The computerisation of compressed air

This paper explains the principles behind Industry 4.0, a German Government led initiative design to develop computerisation and digitisation in manufacturing, and how this will optimise the performance and efficiency of compressed air systems.

Industry 4.0 – the next industrial revolution

First came the steam engine and mechanisation, then came Henry Ford's assembly line - and then the microchip revolution shrank the computer to a size that allowed it to be used in every workplace. The fourth industrial revolution will combine the previous three, as smart devices take control over the machinery of manufacturing and distribution.

This fourth industrial revolution is being guided by Industry 4.0, a high-tech strategic project led by the German government, designed to develop the computerisation of traditional industries such as manufacturing. The ultimate goal of the project is the 'smart factory', in which adaptability, resource efficiency and ergonomics are optimised, while customers and business partners are integrated into business and value processes to further maximise efficiency.

This development is based on cyber-physical systems and the 'Internet of Things',1 a principle that is based on the potential for connecting various components or parts over the Internet to ensure they communicate with each other, as well as with users. For example, a packaging chip embedded in a component could communicate with a smartphone and, indeed, interact with other processes higher up the manufacturing or distribution chain.

Conceivably, such a system could result in an industrial process that is fully automated, with little or no human interaction as items would effectively 'move themselves around', with human interaction only the last link in the chain. Commentators claim that the fourth industrial revolution could usher in a smart factory or distribution centre of this kind in as little as 10 years.

One reason why the Internet of Things is only now reaching the potency required for computerisation of manufacturing and distribution systems is the availability of IP addresses. The current IP system permitted a mere 4bn unique combinations – a large number but dwarfed by the countless linked devices by systems such as the one highlighted above and multiplied by the number of people on the planet.

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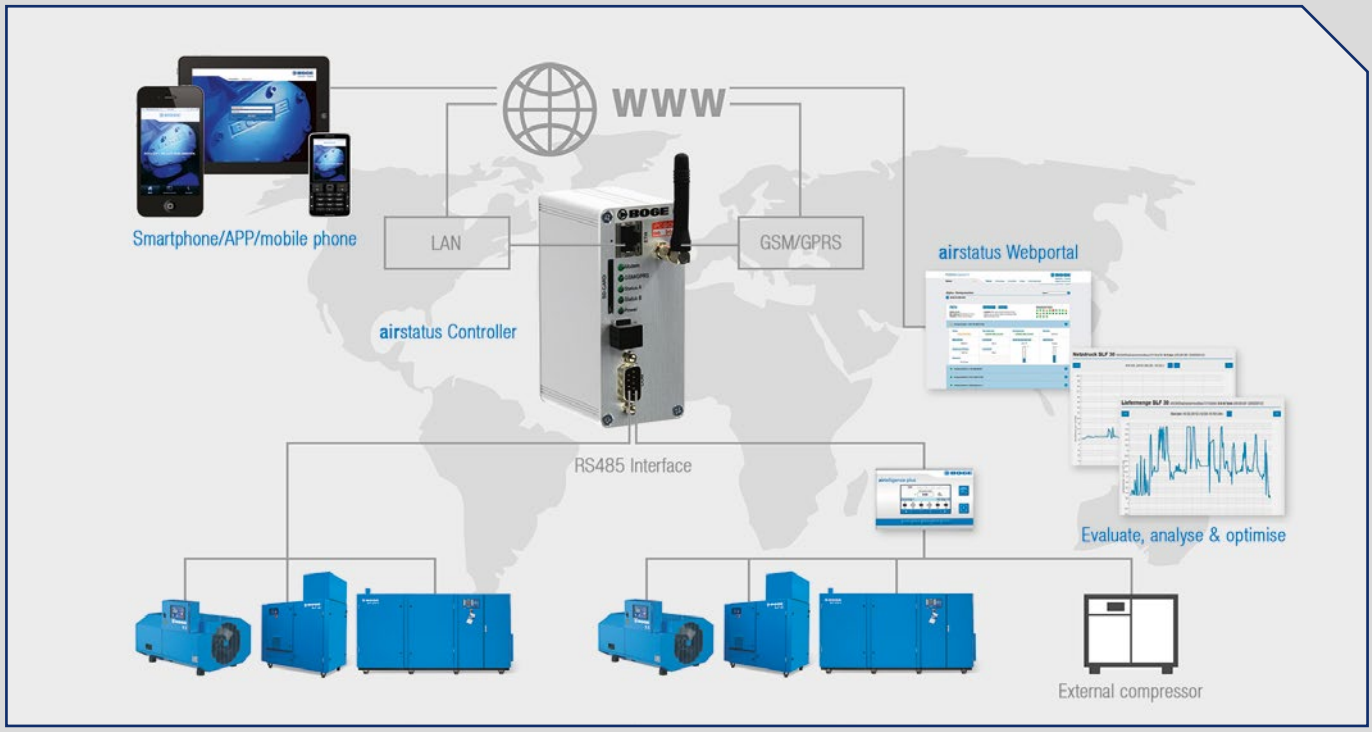

However, an agreement has now been reached for the implementation of a new IP protocol (IPv6) that allows for a staggering number of unique connections, 3.4 x 10 to the power of 38 (340 trillion trillion trillion addresses). We are therefore now standing at the gateway of the smart factory.

Industry 4.0 and compressed air technology
Applying computerisation as described above to a compressed air control system would increase both the safety and transparency of compressed air production and all associated components. This would ensure the high-level of performance and efficiency demanded by users who operate compressed air stations and, integrated with monitoring and management of complex systems and plants, would contribute to making the smart factory a reality.

The need for compressed air control

Good diagnostic information provides important data to ensure that problems are detected early enough to allow planned maintenance intervention or repair to be carried out with minimal disruption, reducing overall maintenance costs, improving safety, and increasing both plant availability and product quality. Designers and engineers have already developed a wide range of online tools to monitor various parameters. Compressed air users require such tools to swiftly determine how critical equipment is running and identify early any operational problems so that they can be addressed at a time convenient to the production process, thus maximising asset performance and efficiency.

When it comes to compressor efficiency, flexible, status-based maintenance removes the need to

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replace high-value components, such as compressor stages and motors, at previously defined intervals, resulting in significant cost savings for the customer.

The increased use of electronics in compressors therefore means that comprehensive data already available in the compressor or in a master control system can thus be collected and – after correct interpretation – can be used to provide information regarding the wear of the machinery and its components. For example, by monitoring vibration, the status of the rolling bearings is determined on a continuous basis. These can then be replaced or renewed only when the diagnostic data indicates that this is necessary.

How a computerised compressed air system would work

A smart factory would allow the operator of a compressed air system to monitor and control the status of multiple components from anywhere in the world via iOS and Android devices. Process data such as status, maintenance messages, temperatures and pressures could be directly transmitted and displayed, offering a powerful remote diagnostics tool. This would allow users to identify, analyse and react immediately to fault messages on their own computer or smartphone, considerably reducing the time needed to rectify faults, or used for condition monitoring in order to manage proactive measures and to plan and coordinate maintenance work.

Development is now taking place to produce computerised control systems that offer a range of control options and which, to varying degrees, prepare users for the coming revolution. These span from a "local monitoring" package that has been developed with hardware, web portal use and APP, to a premium monitoring package that can be used with a smartphone.

BOX OUT

BOGE has launched the BOGE airstatus, a new remote diagnostic tool designed to deliver maximum control and reliability. As industries across the world move to enhance efficiency via the computerisation of manufacturing, BOGE's pioneering technology redefines and enhances the communications

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between man and machine, helping users to optimise compressed air performance.

With airstatus, users are able to quickly and easily analyse and control the status of up to 32 components from anywhere in the world. Process data such as status, maintenance messages, temperatures and pressures are directly transmitted and displayed via the web portal, making airstatus a powerful remote diagnostics tool. This enables users to identify, analyse and react immediately to fault messages on their computer or smartphone, reducing the time needed to correct faults.

A ModbusScan to detect each of the compressors and components makes it easy to commission the BOGE airstatus monitoring facility. The system data communication is processed in real-time via GSM/GPRS or a LAN connection and users view data in the BOGE airstatus web portal or in the BOGE airstatus app. Alarm management by email or SMS if defined limits are exceeded or undercut provides an additional safety feature. With this capability, users can employ the BOGE airstatus for condition monitoring in order to manage proactive measures, such as planning and coordinating maintenance. The BOGE airstatus app offers simple and flexible management 24 hours a day and works with all mobile iOS and Android devices.

Summary

Over the next decade we will see an acceleration in the speed of evolutionary change in the management and utilisation of data as a result of initiatives such as Industry 4.0. The potential to gather and share information on compressed air systems can be profitably exploited by the engineering industry.

Industrial efficiency has to improve, particularly energy efficiency now that resources are ever-more scarce, and that will also accelerate the need to establish the smart factory. The need to be more energy efficient as a means of increasing profits goes hand in hand with the growing change in the attitudes of both engineering companies

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and their customers towards conducting more ethical operations. We are moving towards a more responsible industry, where specialists and innovators are prized more highly than ever before.

2014's Hannover Messe proved the point. This marked the first time that the popular trade show offered guided "Industry 4.0" tours[2]. These tours took trade visitors directly to a variety of technology demonstrations, including fully automated production lines where smart work pieces directed their own individual processing steps.

The focus placed on Industry 4.0 at Hannover Messe left the engineering industry in no doubt that computerisation of machinery will bring huge benefits to all concerned, not least users of compressed air systems. Considering the cost of energy and the waste generated by an inefficient compressed air system, embracing computer control of compressed air systems will not only start bringing in cost-savings but also prepare users for the even greater efficiencies that will be established by the fourth industrial revolution.

To find out more about BOGE Compressors and specialist gas generators, please contact us or visit our website:

www.boge.com/uk

References

1 - http://en.wikipedia.org/wiki/Industry_4.0
2 - http://www.hannovermesse.de/en/exhibition/tours/guided-tour-industry-4.0/index.xhtml

Further reading

1 - http://www.siemens.com/innovation/apps/pof_microsite/_pof-spring-2013/_html_en/industry-40.html
2 - http://www.theengineer.co.uk/channels/production-engineering/automation/industry-40-the-next-industrial-revolution/1016696.article

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