

Simple but precise and effective

Compact sensor solution ensures high quality in manual production

The focus of an interesting application does not always have to be highly complex technology. The best example is an automotive supplier who has implemented a production process with zero fault tolerance using a simple but very effective sensor solution at a manually operated punch.

Bade und Rinscheid Metallwarenfabrik GmbH (BARI) is a manufacturer of forming parts, primarily for the automotive industry. "Hardly a car or truck today is traveling without one of our products. We manufacture precision parts mainly of aluminum, stainless steel and spring steel in large series, whereby our core competencies in forming technology are for applications in electronics, cable routing and the integration of metals in intelligent solutions for vibration and noise reduction," describes Christian Dröge, Technical Master of BARI in Olpe (southern Sauerland), the company's production line.

Tool for manual production developed

One of BARI's recent orders is the production of a steel sheet part for the insertion of circuit boards for a navigation system. For this purpose, so-called stud bolts must be pressed from below into the underside of the component. According to Christian Dröge, it is not worth investing in a more complex automation solution for the expected number of pieces. "Therefore we have developed a tool for this task with one of our suppliers, which is used on a manually operated punch. In one part of the tool, a total of seven bolts must be inserted manually before the pressing process."

Looking for a solution for process-safe production

Manual activities always involve the risk of faulty processes, as the Technical Master knows only too well: "When inserting the bolts, there is, of course, the problem that a bolt can be forgotten and thus rejects can be produced. During the search for a sensor solution which ensures safe, reliable manual production, we consulted ipf electronic." A good decision, as it turned out, because after an initial praxis test on site, the application specialist from Lüdenscheid could quickly present a simple but very effective solution to the company. Key components of this solution are the optical sensors OTQ40173, an RGB signal light (AO000458) and a distribution box, which can logically link the input signals of the optical sensors.

Optical small sensors for confined spaces

The optical sensors of the OTQ4 series are extremely compact, rod-shaped devices with protection class IP65, which are particularly recommended for applications with extremely confined spaces, i.e. also in areas that until now have mainly been reserved for optical fibers. The commissioning of these sensors, which work with visible LED red light, is quite easy, since the alignment and adjustment of

the devices is simplified by the highly visible light spot. Seven optical diffuse reflection sensors were installed at different positions of the respective tool part in order to detect the manually installed stud bolts, so that the operator can work unhindered on the punch. In this specific application, the diffuse reflection sensors have a scanning range of 50mm with a light spot size of 2mm and a switching frequency of 1kHz. As the devices provide a background suppression in addition to the compact dimensions, the sensors operate independently of the reflective properties of the objects' surfaces (color, gloss, structure) with an exactly defined range. This ensures that only the desired objects are detected and, if necessary, the parts in the background are safely suppressed.

Logic links switching signals for RGB signal light

If, as desired, all bolts are inserted into the tool, they are reliably detected by the optical diffuse reflection sensors, each device producing an output signal. The further task was to visualize this information (all pins present) as simply as possible without any automation effort. In order to generate a common signal from the individual information of the sensors, all sensors are linked via a distribution box, in which all inputs are logically AND-linked. This means that only if all input signals are present at the distribution box at the same time, it produces an output switching signal. Since the distribution box provides eight inputs, in the application, however, only seven sensor signals are to be connected, the free input had to be provided with a so-called jumper, which quasi simulates the missing input information.

With the output or sum signal a changeover contact is triggered, which supplies – dependant on the switching status - two different signal inputs of the RGB signal light with +24V. The luminaire ultimately serves to signal to the operator whether all bolts were inserted into the tool or not. Since the economical luminaire (max. power consumption of 8W) with degree of protection IP54 has an angle of emitted beam of 120° and the LED light is very bright, it could be mounted in the rear part of the punch above the tool, in order not to hinder the operations on the machine in any way.

Christian Dröge summarizes the function of the solution: "If the tool is not already equipped with bolts, the RGB light lights up permanently "red". This is certainly its permanent state. The light color only changes to "green" when the corresponding light input is applied to the relay with 24V. For this purpose, the relay must be controlled via the output of the distribution box, which only occurs when all optical sensors simultaneously detect a bolt.

If the green light lights up, all the bolts are inserted into the tool and can be pressed with the subsequently placed component."

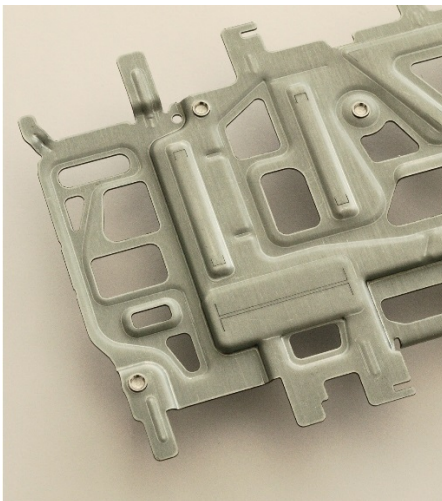
If, however, a bolt is forgotten, the output signal of the distribution box is not present. In this case, the signal light is connected to another control input and lights up "red".

Extremely reliable process

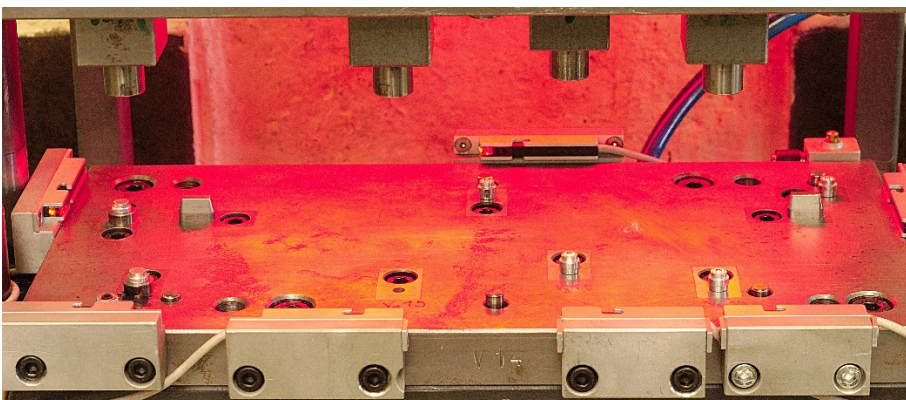
"If only a single rivet is missing in the tool, the employee at the punch will recognize this immediately, because the signal is impossible to ignore. In this way, we achieve an extremely reliable manual production process and specifically avoid operating errors," explains Christian Dröge. "The solution is quite simple, but very effective. In this context, I was particularly convinced by the very compact design of the sensors, in which a device reaches just the thickness of two matches situated one above the other. Therefore, the sensors could easily be integrated into the tool."

Already during the pre-production of the new product, BARI was able to test extensively the sensor solution with success. "Within this time period, we manufactured about 500 parts at the punch, and that without errors," says Mr. Dröge.

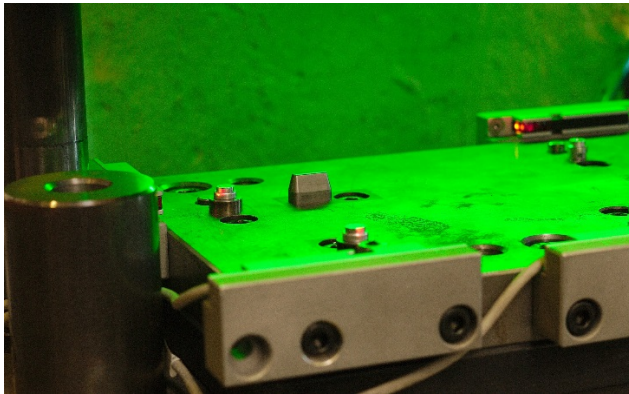
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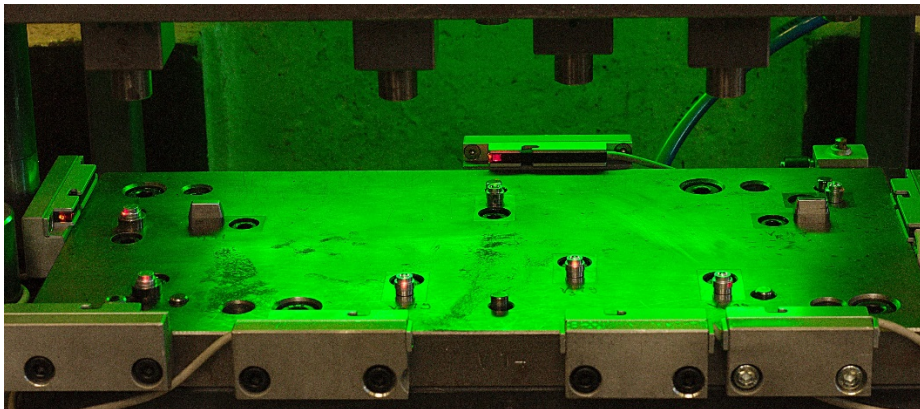
Upper side of the component in which the stud bolts were pressed to insert a circuit board.



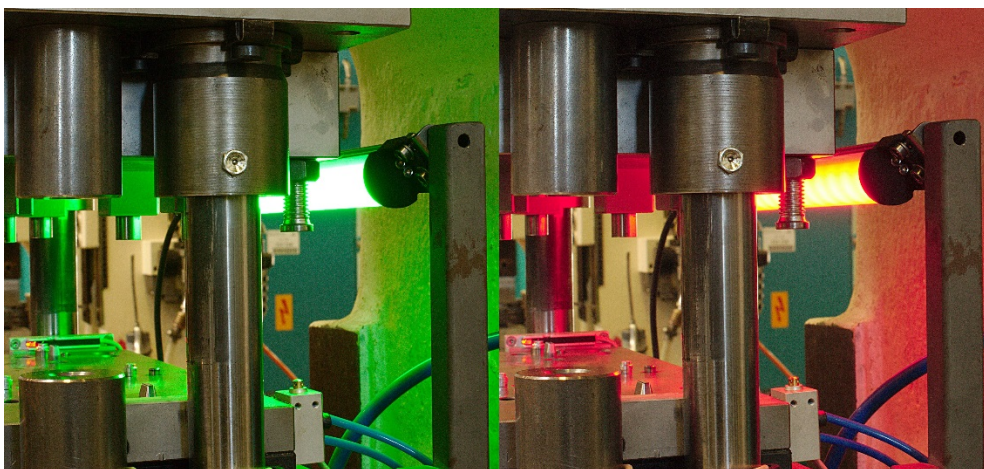
Impossible to ignore: the light of the RGB signal lamp at the tool.



The light color of the signal lamp changes to „green“, as soon as the luminaire receives the logically linked AND-signals of the optical sensors. All bolts are present in the tool and can be pressed into the component.



As the sensors operate with visible LED red light, the installation is very simple.



The RGB signal lamp was installed at the rear of the punch, above the tool.



Christian Dröge, Technical Master of the metal goods factory Bade und Rinscheid: "I was particularly convinced by the very compact design of the sensors and the concept of the complete solution that was easy to realize."



The sensors of the product group OTQ4 reach just the thickness of two matches situated one above the other.