



## Contact wire measuring

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ELAG Elektronik is the specialist for dynamic, non-contact distance and profile measurement. The measurement technology of OPTIMESS is the perfect solution for the measurement of overhead line systems. Various sensors and combinations are available to provide the best solution for our clients. ELAG offers the whole range, from individual measuring devices to complete turnkey systems.



## OPTIMESS CAT

All measuring systems of the OPTIMESS CAT series work with high-precision laser technology. They have been developed for the harsh railway environment and defy the most unfavorable environmental conditions. Temperatures from  $-20^{\circ}\text{C}$  to  $50^{\circ}\text{C}$  are no problem. Whether in broad daylight or in the darkest night, in light rain or snowfall, in wind and fog, the OPTIMESS contact wire measuring systems reliably and accurately provide the position of the contact wire. At the same time, they are designed for daily use; and this with the highest reliability. In addition to standard products, ELAG also offers solutions that are perfectly custom-made to the customer's needs. This includes the hardware, such as operating and display elements, as well as individual software, which is completely adapted to the customer's wishes.



## Laser sensors

Different sensor types are available for measurement. Each has their respective advantages and disadvantages. The various options are compared below. The following are the different sensor types.



## OPTIMESS CS / CSD Scanner

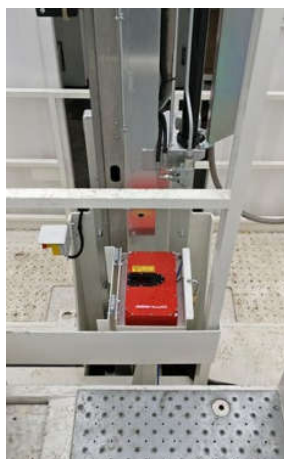
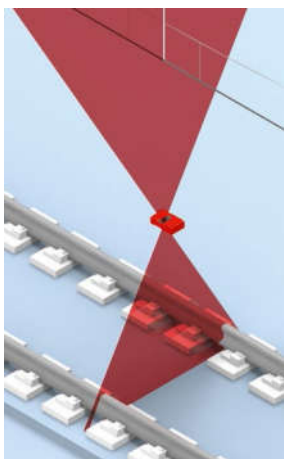
The OPTIMESS CS / CSD is extremely compact and with less than 4 kg also a really lightweight device. Nevertheless, it is very robustly built and waterproof according to IP67. Even without the optional protective housing, it's already equipped with a smart window heating to reliably prevent condensation in critical situations. Even a blow-off device is integrated in order to be able to keep the panes clean at all times using compressed air.

The difference between the CSD and the CS scanner is the double scanning range. The OPTIMESS CS has a 60° measuring range upwards, while the CSD additionally offers a 60° scanning range downwards. This makes the CSD an ideal device for simultaneous detection of contact wires and rails. With a single sensor, the position of the overhead line in relation to the track can thus be measured directly. No special calibration and adjustment are required. This concept is perfect, if the field of view is both upwards and in the direction of the rails. Especially for two-way or trolley vehicles, this is often an optimal and cost-effective configuration. The scan rate in this application ranges up to about 30 Hz for the CSD, and up to 50 Hz for the CS.



## OPTIMESS WSH

The laser scanner OPTIMESS WSH is the result of consequent further development of the OPTIMESS laser scanners. Its scan rate is unmatched and unique. With the help of a high-precision polygon mirror, up to 400 scans per second are achieved. The maximum frequency of the individual measuring points is one million measurements per second. With a high speed train traveling at 360 km/h, the scanner still achieves a remarkable resolution of 4 position values per meter. Of course, this scanner also fulfils the typical OPTIMESS characteristics in terms of robustness and durability. A controlled window heating is also integrated here as standard.





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## OPTIMESS 2D

If highest measuring rates are required, the OPTIMESS 2D is the best choice. It's the undisputed world leader in terms of speed – with up to 6 kHz. Nevertheless, it's one of the cheapest options in terms of cost. This sensor is based on the light section method and, unlike the scanners, has no moving parts. Robustness and durability are not an issue here either.

However, this type has a smaller measuring field. The maximum distance is two to four meters.

As long as the position of the sun is not closer than approx. 20° with the zenith, there's no reason why not to measure during the day.



## Compensation


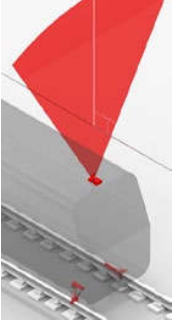
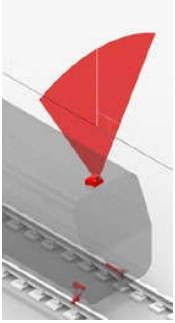

As a rule, the position of the overhead contact line should be output opposite to the track and not opposite to the vehicle. Since the vehicle with the overhead line scanner moves in relation to the track (deflection, lateral inclination, sinusoidal running, wheel wear), this must be taken into account. In order to ensure accurate results, it's mandatory that the position of the vehicle relative to the track is measured, too. This data can then be used to compensate for the movement.

For this purpose, the system is extended with two OPTIMESS 2D profile sensors. These are mounted under the vehicle and measure the complete rail head and use it to calculate the reference height, the lateral inclination and the virtual center line between the rails. Whether normal railway rail or grooved rail is irrelevant. The system can therefore also be used for trams/streetcars without any problems.


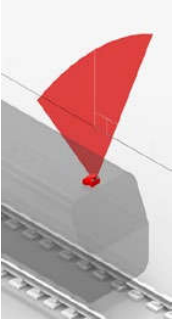



## Comparison of the different systems

With compensation (+C: Profile sensors)

OPTIMESS	CSD	CS+C	WSH+C	2D+C
				
<b>Scan Rate</b>	★	★ ★	★ ★ ★	★ ★ ★ ★
<b>Measuring field size</b>	★ ★ ★	★ ★ ★	★ ★ ★	★
<b>Speed</b>	<80km/h	<160km/h	unlimited	unlimited
<b>Price</b>	\$	\$\$\$	\$\$\$\$	\$\$\$

Without compensation

OPTIMESS	CS	WSH	2D HLS
			
<b>Scan Rate</b>	★ ★	★ ★ ★	★ ★ ★ ★
<b>Measuring field size</b>	★ ★ ★	★ ★ ★	★
<b>Speed</b>	<160km/h	unlimited	unlimited
<b>Price</b>	\$	\$\$	\$

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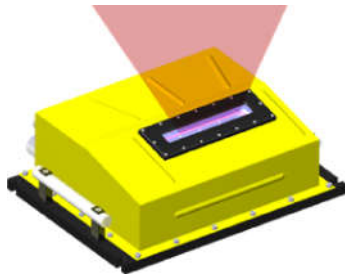
## Accessories

The systems can be extended with a wide range of accessories. This includes protective housings, operating units, processing computers, protective housing ventilation, and much more.

But we also gladly implement cameras including illumination, GNSS (GPS) or customer specific interfaces, as well as other customer requests. The following are a few examples.

## Protective housing

Protective housing for the OPTIMESS WSH with integrated air purge and heated protective screen.



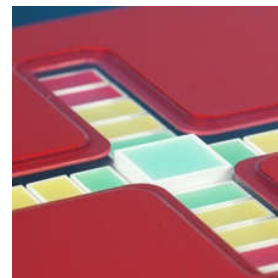
## Processing

Example of a robust device for processing. All connectors are self-locking or screwed in. The power supply for the various sensors is already integrated. It's made for the rough conditions in the railway environment, waterproof, vibration resistant and a temperature range of -20°C to +50°C are a matter of course here.



## Customized control units

An operation directly at the device for outdoor applications, a crosshair for the contact wire adjustment are only examples for the many possibilities.



## Accessories

Cameras, headlights, positioning via GNSS, rotary encoder on the wheel, inertial measurement unit; possibilities are (almost) endless.





ELAG Elektronik AG has been developing and supplying measuring systems world-wide since 1983, setting the highest quality standards.

From laser sensors to complete ready-to-use measuring systems, including sensors, mechanics and user software, everything is developed and manufactured in-house at ELAG Elektronik AG by a powerful, innovative team of engineers. This means that you, as our customer, can benefit from sophisticated sensors and seamlessly integrated measuring systems, where we can guarantee highly precise results and simple operation.

We consciously want to be close to you. We are convinced that short communication channels are decisive in ensuring that your requirements are implemented by us in consistent high quality.

This also includes that we accompany you competently, from the sales consultation, commissioning up to the maintenance of your devices.

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