

Technical Report

# Reliable lab assistants.

## Baumer sensors provide high levels of process safety for QIAGEN laboratory automation systems

Precision, reliability and efficiency are key factors when it comes to laboratory research and analyses. In order to ensure that both are of the same high quality, automated equipment is currently frequently employed to carry out routine tasks. These automation solutions are manufactured by the biotechnology firm of QIAGEN at its Swiss facility in Hombrechtikon. In its work, the firm relies on quality, performance and sensors from the specialists at Baumer.

Automated solutions are increasingly called upon during sample analysis in order to be able to carry out comprehensive research and diagnostic tasks with precision and efficiency, for example, as was required during the recent swine flu epidemic. While results quality remains unchanged, automated analyses operate more consistently and with greater reproducibility than analyses performed by humans. QIAGEN Instruments AG in Hombrechtikon, Switzerland, is one manufacturer of these automation solutions.

### The QIAGEN Group

QIAGEN Instruments AG is a subsidiary of the publicly traded QIAGEN Group, one of the world's most successful biotechnology firms. QIAGEN is a market leader in the area of systems to isolate and analyze hereditary information, and has more than 3200 employees in 23 countries. The company's products include, among other things, reagents for a wide variety of applications as well as containers such as microwell plates or test tubes. The tasks for which QIAGEN products are employed can be automated, using systems manufactured by QIAGEN Instruments. For example, QIASymphony® allows sample preparation and processing to be carried out fully automatically. This is primarily suitable for larger labs which handle medium to large sample volumes.

### High demands made of sensors and systems

High demands are made of laboratory automation solutions. They must operate with precision and must improve process efficiency. "The end user expects our machines to provide a reliable and rugged process



QIASymphony® SP lab automation system for fully automated sample preparation (source: QIAGEN)

in the lab", notes Dr. Claus Kühnel, Associate Director of Electronic Development at QIAGEN Instruments. To meet these expectations, numerous sensors are employed in the automated equipment to ensure its trouble-free operation. They work inconspicuously in the background, but nonetheless guarantee high levels of process safety at correspondingly high throughput rates.

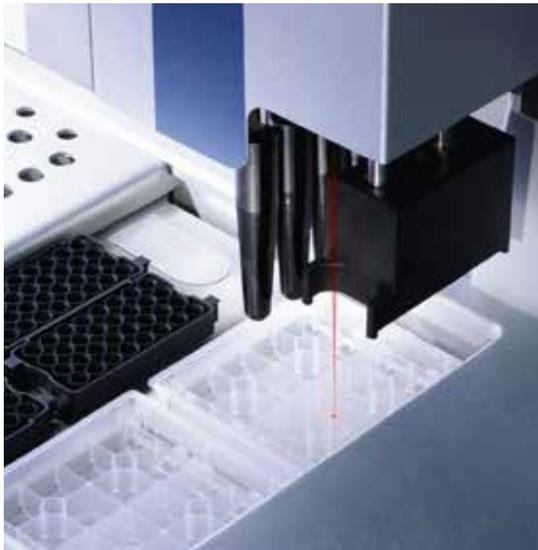
Prior to sample purification, the supply drawers of the QIASymphony® are filled with the necessary containers and reagents, together with the samples to be processed. Subsequently, a sensor carries out an inventory. With regard to the type of the sensor to be employed, QIAGEN developers selected a Baumer laser distance sensor. "Baumer was well-known to us in the field of sensors. This is why we approached them and included an OADM 13 laser sensor in our initial selection. This

sensor was convincing during our [www.baumer.com](http://www.baumer.com) September 2010 subsequent evaluation”, explains Dr. Kühnel. Aside from the convincing test results, QIAGEN also regarded the easy accessibility of Baumer as a supplier as yet another advantage. This was decisive during the QIASymphony® development phase, since solutions were able to be quickly

Initially, the sensor inside the QIASymphony® was only intended to detect the presence of pipette tips. However, as time passed, it was discovered that the sensor’s potential and performance scope could be more fully exploited. Thus, the equipment’s level of automation was able to be improved and its efficiency was increased. Thanks to close technical cooperation between Baumer and QIAGEN, the OADM 13 is now able to perform four different tasks in the QIASymphony. In this regard, Baumer’s competence in the field of sensors formed an optimal complement to QIAGEN’s application know-how.

#### Sensors ensure process safety

During the stock take using the so-called “Load Check”, the sensor determines whether the correct number of the right accessories for the intended process are present, so as to avoid any filling errors. The OADM 13 detects the presence of pipette tips together with the presence and quantity of the analytical containers. In addition, and based on their material coding, the sensor also determines the type of container in question.



The OADM 13 laser sensor inspects the stocks prior to the start of purification (source: QIAGEN)

Further, the sensor also examines the position of the supply drawer, so that the robot arm, operating with a precision of one-tenth of one millimeter, does not miss the tiny sample and test tube openings during pipetting. Here, additional Baumer sensors also provide assistance. In order to provide the requisite degree of process safety, type IFRM 05 miniature inductive sensors reliably ensure that all drawers are completely closed before the purification process can start.

The laser sensor’s most decisive product properties included its high level of precision and its large measuring range. With a resolution of 0.01 mm and a measuring distance of up to 550 mm, the OADM 13 meets both these criteria. Beyond this, the sensor also possesses a very limited black/white drift. This allows it to securely detect both translucent test tubes as well as black pipette tips. In addition, the sensor can also be taught either via its teach-in button or, externally, via a cable.



The OADM 13 laser distance sensor

#### Joint solution to great challenges

New application-specific challenges which needed to be jointly met arose constantly during the development phase. A particular example of this were the reflections and mirroring caused by the transparent plastic containers. The laser beam reflection was difficult to calculate due to the underlying darker objects and the awkward angles resulting from the employed materials.

“Because Baumer was included from a very early point in the QIASymphony® development process, we were able to jointly come up with an optimal solution for the application”, states Christof Rietmann, Development Team Leader for Baumer in Frauenfeld. “We provided intensive support to QIAGEN and, thanks to our experience in the area of sensors; we were also able to provide recommendations for optimizations on their part. Further, we could optimize our sensor to the specific

application, and were able to tailor our firmware to the customer's specifications. In turn, QIAGEN was able to adapt the evaluation algorithm to its requirements."

**More information:**  
[www.baumer.com](http://www.baumer.com)

The close cooperation between the two development departments was not merely able to provide the desired solutions for the application. "During the development phase, Baumer employees provided a great deal of information regarding sensors, their potentials and limits", Dr. Kühnel goes on to note. "This is knowledge which we will be able to apply to future projects."

#### Reliable sensor partner

Cooperation between QIAGEN and Baumer is not simply limited to a single project. "Aside from the two sensors in QIASymphony, we currently also employ a Series 07 MINOS photoelectric sensor in our QIACube", notes Dr. Kühnel. The QIACube automation system is smaller than QIASymphony®, and was developed for a far smaller sample throughput. As the smallest diffuse sensor equipped with background suppression and teach-in, the MINOS is outstandingly well suited for employment in this system.

Additional joint projects are also in the planning phase. The new Series 09 ultrasonic sensor, developed especially for laboratory automation, has already been tested by the QIAGEN developers. In addition, QIASymphony® is being continuously optimized, and, together with Baumer, new sensor solutions to further increase the system's efficiency are being sought. As Dr. Kühnel goes on to describe the business relationship: "Baumer represents a reliable sensor partner with whom we have had nothing but good experiences when it comes to support, and who is able to offer us its large portfolio of solutions for many applications".



Baumer's broad sensor line offers solutions for many applications