

Application Report – Innovative image-based quality inspection at pressure gauges

Mechanical pressure gauges bridged into the digitized world

Demands on the reliability and safety of pressure gauges in plant engineering are extremely high – especially in power stations and industries such as oil & gas and hydropower. The new Bourdon-Haenni approach in image processing allows for efficient, ultra-precise and reproducible final inspections with documented process results and is set to revolutionize quality inspection at mechanical pressure gauges.

Because of its reliability, the Bourdon tube, invented by Eugène Bourdon in 1849, is still the most common centerpiece in mechanical precision pressure gauges of the 21st century. The use of pressure measurement via motions inside the C-shaped Bourdon tube with an oval cross-section has proven reliable and therefore has remained unchanged for 170 years. Bourdon-Haenni is an international technology leader in high-quality

pressure gauges and the only one to produce Bourdon pressure gauges under the original *Bourdon*® brand. These gauges are still widely utilized because of their robustness, wide pressure range (0...0.5 bar up to 0...1600 bar), ease of operation and maintenance, extended service life (10 years plus), and their immunity to voltage fluctuations and power failures. Integrated components must meet the highest safety standards



Photo: Bourdon-Haenni

Even today, mechanical pressure gauges operating on the Bourdon tube are considered to be among the world's best – not least because of their reliability and operation principle without any electrical power.

and prove absolutely reliable even under extreme conditions and in the event of a power failure. Therefore, plant manufacturers around the world rely on the advantages of Bourdon pressure gauges in a multitude of industries including oil and gas, power stations, hydropower, aviation, railway and shipbuilding.

Building a bridge between the mechanical and digitized world of pressure gauges

Bourdon-Haenni offers millions of features and properties so that users can configure their best match in terms of nominal size, accuracy class, material, process connection, pressure range, housing, and process connection. This high level of vertical range of manufacturing allows for cutting-edge methods. The BTrace production system monitors and documents every process step, ensuring full traceability throughout the entire process chain from ordering to manufacturing in compliance with the "zero defect philosophy". To increase automation in industry-typical manual calibration and qualification and to ensure reliable quality inspection with 100% traceability, Bourdon-Haenni developed an image processing solution allowing for seamless documentation of measured values and allocated images. Each inspection task is backed up by reproducible and digital documentation of the pressure gauge which is set to leave the factory. The recorded measured values are stored in a database which allows for automatically generated calibration protocols. Additionally, the measured data is accessible for further quality evaluation and trend analysis.

Ultra-precise acquisition of the pointer position

The project was put into action at the production site Baumer Bourdon-Haenni in Vendôme/France and implemented within the scope of two master theses at the Zurich University of Applied Sciences. A unique challenge in the system design was the high precision required. Pressure gauges of accuracy class 1, for example, must not show deviations of more than 1 percent of the measuring span. In other words, a class 1 pressure gauge with Bourdon tube with 6 bar span must not exceed the maximum tolerance of 60 mbar. Ultra-precise recording of the pointer position is therefore critical to quality inspection. Such high precision is ensured by a Baumer *VeriSens*[®] XF800 vision sensor. Being the system's centerpiece, the sensor is instantly and conveniently configured in four easy steps using the intuitive *Application*



After entry of serial or order number, the pressure gauge is connected to the test system for selecting the required test cycle using the graphical user interface. The Baumer *VeriSens*[®] vision sensor precisely calculates the angle value. The overall inspection process is controlled by a B&R system.

Suite configuration software. The integrated 360° *FEXLoc*[®] feature for position tracking ensures that the vision sensor aligns the pressure gauge with the defined zero point with 100% accuracy, making sure the full 270° measuring span is covered in the inspection. Within the individual measuring spans, up to six different pressures are imposed in automated test cycles. After each pressure test, the pointer position is acquired out of which the angular value is calculated and transferred to PLC via the vision sensor's TCP/UDP process interface. The PLC verifies if the angular value is within the tolerance limits and the comparison against the electronically provided reference pressure delivers the deviation percentage. A graphical user interface visualizes any values outside the tolerances or height deviations from the nominal value.

Instant, seamless documenting

In the *VeriSens*[®] vision sensor, Bourdon-Haenni succeeded in merging 170 years of proven manufacturing technology with latest 21st century



The graphical user interface allows for selection of the required test cycle and immediately visualizes any measured values outside tolerances.

approaches in image-based quality control. Quality inspection is ready for the requirements of the Industrial Internet of Things (IIoT) both in terms of data acquisition and traceability. Full information data, measured values, test results, and images compiled and documented in a database are assigned to a product's serial number. This results in incredible time savings. Jean-Louis Dupré, plant manager of the French Vendôme location notes: "We were able to significantly increase our efficiency. Previously, a manual 5-point inspection with documentation took us ten minutes per pressure gauge. Thanks to the new machine vision system, we cut it down to two minutes, which is an 80% reduction."

Worldwide availability

Presently, the system is being prepared for implementation at the Indian Baumer production plant in the city of Vapi. Because it is crucial to local automotive industry customers that the digital documentation at the end of each test confirm quality and traceability requirements, plans for implementation at the Baumer India site are moving at full speed. Within the scope of a comprehensive utility purchasing program, Bourdon-Haenni sells the system to customers purchasing from them the original Bourdon tube. Consequently, other suppliers of pressure gauges also benefit from the new machine vision system.

More informationen:
www.baumer.com/verisens



Photo: Bourdon-Haenni

The image taken from the dial showing the pointer position enables calculation of the current pressure. This is compared against the electronically provided reference pressure, revealing relative error.



Photo: Baumer

The XF800 VeriSens® vision sensor is ideal for inspection tasks thanks to robust FEXLoc® technology for 360° position tracking and high-precision detection of rotation angle.



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