

## Fault Detection Reduces Maintenance Costs

All rolling stock belonging to a train company is subject to stringent checks as part of a periodic maintenance plan. While this in part constitutes a safety requirement, it is also a matter of getting the maximum mileage out of the carriage during its service life. Even if the maintenance plan is carefully followed, damage to carriages may have time to develop in-between these checks. In order to allow simple and continuous checking of the wheel quality, the German company Innotec Europe has developed a measuring system called LASCA® which allows this information even when the train passes the measurement point at full speed.



The system is easily mounted with clamps directly to the side of the rail track and measures, except from wheel quality, the load on each wheel, boogie, wagon and train set as well as the speed. In addition, you can also record the traffic flow at the spot in question. In fact, over 60 parameters can be controlled while a train passes by.

### Measures the force on the rail

The measurement unit consists of a housing containing a laser in one end pointing at a PSD in the other. When a train passes the force on the rail will cause a vertical deflection of the laser beam. This deflection is measured by the PSD and can, by thorough signal analysis, be converted to information about wheel loads and wheel defects.



Figure 1. Principle sketch of the LASCA® measurement unit.

“The choice of the PSD as the sensing device was crucial to achieve the performance needed”, says the measuring system’s inventor, Mr. Siegfried Pieper of Innotec Europe and continues: “By utilizing the high speed and high reso-

lution possibilities the PSD enables, we have developed a system which measures a wheel load of over 20 tons with a resolution of one kilogram, and this on a train passing at 350 km/h”.

This performance makes the LASCA® superior to competing systems based on other techniques, e.g. strain gauge sensors or acoustic measurement methods.

“The main reason for choosing SiTek’s PSD is that they offer the best resolution on the market. Moreover, the device has proved itself resistant to both moisture and damp, which is obviously extremely important to us,” says Mr. Pieper.

### Early warning of wheel defects

The wheel defect analysis is made possible since each defect has a characteristic footprint, different from a perfectly round wheel. By signal processing wheel flats, out-of-roundness and built-ups can all be measured and categorized. This, in essence, provides an early warning system if there is anything wrong, so that a carriage can be taken out of service and thoroughly inspected even between scheduled maintenance checks.

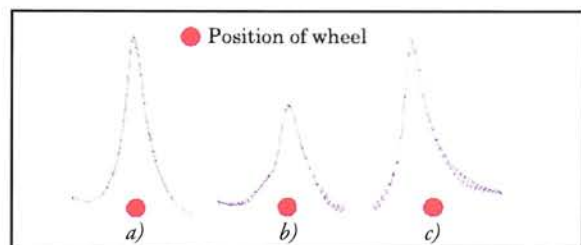


Figure 2. Typical footprints for a) a perfect wheel, b) a polygon shaped wheel and c) an out-of-round wheel.

### Multiple areas of application

Due to the unique design and performance of the system its use isn’t limited only to train control.

“The sensor can also be used to control bridges and high buildings like skyscrapers or wind power stations and we see a great potential in these kind of applications as well”, concludes Mr. Pieper.



## Co-operation with Mid-Sweden University



*Campus at Mid-Sweden University in Sundsvall*

Ever since SiTek invented and commercialised the modern PSD 28 years ago we have been known as the leader in PSD development. We have now further intensified our development efforts by starting a cooperation with the Electronics Design Division at Mid-Sweden University in

Sundsvall, Sweden. The Sensor Group at the Electronics Design Division has a long documented experience in silicon detectors, mainly in device and process research but also in electronics and read-out related topics.

Their research has during the last couple of years been focused towards growth related technologies and hence research related to radiation detectors in general and especially PSDs is a perfect match to their profile.

The first project, "Innovative sensor technique for industrial applications", is a two year project sponsored by EU within the 6<sup>th</sup> framework programme.

Within this project, research on the next generation PSDs will take place and we foresee that it will be the start of a long and fruitful cooperation leading to further developments of the PSD performance as well as new products suitable for both old and new application areas.

For more information please contact SiTek's R&D Manager Mr. Lundgren, +46-31-3400341

**ELECTRONICS**  
Design Division



**Mittuniversitetet**  
MID SWEDEN UNIVERSITY

## New Face at SiTek



My name is Linus Löfgren, I have a Master in Engineering Physics and I am now responsible for chip processing and, to some extent, machine service. The task of maintaining and improving SiTek's high chip quality is

challenging and stimulating. For instance I have recently spent some time adapting and calibrating our new and automatic mask aligner to SiTek's requirements.

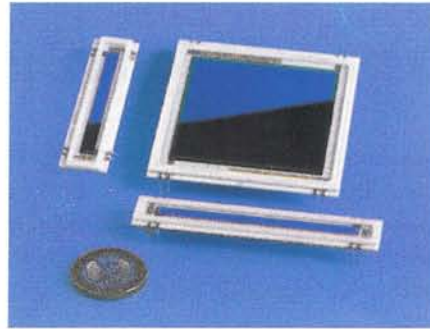
Music is a never ending source of joy for me. When I add records to my collection I dig deep into the last 50 years of popular music. Mod music of the sixties, punk rock of the late 70's and the world wide riot girl movement of today are all amongst my favourites. I have spent a year in London studying and gathered friends from all over the world, from Finland to Mauritius and anything in between. To debate and share views of the world with international as well as Swedish friends over a home made dinner is really nice and something I like to do as often as possible.



# SiTek Supplies The Largest PSDs

Now SiTek have added new dimensions to our wide range of standard components. We have experienced a high demand for larger PSDs and SiTek now offers three new versions, available from stock, the 1L45 (45 x 3 mm<sup>2</sup>), 1L60 (60 x 3 mm<sup>2</sup>) and 2L45 (45 x 45 mm<sup>2</sup>).

Application areas where larger PSDs can be of great advantage are when measurements are done at long distance for example in flatness measurements on large foundations. We are as usual at your service to answer any of your requests or questions.



SiTek PSDs 1L45, 1L60 and 2L45

## Investment Increasing Quality

*SiTek is well known for having the shortest delivery times of all PSD manufacturers, especially on custom designed products. To ensure that we can keep our short delivery times also with the increasing demand we see on our products, a continuous work on our production line automation is on-going. We have now taken the next step in this process by the purchasing of a fully automatic mask aligner, EV620 from EV Group in Austria.*

The manufacturing of the PSD chips is, like most semiconductor device manufacturing, done by adding layers of materials to a semiconductor wafer until the final structure has been created. Each layer has its special purpose, e.g. active area, metal contacts etc, and it needs an individual pattern to work properly. This pattern is defined by a mask aligner. Since the functionality of the complete PSD is built by the interaction between all these layers it is of greatest importance that the patterns of the layers are accurately aligned to each other. In fact, for some of our devices, the alignment between



EV620 fully automatic mask aligner now used at SiTek

layers has to be done with an accuracy of only a few microns to fulfil the demands on functionality our customers have.

To manufacture the duo-lateral high linearity PSD, that SiTek does, puts an even higher demand on the alignment. This is because the patterns on the back side must be aligned to the ones on the front as well, with the same high accuracy.

As the PSD chip is built by several layers, each wafer will pass through the patterning stage numerous times during the manufacturing process. Hence, it is not only important with high alignment accuracy but also with high through-put.

A mask aligner that fulfils all these demands is the EV620 from the Austrian manufacturer EV Group. The high through-put is ensured by the robot wafer handling as well as the automatic alignment feature and the high accuracy is obtained by an advanced automatic pattern recognition system. The robot handling is not only favourable from a through-put point of view, but also from a quality point of view. Manual wafer handling always increases the risk for particle contamination and by introducing the fully automatic robot handling system the manual handling is kept to a minimum during this critical process step. Since the new mask aligner not only increases the capability in terms of through-put but also pushes the accuracy and resolution into the sub-micron region, our possibilities for further PSD developments has also increased. With the new mask aligner we have put ourselves in a good position for the future and made us well prepared to meet the increased demands on our PSDs both from customers as well as applications.

# See us at Electronics/EP, 1-3 Feb

SiTek welcomes all customers and suppliers the 1st – 3rd February at the Stockholm International Fair. Take the opportunity to meet us in our booth **A15:30** and we will tell you more about our position sensing detectors (PSDs) and how you can use their unique qualities.

We will be at your service with all available knowledge during these days so take this opportunity to learn more about our wide range of standard PSDs and the special features our customised PSDs have, such as stray light elimination, optimised sensitivity and optimised speed.

Let us present our new standard PSDs with unique dimensions and experience our products in real setup applications.

Participate in our laser shooting contest, a very nice prize to the best shooter, the latest **MP3 Player, MP400, from Jens Of Sweden**

We welcome you to our booth **A15:30** to learn more about our products in non-contact measurements.

For further information: [www.elektronikmassan.com](http://www.elektronikmassan.com)



Actual size



## Coming Exhibitions World-wide

Our distributors will be attending the following exhibitions and you are very welcome to visit their booth. For further information please contact us or our distributors.

Country	Distributor	Exhibition	City	Date
Germany	Laser Components <a href="mailto:info@lasercomponents.com">info@lasercomponents.com</a> <a href="http://www.lasercomponents.de">www.lasercomponents.de</a>	Sensor Test	Nuernberg	10-12 May -05
		LASER	München	13-16 June -05
The Netherlands	Promis Electro Optics <a href="mailto:info@gotoPEO.com">info@gotoPEO.com</a> <a href="http://www.promis.electro-optics.com">www.promis.electro-optics.com</a>	Precisiebeurs	Koningshof Veldhoven	10-11 November-05
USA	On-trak <a href="mailto:info@on-trak.com">info@on-trak.com</a> <a href="http://www.on-trak.com">www.on-trak.com</a>	Photonics West	San Jose	25-27 January-05