

SENSOR.KOSMOS.

Issue 30 | April 2023



Back from the Pandemic

Sensitec starts the new year with successful XMR-Symposium

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AFTER THE LOCKDOWN

No more lockdown in sight, the corona virus has been defeated, it can start again! Actually, the time had already come before last winter - in addition to the most far-reaching elimination of the mask requirement, all the inhibitions built up over the past two years to get together in groups or even at large events fell away. After the hitherto fortunately rather mild winter months, it is only now that one really becomes aware of the fact that we have arrived at a piece of normality again. Personal contact with business partners, the conversations at trade shows and the small talk during breaks at events, and last but not least, visits to customers on site. People who are pleased, confidence in their faces and the motivation to get going again.

Of course, the coronavirus has not been defeated - it has merely weakened in order to stay. So we'll share the planet with SARS-CoV-2 B.1.x - we'll figure it out.

Back to the lockdown or with the view from Sensitec's point of view more to the double lockdown. While the corona-related lockdown hit most companies by surprise and almost brought them to a standstill, Sensitec felt it was the anchor throw to the brake, on which they already stood during the sales process anyway. The period between "signing" and "closing" was unusually long at Sensitec, which was largely related to more complex bureaucratic issues. This phase feels like the no man's land between two borders – neither side is quite responsible. And then Corona with lockdown, home office, reorganization of production and office operations, etc.

With the closing of the sales process and the new owner **Sinomags**, the above mentioned anchor was lifted. Significant progress has been made in many areas over the past year and a half. Investing in new assets, internal reorganization and a long-term strategy are also major challenges due to the changes, but they bring new momentum and motivation.

Now, without the risk of corona-induced lockdown in our neck, we are on our way again, with new products, our powerful technology and the will to equip sustainable and efficient applications with the best possible sensor technology. For customers on site, at trade fairs and events – advancing solutions together and personally.

Here it is a good idea to refer to the XMR-Symposium held in March. This has been postponed due to the lockdown in recent years. Now Sensitec - as the organizer - was again able to offer a forum for xMR experts and users for an international, personal exchange about research, development and applications based on MR technology. More exciting information about the XMR-Symposium can be found in this issue of our Sensor.Kosmos.

„THE PERSONAL CONVERSATION WITH OUR CUSTOMERS IS IMPORTANT TO US.“



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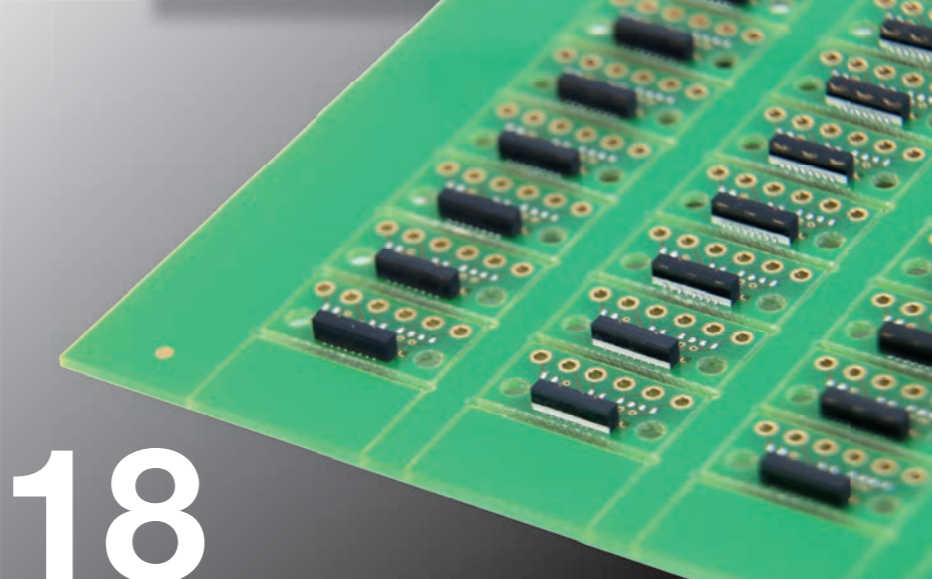
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ROTEC BECOMES EXCLUSIVE SALES PARTNER FOR SENSITEC VALVE LIFT SENSORS



TEAM VISPIRON ROTEK & SENSITEC

from left to right:

Tino Zillmann, Applications Engineer Rotec

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Christopher Lehne, CEO Rotec

Kevin Rohwedder, Head of Measurement Technology Rotec

Tobias Lenze, Applications Engineer Sensitec

Glenn von Manteuffel, Sales Sensitec

ROTEC BECOMES EXCLUSIVE SALES PARTNER FOR SENSITEC VALVE LIFT SENSORS

Vispiron Rotec as an established company in the field of measurement technology for drive technology, takes over fully and exclusively the marketing and distribution of the proven Sensitec magneto-resistive sensors for valve lift measurement on fired engines.

After the takeover by the Sinomags Group, Sensitec has revised its range of services and removed its focus from the business area of sensors for test benches. "We are now focusing more on the broad range of current sensors, whose share with Sinomags has increased massively," explained Glenn von Manteuffel, who initiated the partnership with Vispiron Rotec in his sales area of Southern Germany. René Buß, CTO at Sensitec, added: "Our technology and sensors will continue to be available via Vispiron Rotec. We have also passed on the know-how for optimal integration and application of the sensors to the experts at Vispiron Rotec."

Among other things, Vispiron Rotec offers measurement solutions for drive technology. In addition to specially developed hardware for signal processing, the ROTEC measurement and analysis software is a powerful tool for data acquisition, analysis and presentation. It provides numerous modular software mo-

dules, such as the valve drive module, for the measurement of fired valve drives. Vispiron Rotec has already used Sensitec valve lift sensors for measurement and analysis on the fired engine, which is why they are optimally matched to the Rotec measuring system.

"With our know-how and the technology of Sensitec magneto-resistive sensors, we are able to collect and analyse powerful data on the movement of valves in a fired engine – for our customers and, in the future, for Sensitec customers as well. This enables development departments in drive technology to optimize the valve drive with regard to fuel efficiency and emission reduction," says Kevin Rohwedder, Head of Measurement Technology at Vispiron Rotec.

VISPIRON ROTEC will be present at the **Automotive Testing Expo Europe** in June to present the measurement chain with Sensitec sensors and evaluation of valve lift behavior.

MEASUREMENTS ON THE VALVE TRAIN / OF VALVE TRAIN DYNAMICS

The development of **efficient and powerful combustion engines** is one of the main goals of automotive development. In this context, **valve timing** is a decisive element in the **optimization of thermodynamics** and thus in the efficiency of combustion engines.

The analysis of valve timing is carried out based on the measured, analog variables **valve lift** or **valve speed** in relation to the camshaft position. Here, the focus is particularly on the **dynamic opening and closing behavior of the valve** (e.g. closing velocity) as a function of the **engine speed**.

MEASUREMENT ON THE MOTORED CYLINDER HEAD AND FIRED ENGINE



To be able to reliably assess the opening and closing behavior, measurements and calculations of the three measured variables **valve lift**, **valve speed** and **valve acceleration** are necessary. Two different measuring methods can be used for this purpose: **measurement on the motored cylinder head using a laser vibrometer** and in **fired operation using magneto resistive (MR) sensor technology**. The measured variable valve lift can be determined both on the motored cylinder head and in fired operation using MR sensors. For this purpose, the speed signals and angular positions at the camshaft drive system are recorded. In the first step, the torsional vibration behavior of the camshafts can be derived from this. The measured data from speeds and valve lift can then be evaluated in the valve train software module. This allows variables such as valve speed and acceleration, opening and closing behavior, lift loss, resonance, and stress behavior to be automatically evaluated and graphically displayed

ADVANTAGES OF VALVE TRAIN TESTS ON THE FIRED ENGINE

Measurements on the fired engine have advantages over those on the towed cylinder head. For example, you can also investigate the effects of the **gas forces** under real torsional vibration and **thermal expansion behaviour of the camshafts or the cylinder head** on the fired engine. These effects are becoming more and more important with increasing charging and exhaust gas backpressures (particle filters).

Another advantage is that the costs for the **construction of a sometimes very complex test part carrier can be saved**.

SOFTWARE MODULE FOR AUTOMATED EVALUATION OF DYNAMIC PARAMETERS

The manual evaluation of dynamic parameters, such as the **valve touchdown speed** or the time of **dynamic opening and closing**, is very laborious with a large number of different operating points and takes up a lot of your working time.

The **software module "Valve Train"** was developed with the aim of performing these evaluations **automatically**. This not only **reduces the evaluation time**, but also the **size of the test matrix** and, accordingly, the utilisation time of the test bench. Instead of performing measurements at constant, discrete speeds, you can now perform **speed ramps**.

With the software module, the following parameters, among others, can be evaluated: **Angular position of dynamic opening and closing**, **touchdown speed**, **stroke loss**, **lift-off**, **valve bounce**, **mechanical load** on the components (surface pressure during cup drive), **stroke area** and **valve overlap**.

The software **evaluates progressions of several signals** (stroke, speed and acceleration) and automatically displays them **comparably** for each cycle with the corresponding result parameters. For some analyses, additional evaluation methods are stored that are ready-made for the specialised user (e.g. touchdown speed).

In addition to the multitude of analysis options, you can automatically record **cycles with signal errors** and remove them from the evaluations.

The application of the measurement technology as well as on-site measurements, analysis and evaluation can be completely provided and carried out by ROTEC ENGINEERING.

ROTEC ENGINEERING carries out tests on electric as well as hydraulic camshaft phasers. Thus, interactions between valve actuation and timing are recorded or the functional behaviour of the camshaft phasers is explicitly analysed.

ROTEC

TORSIONAL VIBRATION PROFESSIONALS

About Vispiron Rotec

Since 1988, Vispiron Rotec, headquartered in Munich, Germany, has been the world market leader for sophisticated measurement technology, analysis software and engineering services for torsional vibration analysis and complex measurement tasks.

The Rotec measuring system is used by measurement engineers for investigations and analyses of (electric) drive trains, gears, turbines and rolling element gears. It is used for the precise analysis of the causes of acoustic problems and mechanically harmful (rotational) vibrations. It provides engineers with meaningful results for the development of their products, damping methods and the design of components.

Rotec Engineering is an engineering team that specializes in consulting and managing complex measurement projects for drive components and vibroacoustics.

Rotec is represented in the Mobility, Power, High Performance Engines, Heavy-duty Engines and Mechanical Engineering sectors.

IN AN INTERVIEW WITH DR. JOHANNES PAUL NEW SPUTTERING PLANT AT THE MAINZ SITE

In this interview, Dr. Johannes Paul (Development Mainz) talks about the strengthening of the Mainz location through the new production facility of SINGULUS TECHNOLOGIES AG.

Marion: Welcome to this interview, Johannes. Since when have you been with Sensitec and what are your responsibilities?

Johannes: I applied for a job with Mr. Lust in June 2005, at that time still at Naomi Technologies, which, however, belonged 100% to Sensitec GmbH. In fact, I have been at the site for a long time, since I also worked here in Mainz back in the IBM days. Today, I am the head of development at the Mainz site.

Marion: For some time now, Sensitec has had the new „Singulus RSM“ plant. Please explain the tasks of the plant?

Johannes: Well, we develop and produce magnetoresistive sensors e.g. tunnel magnetoresistive (TMR) sensors. The materials used consist of many successive layers. Their layer thicknesses vary from only 0.2 nm to about 20 nm, and this requires machines that can reliably produce these materials.

Marion: What are or were the biggest challenges in repairing the new system?

Johannes: Today, there are several manufacturers of such highly specialized equipment. A special feature of our plant is its flexibility, because it is possible to produce 125 mm wafers as well as 200 mm wafers.

Marion: What about in case of a breakdown of the system? Could another one simply take over?

Johannes: Rather not, we have an alternative TMR sputtering system that was still installed by IBM. All products that are already qualified there today can also be run on the old system. However, there are also new products, including the important current sensors, which can only be produced on the new system due to the tight specifications of the materials. In the event of a malfunction, the plant must be repaired as quickly as possible. But there is also a warranty from the manufacturer for this.

Marion: What are the special features of the production line? For example, does it require special training for those who operate it?

Johannes: When you buy such a plant, comprehensive training is always part of the purchase contract. The training covers two areas: a) maintenance is trained and b) process capabilities are taught. We also hired a new process engineer because of this plant. That means we have a lot of ideas about what materials we want to develop in the future, now that we have the opportunity. This will only succeed if there are also experts to implement these ideas.

Marion: What advantages do our customers have from the production expansion?

Johannes: We can develop new products with tighter specification limits or higher performance. In addition, this system is the first building block of our future 200 mm fab. This will make it possible to produce more cost-effectively, since there are about 2.5 times more chips on a 200 mm wafer than on a 125 mm wafer.

Marion: Does Sensitec pay attention to the environment during production?

Johannes: Quite clearly yes. We have an environmental manager and are certified according to ISO14001. We meet all the requirements, and we also consider resource consumption when we invest.

Marion: What are the hopes or wishes for the Singulus RSM production facility and for Sensitec in the future?

Johannes: There has already been more investment in the first year since Sensitec GmbH was acquired by the Sinomags Group than in the previous 10 years under our previous owner. This machine is the first puzzle stone of a new 200 mm fab in Mainz. I am especially looking forward to the day when we have built our first 200 mm wafer. We are really stepping on the gas to make sure that this opportunity is seized. For me, that means the future instead of stagnation.

Johannes, thank you for taking the time to answer our questions.

Photo (from left to right): Dr. Frederick Casper and Dr. Johannes Paul (Sensitec GmbH)



16. XMR-SYMPOSIUM

„MAGNETORESISTIVE SENSORS AND MAGNETIC SYSTEMS“

For the 16th time the symposium “Magnetoresistive Sensors and Magnetic Systems” took place. Around 170 participants gathered from 8-9 March in the Stadthalle in Wetzlar to learn about the latest research results and new applications in the field of XMR sensors.

In his welcome message, Dr. Jianguo Wang introduced himself as founder of the Chinese Sinomags Group and new CEO of Sensitec GmbH.

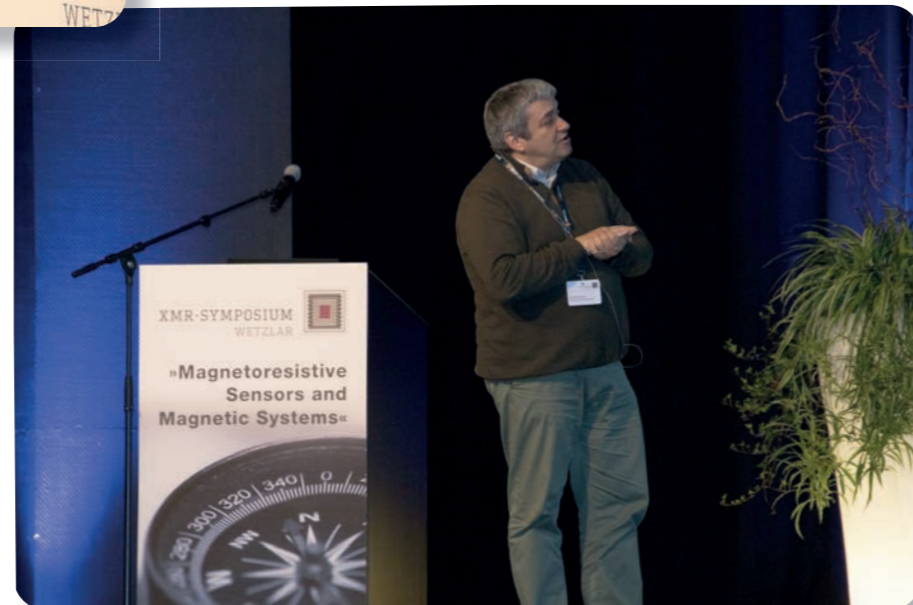


Dr. Jianguo Wang, CEO Sensitec GmbH

Afterwards, one of the great pioneers of XMR sensors, Professor Dr. Paulo Freitas, spoke about how the most important parameters of TMR sensors for out-of-plane field measurement can be further developed. Dr. Aurélie Solignac presented solutions to reduce noise and improve the detection capability of GMR and TMR sensors. After the two presentations on the optimization of sensor elements, Cornel Frigoli presented a new, absolutely measuring 3D magnetic field sensor based on a patented magnetization process. Professor Dr. Susana Cardoso de Freitas, in turn, informed about a new 2D TMR sensor system for the application to measure the degree of ripeness of fruits.

One of the main topics of the conference was electromobility. Dr. Richard Dixon explains here that in the electrical and electronic architecture of electric vehicles the trend is moving from a more decentralized to a centralized control system, whereby a central computer controls numerous decentralized zone controllers. This takes into account the increasing complexity of electronic systems in the vehicle and leads to weight savings by reducing cables and ECUs. The functions of the sensors remain unchanged. Due to the more powerful ECU in the zone control, the processing of sensor raw data is possible. Matthias

Brusius gave a very compact overview of the numerous requirements for current sensors based on the latest power electronic components. Heiko Knoll reported that current sensors not only meet quality requirements, but also function reliably over their lifetime. He showed how progress has been achieved in a current European funding project together with partners using the Digital Twin concept and application-based concepts. Ulrich Marl explained how high-speed measurements for test benches in the automotive sector are implemented with proven GMR sensors in his presentation.



Professor Dr. Paulo Freitas, Interim Director General INL



dimensional embodiments (DIN SPEC 91411) and, more recently, the characterization of dimensional embodiments (DIN SPEC 91479). The topic of Dr. Werner Pessenhofer was to produce more robust dimensional embodiments. He explained that Miba is developing PVD processes and plants to provide more robust, hard magnetic coatings for automotive applications. Dr. Mathias Rechel and Benjamin

Wenzel informed about their own methods for detecting magnetic codes and dimensional embodiments. Finally, Tizian Schneider showed how in a BMBF-funded project the sensor data were evaluated using a linear guide using machine learning methods and how wear on ball bearings can be detected in time and measures can be taken.

Throughout the event, many personal conversations and discussions could be observed, be it at the poster exhibition, during the breaks or during the evening event. This makes it clear that the personal encounter with old acquaintances and new participants is a key focus of the event and that a virtual event concept would fall short here.

Dr. Rémy Lassalle-Balier and Dr. Yunfeng Li presented the Speed Sensor concepts and current products from Allegro and Infineon. Enda Nicholl reported on significant progress in the product development of True-Power-on Multiturn sensors, which had already been presented to participants of previous symposia as concepts and functional models.

On the second day of the conference, Berthold Ocker demonstrated to the audience that the production of high-quality TMR stacks depends, in particular, on copper intermediate layers, which have to be deposited homogeneously via the wafer in the Ångström region. Dr. Anuraag Mohan introduced the monolithically integrated high-performance TMR sensors for current and angle measurement to the audience. Jeroen van Schagen showed that GMR sensors are of great importance for the quality assurance of steel sheets, which will lead to increased yield and energy savings/CO2 reduction.

In a separate session, David T. Robinson, Dr. Jianfeng Wu, Joachim Quasdorf and Dr. Jinfeng Liu reported on new evaluation modules and their applications in encoder modules.

Through various presentations it became clear once again that magnetic field sensors are dependent on magnetic dimensional embodiments for many applications. The quality of these components contributes significantly to the accuracy and robustness of sensor systems. Dr. Jürgen Gerber informed the audience about standardization work with regard to magnetic dimensional embodiments; the representation of



»Magical« evening event with Marco Huynh

Since October 2022, Sensitec GmbH has been able to count on the expertise and support of Tim Leukel, who will take over the purchasing management.

In the past years, Mr. Leukel has been active at various management levels for GEA or the business unit "Slicing & Packaging" and has a large network and expertise which should be brought profitably to Sensitec GmbH.

Mr. Leukel is married and has three children. In his private life, jogging and travelling are his hobbies, in addition to his family.

The vision shown to me by the management and Dr. Wang led me to the step of joining Sensitec GmbH. With Sensitec, I am convinced that we can become an absolute player on the market and that we would like to make a significant contribution in my team.

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TIM LEUKEL

MR SENSOR PACKAGE

FOR HORIZONTAL AND VERTICAL MOUNTING ON THE PCB

Increasing demands on the reliability of MR sensor systems and the simultaneous need for high cost efficiency require application-adapted MR sensor packages. For the horizontal and vertical mounting of MR sensors on the PCB, Sensitec GmbH is developing two packages with the same, sensor-independent pin-out, which will be available as series products in the course of 2023.

The development of the compact sensor packages (SIN8/SIN8D and SIL8/SIL8D), which are suitable for both horizontal and vertical mounting on the PCB, are about to go into series production, which is planned for 2023.

The package **SIN8/SIN8D** (SIN = Single-Inline-No lead; 8 = Pins; D = Double) is a leadframe based, transfer molded MR sensor package, which is produced using standard DFN/QFN processes (**Dimensions (L x W x H): 7.0 mm x 1.5 mm x 2.0 mm**).

The **SIL8/SIL8D** package is a further development of the SIL6 package, which has been established for a long time at Sensitec GmbH. This package has a PCB as substrate and is based on the LGA concept (**Dimensions (L x W x H): 6.0 mm x 1.5 mm x 2.0 mm**).

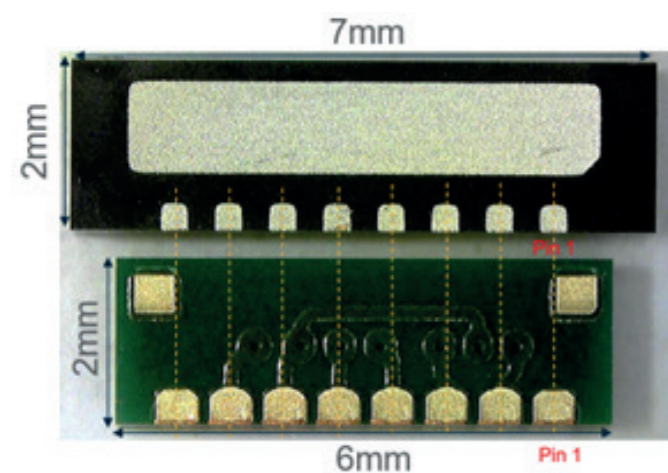


Fig. 1: Dimensions of SIN8/SIN8D and SIL8/SIL8D in comparison.

Due to the same pin-out and the same pitch of the contact surfaces, the SIN8/SIN8D and SIL8/SIL8D packages with the same MR sensors can be substituted for each other depending on the requirements in the application.

In a direct comparison using the example of the AL780 length sensor (5 mm FixPitch MR sensor), there are no differences in performance to the SIN8 and SIL8 package. For example, the bidirectional positioning error at a small working distance of 1.5 mm is $31 \pm 1 \mu\text{m}$ for the AL780AIA-AE (SIN8) and $32 \pm 1 \mu\text{m}$ for the AL780AMS-AE (SIL8). Even at larger working distances (e.g. 2.5 mm) there are no significant differences in the positioning errors: AL780AIA-AE $45 \pm 1 \mu\text{m}$ vs. AL780AMS-AE $44 \pm 1 \mu\text{m}$.

All packages are available for further processing in PCB assembly in tape & reel, are RoHS compliant and can be used for processing with lead-free Sn solders (e.g. SAC 305). For the layout of the carrier PCB, customer-specific requirements can be implemented or suggestions from Sensitec's footprint layout proposal can be used.

Pad	Signal
1	n.c.
2	+V ₀₁
3	+V ₀₂
4	V _{CC}
5	GND
6	-V ₀₁
7	-V ₀₂
8	n.c.

Fig. 2: Pin-out SIN8/SIN8D and SIL8/SIL8D independent of the sensor type.

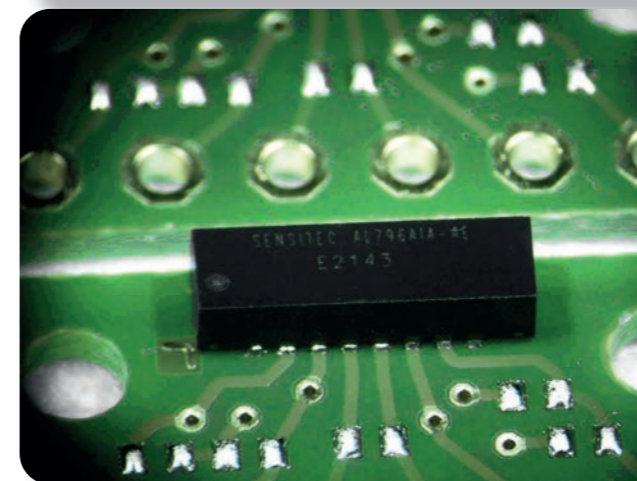
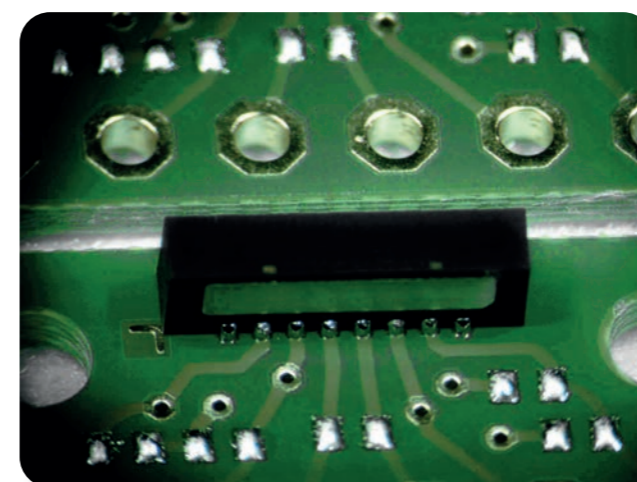
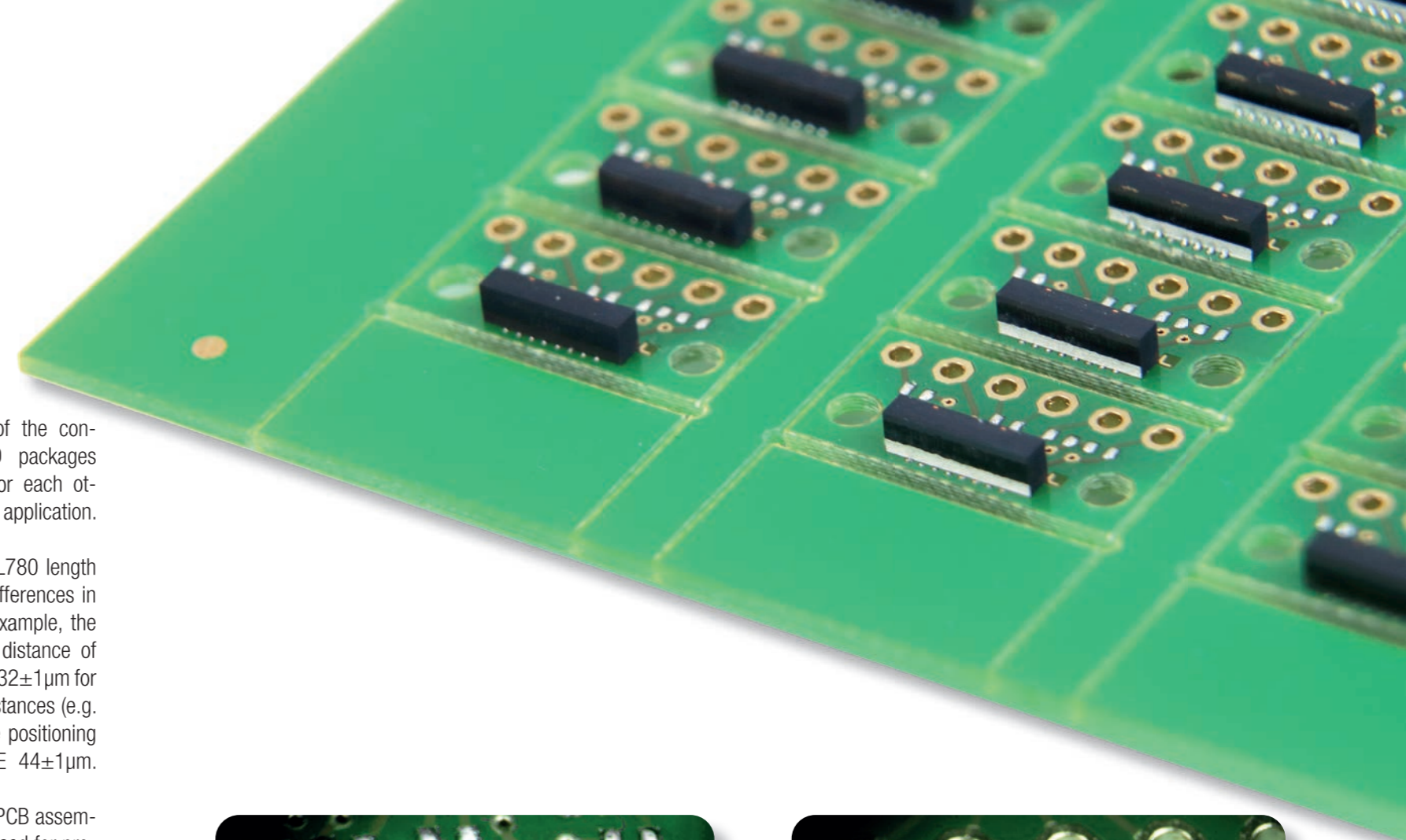


Fig. 3: Mounted SIN8/SIN8D (top horizontal, bottom vertical).

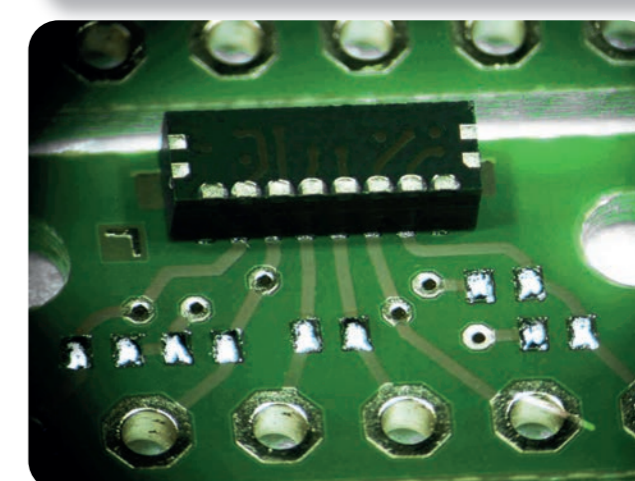
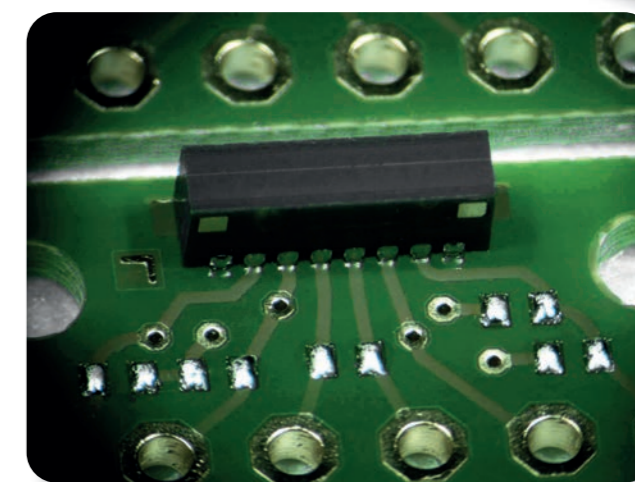
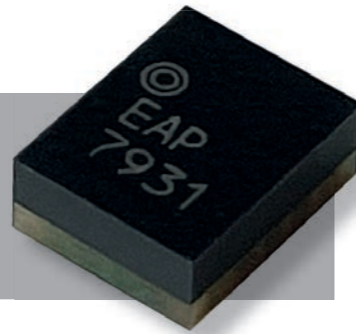


Fig. 4: Mounted SIL8 (top horizontal, bottom vertical).

EAP7931

FLEXIBLE MULTICHIP SOLUTION IN A COMPACT LGA PACKAGE



The EAP7931 sensor module consists of a TMR FreePitch sensor and a very small microcontroller, all combined in a very compact LGA package for assembly in the SMD process.

Due to the TMR FreePitch sensor, the sensor module enables an absolute angle detection of 360° at a shaft end dipole magnet. The position output is done via a common microcontroller interface SPI. In a first software variant the module offers a usual calibration of the sensor parameters like offset, amplitude and phase to achieve an optimized angle result. This calibration can be re-triggered at any time - a storage and use of the stored parameters is done automatically.

In addition to the SPI interface, a PWM output has also been implemented. The module can be operated with 3.3 V as well as 5 V supply voltage.

In the function with a rotating dipole magnet the module shows the advantage of the TMR sensor. Even with a wide working distance range of several milli-

meters, the angle detection remains stable and accurate. Due to the low processor performance and the ADC with only 12 bit resolution, the module should not be expected to fly high. Rather, it demonstrates and opens up further flexible possibilities to use the sensor signals for different applications. An implementation of different, angle-related switching points on one of the GPIO's or even the low-power „counting“ of revolutions is conceivable and easy to implement via software. Thus the EAP7931 serves as a small TMR angle measurement solution as a first impact of a platform of further, also more powerful modules, with flexible programmable functionality.

A demo board is also available for the EAP7931, which allows easy access to the signals and provides a mechanical connection for a rotatable dipole magnet.

SENSITEC
MAGNETORESISTIVE SENSORS

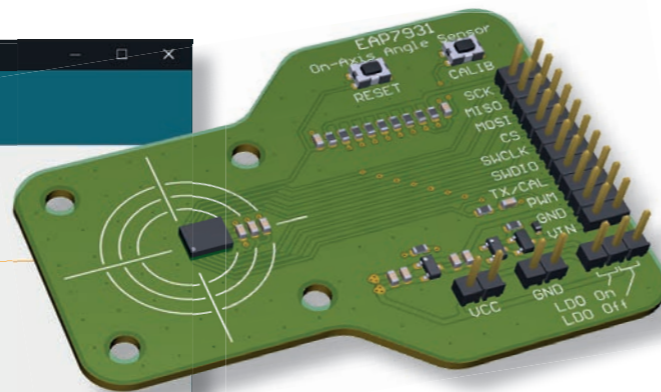
EAP7931
SMART SENSOR LINE

Features / Specifications

- Resolution up to 12 bit
- Autocalibration, Phase correction
- Output: SPI / PWM
- Absolute position Sensor TPO
- Compact System in Package (SIP) 2.4 x 4.0 x 5.0 mm

Applications
Shaft End Position, Speed Sensor, Magnetic Potentiometer, Low Power Applications

Absolute position
147 deg
calibration done



NEWS

TRADE FAIR DATES

You are cordially invited!

We will be happy to present our new solutions to you at the upcoming trade fairs. With live demonstrations, we will provide you with insights into the fascinating possibilities of the technology. Of course, you can also test our solutions yourself.

Would you like a personal consultation and would you like to make an appointment in advance? You are welcome to do so! Simply contact us at +49 6441 5291-0 and we look forward to answering your questions and to stimulating discussions.

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