It’s all about high speed sorting

Intelligent sensor solutions for 100 percent quality control

Screws, nuts, washers and bolts are mass-produced articles to which not much attention is paid. Actually, such fasteners are often processed further, e.g. on production lines in the automobile industry. There, a small defect in a part, e.g. a faulty thread or even a small crack can shut down an entire production line. 100-percent quality control with appropriate high-end equipment is essential and for this, sophisticated sensors are indispensable.

As Thomas Rothweiler, Managing Director of Gefra GmbH states, “The dimensional checking of fasteners is no longer something special and today, it is a standard part of every quality checking system”. For over 15 years, the Friedewald-based company has specialized in the development and production of optical checking systems in areas related to the measuring, inspecting and sorting of manufactured parts made of metal and plastic.

The answer to ever increasing customer demands

For about two years now, the company from the Westerwald region has ranked as a global specialist for high-end checking systems. As Thomas Rothweiler goes on to state, “Our customers' needs are constantly increasing. That’s why we focus our attention on developing non-contact, high-end optical control systems with a 0ppm error rate. Where simple dimensional checks used to be sufficient, today, complex geometries are checked for damage such as dents, scratches and points of impact. The object to be checked is examined for cracks at various locations. Coating / paint errors are detected as well as soiling.

Nothing is possible without high performance software

Tried and tested product lines which can be flexibly adjusted according to customer requirements form the basis for this. As Gefra’s head of testing technology Thomas M. Bock explains, “The heart of our test systems is the software we have developed. It enables us to make complex analyses and evaluate them at high speed. With this software, we are also capable of addressing the needs of customers and integrating them seamlessly into the overall system”.

‘All-round’ testing of fastening elements

CMOS cameras with a firewire interface and the corresponding lighting systems are used for the optical examination. The intended future use ultimately determines how many cameras are used in a test cell. As Thomas M. Bock states, “In the simplest of cases a specimen passes through one station and in the most complex configuration, up to seven stations are used”. As such, it is possible to implement a system with up to 10 cameras and/or a 360-degree examination in order to analyze the completeness of a thread or the surface characteristics of a cylindrical body.

High reliability combined with high speed

As the head of testing technology went on to state, “The high reliability of the optical check needs to be accompanied by a high checking speed. Not an easy task, as with each camera, another image to be analyzed accures the runtime - something that correspondingly makes data processing a complex task. Our software however is so powerful, that even with a high number of cameras and very complex checks, we are able to check parts at very high speed”.

Intelligent sensor solutions are sought

The basic configuration of a checking system is usually a measuring station with three cameras, including lighting. The fasteners to be checked are fed into the station on a turntable made of glass. A so-called side plate (that allows for screws to be hinged at the side) or a belt can also be used.

Radial run-out makes detection difficult

In order to start a checking process, the system must first receive a signal via the corresponding sensors that a specimen is located in the range of the measuring position. But as Thomas M. Bock states, this is easier said than done: “A glass turntable is not perfectly flat or planar, but always has a certain eccentricity to it. If a very flat part, such as a washer is placed on the turntable, it makes the task of detection much more difficult, as the radial run-out of the glass turntable may lie in the vicinity of the washer thickness”.

Dealing with special challenges

For ipf electronic, this was a special challenge that required a very special solution. Therefore, the engineers from the Lüdenscheid-based sensor specialists developed for Gefra a fork-shaped light barrier which produces a line-shaped laser beam (Fig. 1). A part of the 10mm high beam is covered by a glass turntable, and transmits an analog signal proportional to the covered part. Due to the eccentricity in the rotating glass turntable, this signal levels out at a certain range. As Thomas M. Bock states, “The signal is continuous, similar to a sinusoidal curve”. “If a specimen passes the range of the light barrier, this signal changed dramatically. By filtering out the signal change from the relatively uniform signal caused by the eccentricity, it is possible to reliably detect even extremely flat fasteners on the glass turntable.”

Fig. 1

Path-controlled evaluation of the activation position

The measurement process and with it, the activation of the camera and flash is started via an FPGA (Field Programmable Gate Array) which is coupled to an encoder. As Thomas M. Bock explains Here, position 0 is determined by the sensor. In turn, the activation position for the measurement process is defined via the angle of rotation. In contrast to timed measurement, the path-controlled evaluation of the activation position has a key advantage in that small fluctuations in the turntable speed are negligible. Depending on the lapsed angle argument, several stations can be activated reliably and thus, at the end of the test, the images corresponding to a specific part can be reliably related to each other and brought together”.

'The only correct way'

If the specimen is identified as OK, it is blown out at the end of the system. Thomas Rothweiler though is convinced of an alternative way, "Here, contrary to other concepts, which feel that blowing out the not OK, we pursue the only correct way" and provides a cogent argument: "If there are times when there is a fault within the system, e.g. as a result of a faulty purge valve, with this approach, we ensure that no not OK parts find their way among the OK parts".

A proximity switch checks the rotation of the glass turntable

In the vicinity of the laser barrier, there is also an ipf electronic inductive proximity switch which checks the functionality of the glass turntable. To this end, a fixed metal plate attached to the side of the glass turntable passes the sensor and triggers an impulse. If this takes place regularly, this ensures that the glass turntable is rotating and that the system is working properly in order to test correctly.

Controlling the supply of material with fork light barriers

The use of sensors in the test systems of Gefra is not only limited to the areas described above. Thomas M. Bock cites a concrete example: "If for example, screws have to be threaded into a slide plate via a vibrating conveyor, a certain pressure is necessary. At the same time it is necessary to avoid too many screws accumulating on the buffer area of the vibrating conveyor. In order to turn the vibrating conveyor on or off, we use the signals of two light barriers (Fig. 2). They ensure that there is enough material on the feed section and that the system always works properly. If there is no material within the lower light barrier, the vibration conveyor is turned on and remains in operation until the upper light barrier detects specimens. Whilst the material buffer is being processed, the vibrating conveyor is turned off."

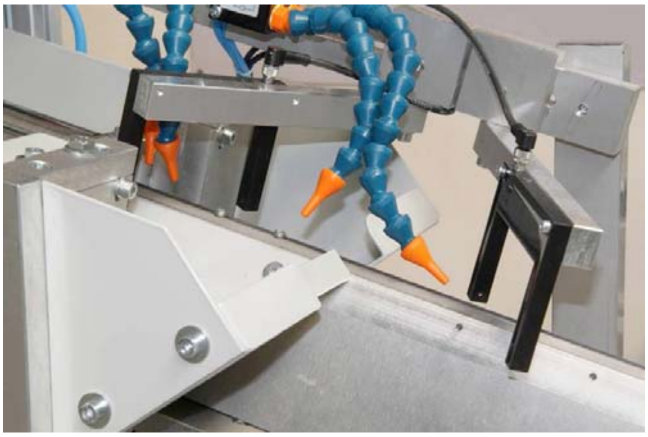

Fig. 2

A wide range of sensor applications

But even with this, there are still other areas where sensor technology is applied at Gefra, e.g. the position inquiry of the lifting cylinder by means of inductive proximity switches. This lifting cylinder serves the task of lifting all components in the test cell in order to allow better accessibility to the system when a turntable is exchanged. The sensor thus ensures that after the exchanging of the turntable, the lifting cylinder with the components is in the correct position again for fault-free operation of the system. As Thomas M. Bock adds, “Another area where we can deploy sensors is at the filling station, e.g. with ultrasonic sensors, in order to ensure that there is a container at the station to be filled”.