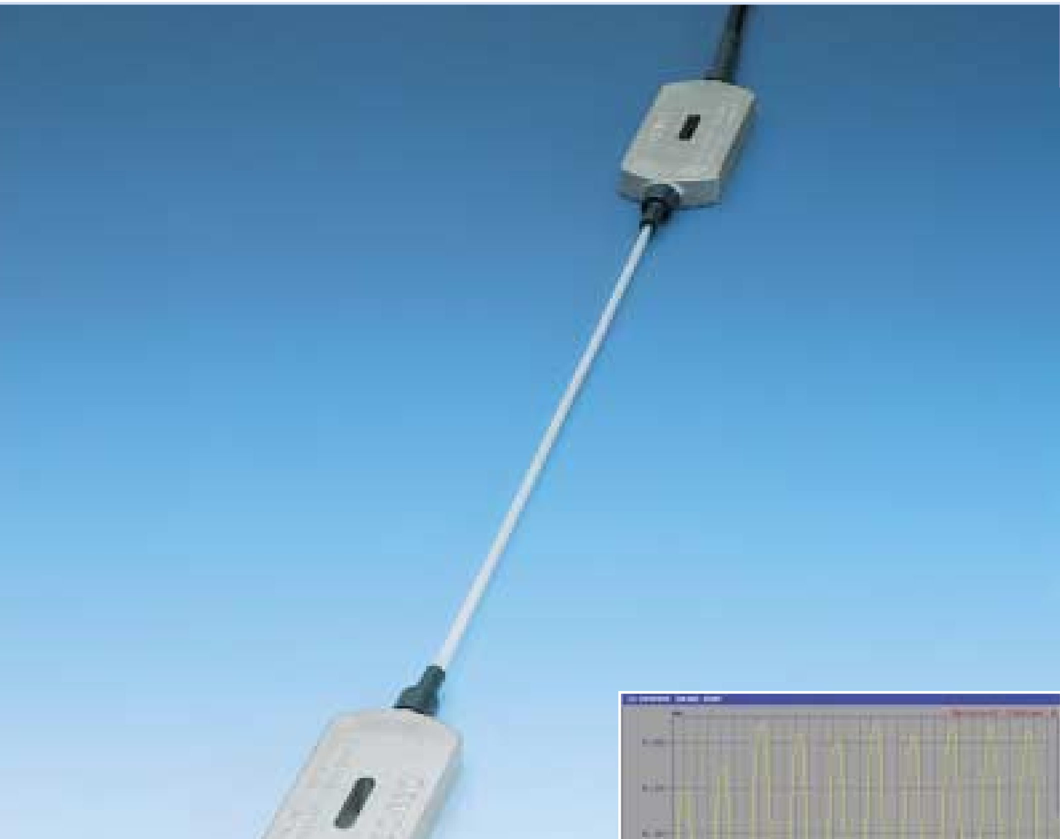
Optical Strand

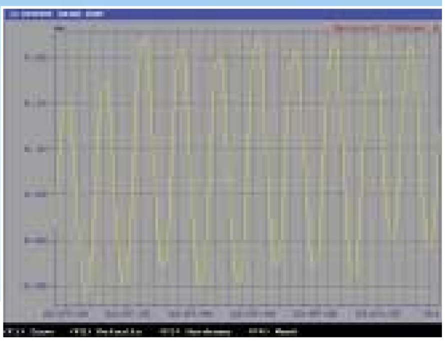
in a silicone hose



Description

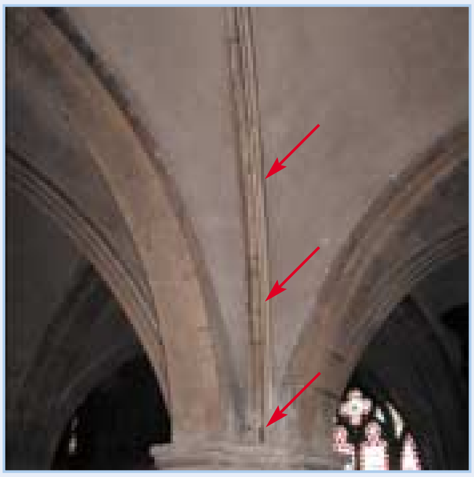
The optical Strand is an innovative device for measuring changes in geometric shape and position over long measurement ranges. This fiber-optic sensor is usually between one and ten meters long.

The sensor is available in a variety of configurations. As an optical strand in a silicone hose, the sensor can be attached directly to the surface of the structure to be monitored.



Dynamic measurement curve.

Applications



Optical Strand in a church vault.

Optical Strand on a steel prop.

Optical Strand on a concrete beam.

Technical specifications

Measuring range

Sensor length:	2 m / 5 m / 10 m
Measuring path:	10 mm / 25 mm / 50 mm
Resolution:	0.001 mm
Measuring accuracy:	Type ± 0.002 mm during dynamic monitoring; 2% of final value during long-term monitoring
Measuring frequency:	Up to 100 Hz
Repeating accuracy:	1%
Response speed:	Infinite (dead time = zero)
Temperature range:	-20 °C to +60 °C, operating range -30 °C to +60 °C, storage
Temperature sensitivity:	0.6 x 10^{-6} m/K
Stability, fatigue behaviour:	> 150 million measuring cycles without drift
Electromagnetic compatibility:	Insensitive and neutral
Service life:	> 20 years
Connection: *Without intermediate amplification:*	Customizable fiber-optic cable with a length of up to 1 kilometer to the OSMOS monitoring station *Sheathed optical cable with protective hose and plug connection*

Housing

Housing dimensions [L x W x D]:	[118 x 48 x 16] mm
Weight:	2 x 466 g and SI fiber/m = 20 g
Material:	Terminal box: Fe/Zn 8C, galvanized, blue, chromated in GG60 Protective sheath: Silicone of the optical Strand Cover: Galvanized steel, blue, chromated
Protection class:	IP65

Test

Vibration test:	55 hours at 20 Hz, ± 1 mm -> no drift

Accessories

Protective cable ducts:	On request
Sag prevention fixture:	On request
Attachment plates:	On request

Order

Please fill out the spaces below. Select an underscored letter or value for each of the option fields provided.

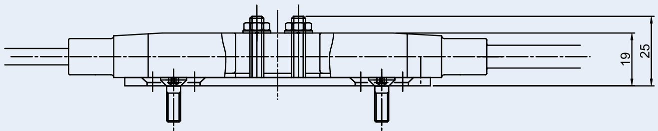
Quantity:		
Sensor type:	SI	
Sensor length:		2 m / 5 m / 10 m
Connection length: Optical cable (m)		Standard: 30 m
Operating mode:		Permanent / Sleeping

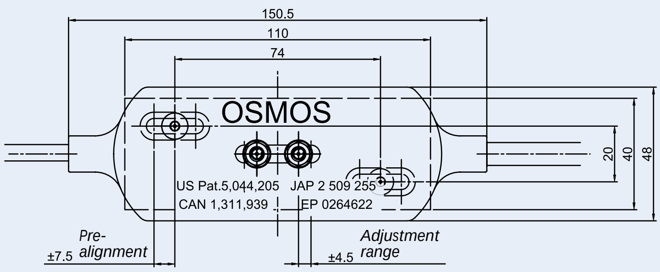
Example:

Quantity:	2
Sensor type:	SI
Sensor length:	5
Connection length: Optical cable (m)	50
Operating mode:	P

Fastening of the optical Strand.

CAD drawing





Optical Strand

in a spiral steel hose

Description

The optical Strand is an innovative device for measuring changes in geometric shape and position over long measurement paths. This fiber-optic sensor is usually between one and ten meters long.

The sensor is available in a variety of configurations. As an optical strand in a spiral steel hose, the sensor is meant for monitoring concrete components, in which it is installed together with the protective spiral hose, a terminating splice box and an optical connection cable.

Optical Strand in a reinforcing cage.

Applications

Optical Strand during concrete pouring.

Optical Strand post-installed in mortar.

Optical Strand in injected bores.

Technical specifications

Measuring range

Sensor length:	2 m / 5 m / 10 m
Measuring path:	10 mm / 25 mm / 50 mm
Resolution:	0.001 mm
Measuring accuracy:	Type ± 0.002 mm during dynamic monitoring; 2% of final value during long-term monitoring
Measuring frequency:	Up to 100 Hz
Repeating accuracy:	1%
Response speed:	Infinite (dead time = zero)
Temperature range:	-20 °C to +60 °C, operating range -30 °C to +60 °C, storage
Temperature sensitivity:	0.6 x 10^{-6} m/K
Stability, fatigue behaviour:	> 150 million measuring cycles without drift
Electromagnetic compatibility:	Insensitive and neutral
Service life:	> 20 years
Connection: *Without intermediate amplification:*	Customizable fiber-optic cable with a length of up to 1 kilometer to the OSMOS monitoring station *Sheathed optical cable with protective hose and plug connection*

Housing

Housing dimensions [L x W x D]:	[118 x 48 x 16] mm
Weight:	2 x 466 g and ST fiber/m = 92 g
Material:	Terminal box: Fe/Zn 8C, galvanized, blue, chromated in GG60 Protective sheath: Steel spiral with PVC enclosure of the optical Strand Cover: Galvanized steel, blue, chromated
Protection class:	IP65

Test

Vibration test:	55 hours at 20 Hz, ± 1 mm -> no drift
	No contact with the concrete vibrator

Accessories

Attachment plates	On request

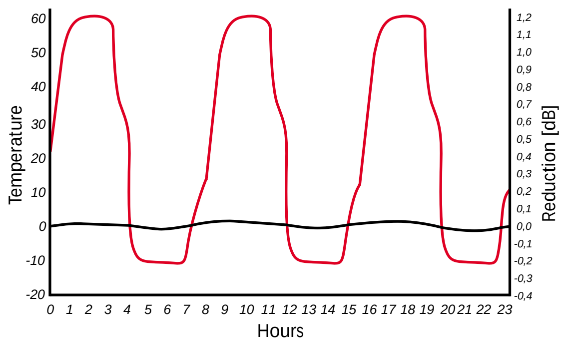
Order

Please fill out the spaces below. Select an underscored letter or value for each of the option fields provided.

Quantity:		
Sensor type:	ST	
Sensor length:		2 m / 5 m / 10 m
Connection length: Optical cable (m)		Standard: 30 m
Operating mode:		Permanent / Sleeping

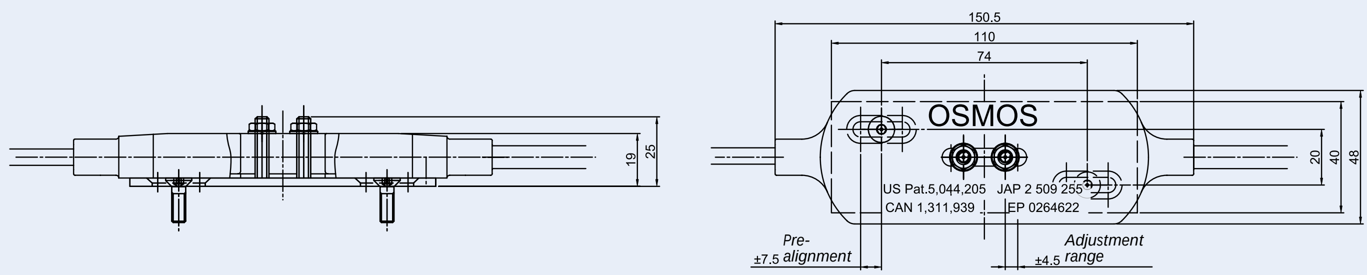
Example:

Quantity:	2
Sensor type:	ST
Sensor length:	2
Connection length: Optical cable (m)	40
Operating mode:	S



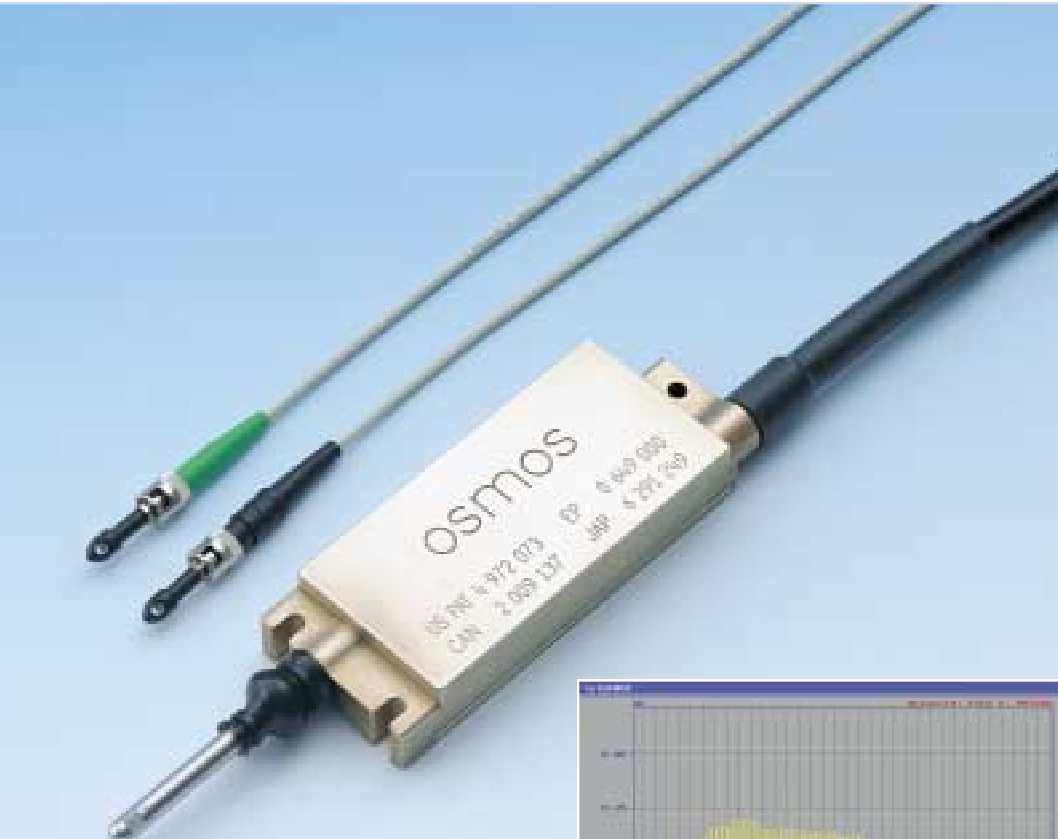
Temperature response of the optical Strand.

CAD drawing



Optical Extensometer

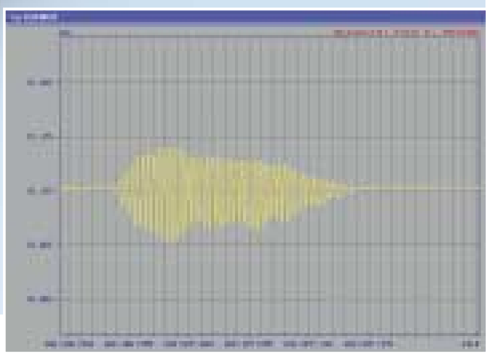
osmos



Description

The optical Extensometer is a robust and extremely accurate fiber-optic displacement transducer. Its compact design allows it to measure a wide range of length changes and displacements of up to 5 mm.

The optical Extensometer registers these mechanical variables with a sensing head and converts them internally into optical signals. Conversion is performed in accordance with a patented microbending principle. The optical Extensometer is able to register static and dynamic measurement variables over periods ranging from brief to many years, in accordance with the user's requirements.



Dynamic measurement curve.

Applications

Extensometer on a wooden structure.

Extensometer as a fissure monitor.

Extensometer as a probe on a steel structure.

Technical specifications

Measuring range

Measuring path:	5 mm
Measuring range:	0.1 m to 10 m
Resolution:	0.001 mm
Measuring accuracy:	Type ± 0.002 during dynamic monitoring; 2 % of final value during long-term monitoring
Measuring frequency:	Up to 100 Hz
Repeating accuracy:	1 %
Response speed:	Infinite (dead time = zero)
Temperature range:	-20 °C to +60 °C, operating range -30 °C to +60 °C, storage
Temperature sensitivity:	0.6 x 10^{-6} m/K
Stability, fatigue behaviour:	> 150 million measuring cycles without drift
Electromagnetic compatibility:	Insensitive and neutral
Service life:	> 20 years
Connection: *Without intermediate amplification:*	Customizable fiber-optic cable with a length of up to 1 kilometer to the OSMOS monitoring station *Sheathed optical cable with protective hose and plug connection*

Housing

Housing dimensions [L x W x D]:	[120 x 46 x 20] mm
Weight:	525 g
Sensing head:	High-grade steel, 50 mm long with hemisphere ± 6 mm or adapter M5
Material:	Messing
Protection class:	IP65

Accessories:

Sensing head:	50 mm, extensible to 10 m on request by means of a coupling or spring box
Special fastening material:	On request

Test

Vibration test:	55 hours at 20 Hz, ± 1 mm -> no drift

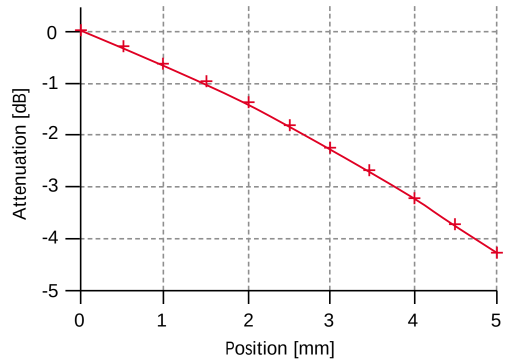
Order

Please fill out the spaces below. Select an underscored letter or value for each of the option fields provided.

Quantity:		
Sensor type:	EX	
Application:		Probe / Sensor
Measuring base:		(0.1 to 10) m
Connection length: Optical cable (m)		Standard: 30 m
Operating mode:		Permanent / Sleeping

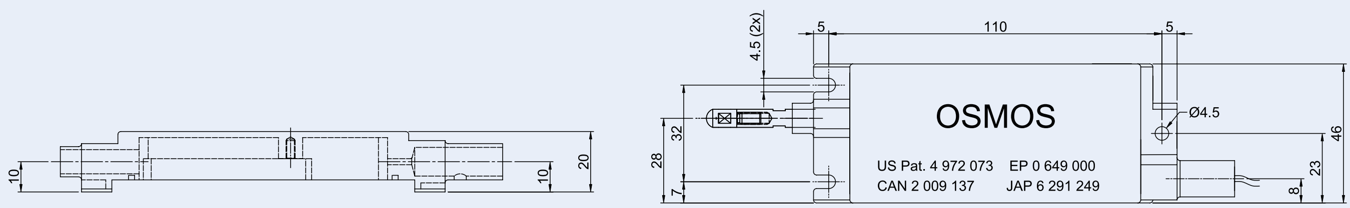
Example:

Quantity:	1
Sensor type:	EX
Application:	S
Measuring base:	0.5
Connection length: Optical cable (m)	40
Operating mode:	P



Calibration curve of an extensometer.

CAD drawing



EX-Large®

Description

The EX-Large sensor is similar to the optical extensometer but designed for longer measurement ranges of up to 0.5 m. It is based on fiber-optic measurement technology, so that its advantages include the fact that it can also be mounted at locations only accessible during assembly and not later during remote monitoring.

Two robust, nested cylinders accommodate the mechanism used for measuring the axial displacement of the EX-Large.

In accordance with available budgets and anticipated risks, the EX-Large can be operated in either the 'permanent' or 'sleeping' mode.

Picture, top right: EX-Large in the compressed state.

Applications

EX-Large connects abutments with bridges.

EX-Large mounting.

Detailed view of an EX-Large, zero-play attachment.

Technical specifications

Measuring range

Measuring range:	500 mm
Measuring base:	1260 mm to 1760 mm
Resolution:	0.1 mm
Measuring accuracy:	0.5 mm
Response speed:	Dead time = 1 ms
Repeating accuracy:	1 %
Transmission ratio and linearity:	See diagram
Temperature range:	-20 °C to +60 °C, operating range -30 °C to +60 °C, storage
Temperature sensitivity:	15 x 10^{-6} m/K
Electromagnetic compatibility:	Insensitive and neutral
Service life:	> 20 years
Connection: *Without intermediate amplification:*	Customizable fiber-optic cable with a length of up to 1 kilometer to the OSMOS monitoring station *Sheathed optical cable with protective hose and plug connection.*

Housing

Housing dimensions:	D: 130 mm L: 1500 mm
Weight:	21 kg
Material:	High-grade steel, aluminum
Protection class:	IP65

Accessories

Other housings are available	On request

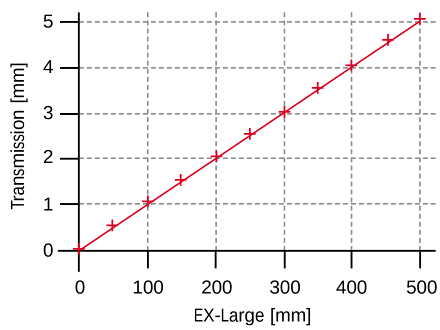
Order

Please fill out the spaces below. Select an underscored letter or value for each of the option fields provided.

Quantity:		
Sensor type:	EL	
Connection length: Optical cable (m)		Standard: 30 m
Operating mode:		Permanent / Sleeping

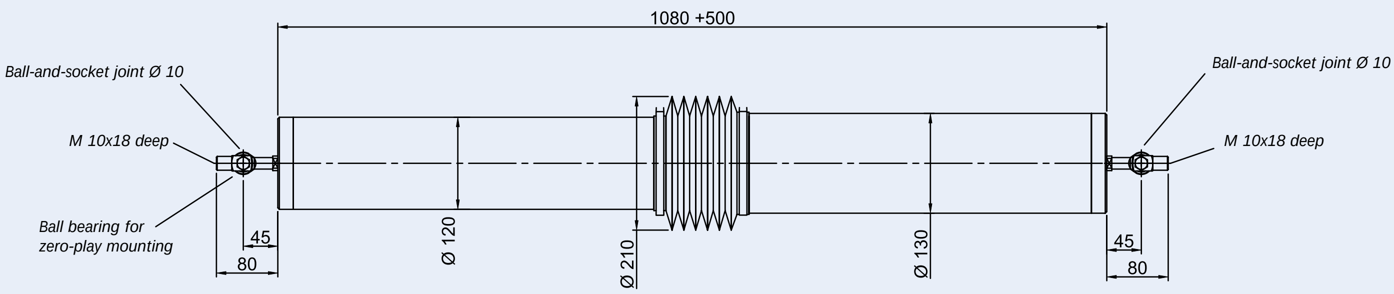
Example:

Quantity:	2
Sensor type:	EL
Connection length: Optical cable (m)	60
Operating mode:	P



Transmission ratio of the EX-Large.

CAD drawing



X-Trigger

Top photo: X-Trigger as a fissure width monitor, wired; Bottom left photo: X-Trigger as a sleeping alarm fuse; Bottom right photo: X-Trigger as a probe.

Description

As a sensor, the X-Trigger measures changes in length between two points which usually also serve as fastening points and are ideally located on both sides of the object to be monitored, for example, a joint or fissure.

On transgression of a previously specified threshold value, the optical characteristics of the X-Trigger change; this is signaled at once via an optical cable to an opto-electronic converter, the OSMOS monitoring station. The X-Trigger accordingly offers a yes/no decision. Events are localized only after they have occurred.

The X-Trigger can be operated in various modes, in accordance with the available budget and anticipated risk. In addition to the ‘permanent’ and ’sleeping’ modes, a special feature here is the ‘prepared’ mode in which the X-Trigger can be mounted without a cable and activated subsequently when required.

Applications

Wired X-Trigger along an extended brickwork structure.

X-Trigger following actuation, visual alarm.

Technical specifications

Measuring range

45 available settings, taking into considera-tion the operating modes: permanent sleeping and prepared.	Adjustable threshold values: 0.5 / 1.0 / 2.0 / 3.0 / 4.0 (mm)	Trigger release: Tension Pressure X - - X X X *(immobility)*

Sensitivity:	0.01 mm
Absolute sensitivity:	± 5 % of the set threshold value
Response speed:	Dead time = 5 ms
Temperature range:	-20 °C to +60 °C, operating range -30 °C to +85 °C, storage
Temperature sensitivity:	15 x 10^{-6} m/K
Reversible measurement setting:	> 100 'trigger' without drift
Electromagnetic compatibility:	Insensitive and neutral *(use in areas endangered by radiation and explosion is possible)*
Resistance to media:	Ultraviolet-light and oil resistant (including seal)
Service life:	> 20 years
Connection: *Without intermediate amplification:*	Customizable fiber-optic cable with a length of up to 4 kilometers to the OSMOS monitoring station *Sheathed, special OSMOS optical cable with plug connection.*

Housing

Housing dimensions [L x W x D]:	[145 x 160 x 40] mm
Weight:	400 g
Sensing head:	50-mm steel probe
Material:	PC 30 GF (Makrolon®, Bayer)
Protection class:	IP65
Release signal a) not wired: b) wired:	Signal pin (red) for visual checks On-site with an OSMOS optical-waveguide cable, audio, SMS, fax, modem, e-mail

Test

Mechanical shock test:	1 m free fall
Impact strength:	7.5 kJ/m^2
Vibration test:	Structural safeguarding against false alarms

Accessories

Measurement-path decoupler for trigger-irrelevant tolerance:	On request
Measurement enlarger *(> 4 mm)*:	On request
Measurement-base enlarger:	On request

Order

Please fill out the spaces below. Select an underscored letter or value for each of the option fields provided.

Quantity:		
Sensor type:	XT	
Threshold value:		0.5 / 1.0 / 2.0 / 3.0 / 4.0
Direction:		Tension / Pressure Immobility
Application:		Fissure / Sensor
Operating mode:		Permanent / Sleeping Not wired

Example:

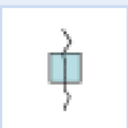
Quantity:	22
Sensor type:	XT
Threshold value:	2.0
Direction:	T
Application:	F
Operating mode:	P

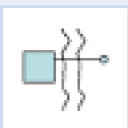
Color selection

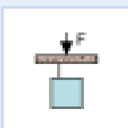
Standard color:	Beige	UN 8014
Colors available on request:		
	Yellow	UN 1245
	White	UN 0005
	Rust	UN 8005
	Black/grey metallic	UN 9017

This color selection is available at extra charge and a minimum order quantity of 100 units. Additional colors are available at extra charge for quantities in excess of 300 units.

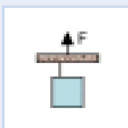
Application possibilities


Fissures < 40 mm

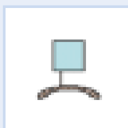

Fissures > 40 mm

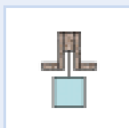


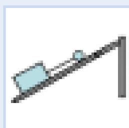
Sagging

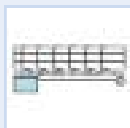


Distancing


Curvature


Spandrel gaps


Guying, inclined ropes


Tension monitoring

Safety product groups

osmos

From a sleeping sensor to real-time monitoring

Stepped monitoring in accordance with risk, demand and budget

The OSMOS safety system can be adapted flexibly to safety and financial requirements through a use of different safety concepts. Monitoring can be performed at various levels in accordance with the risks involved and available budget:

Prepared mode

One possibility, in the case of new buildings and existing structures, is the installation of an X-Trigger which supplies a yes/no decision without the need for additional cabling.

Sleeping mode

The sleeping mode is intended mainly for use at low risk levels – especially in the case of new buildings; here, the sensor is installed without a direct, permanent connection to a monitoring station. Following a reference measurement, the sensor assumes a sleeping mode in which it can be used to detect changes in the length of the enclosing structure. On-site measurements can be performed following establishment of a connection to the monitoring station whenever required.

Permanent mode

Continuous measurement via a connection to a monitoring station is possible with and without remote queries. The objective here is permanent, real-time monitoring. Data acquisition and analysis also take place in real time. The system operates continuously to permit constant monitoring.

Safety product groups

	Prepared	Sleeping	Permanent
Hardware	Binary threshold trigger • *X-Trigger*	Family of Optical Strand • *EX, SI, ST, EX-Large* • *Optical caterpillar* *+ cabling* Binary threshold trigger • *X-Trigger* *+ cabling*	Family of Optical Strand • *EX, SI, ST, EX-Large* • *Optical caterpillar* *+ cabling* *+ monitoring station* *+ inspection unit* Binary threshold trigger • *X-Trigger* *+ cabling* *+ monitoring station* *+ inspection unit*
Service	• *Consultation* • *Installation* • *Commissioning if required*	• *Consultation* • *Installation* • *Reference measurement* • *Inspection* • *Maintenance* • *Monitoring report or activation, if required*	• *Consultation* • *Installation* • *Inspection* • *Maintenance* • *Remote monitoring* • *Regular monitoring report*

Integrated safety for structures

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