CompAir

Compressed Air 4.0

Predictive and Interlinked Intelligence

White Paper

iConn

Contents

Glossary

Industry 4.0 covers the digitisation and networking of products, production and value creation processes.

Predictive Maintenance as a maintenance strategy means predicting and thus avoiding possible malfunctions, errors and impending breakdowns.

Condition Monitoring refers to the collection of data on constant monitoring of the (wear) condition of the component/product.

More efficiency. Productivity. Investment protection.

1. Introduction

1.1 What benefits does Industry 4.0 offer compressed air users?

The digital networking of the components of a system/plant (e.g. compressor, filter, dryer, etc.) can minimise operating costs in advance and increase the availability of a compressed air system.

Networking is a major lever for savings. Above all, it influences and reduces energy and service costs (see fig. 1). In addition, it leads to greater process reliability and cost control.

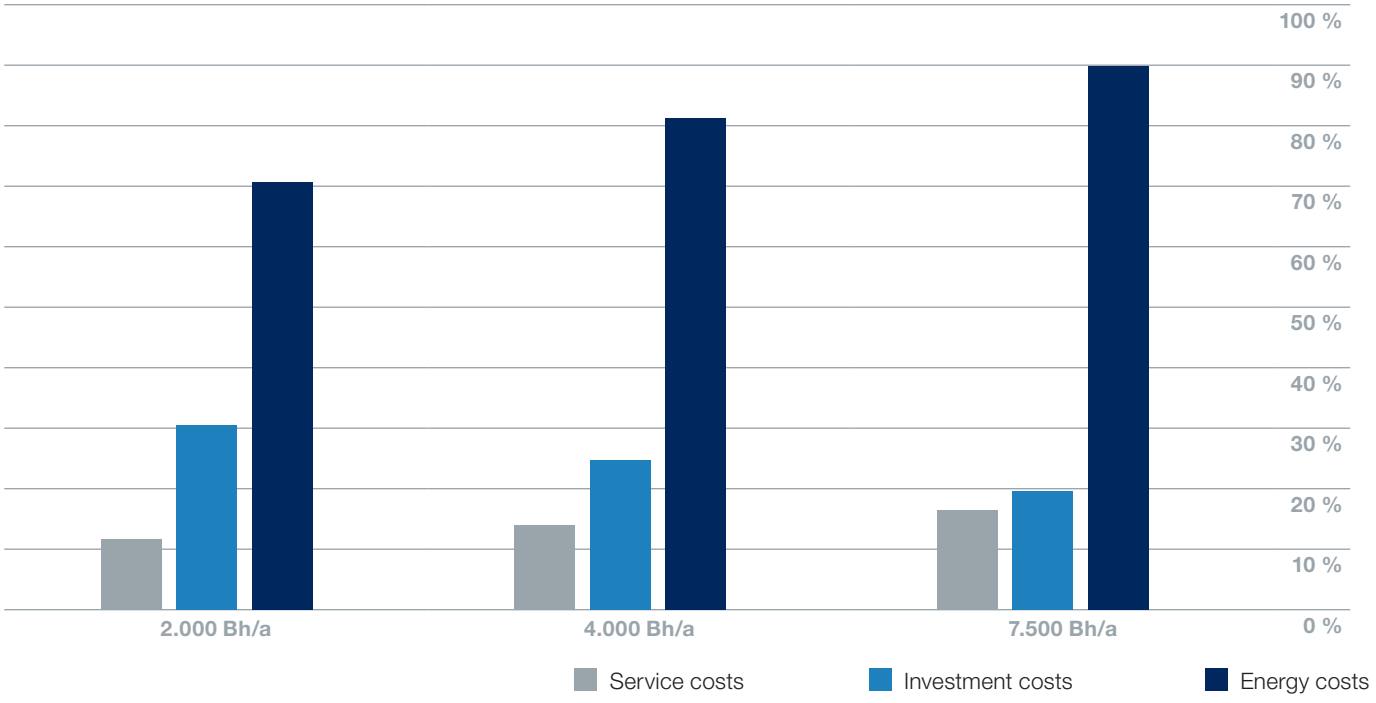

Fig. 1: **Presentation of the cost distribution in the company using the example of a compressed air system**

Source: Druckluft effizient, 2002; adapted and updated, 2018

Digital networking provides data relevant to wear, costs and quality, which can be used to significantly increase functional reliability and productivity. Savings from the reduced operating costs pay for the investment in the shortest possible time.

Advantages at a glance

- Reduction of operating costs in production by reducing pressure drop
- Avoidance of possible functional failures, quality losses and rejects
- Reduction of production costs through energy saving
- IIncreased environmental friendliness through lower CO_2 emissions from reduced energy usage
- Increased availability of the compressed air system
- Full use of the serviceable parts stock; maintenance work carried out when economically most sensible

Figure 2 shows the relationship between networking and a physical plant using the example of a compressed air plant.

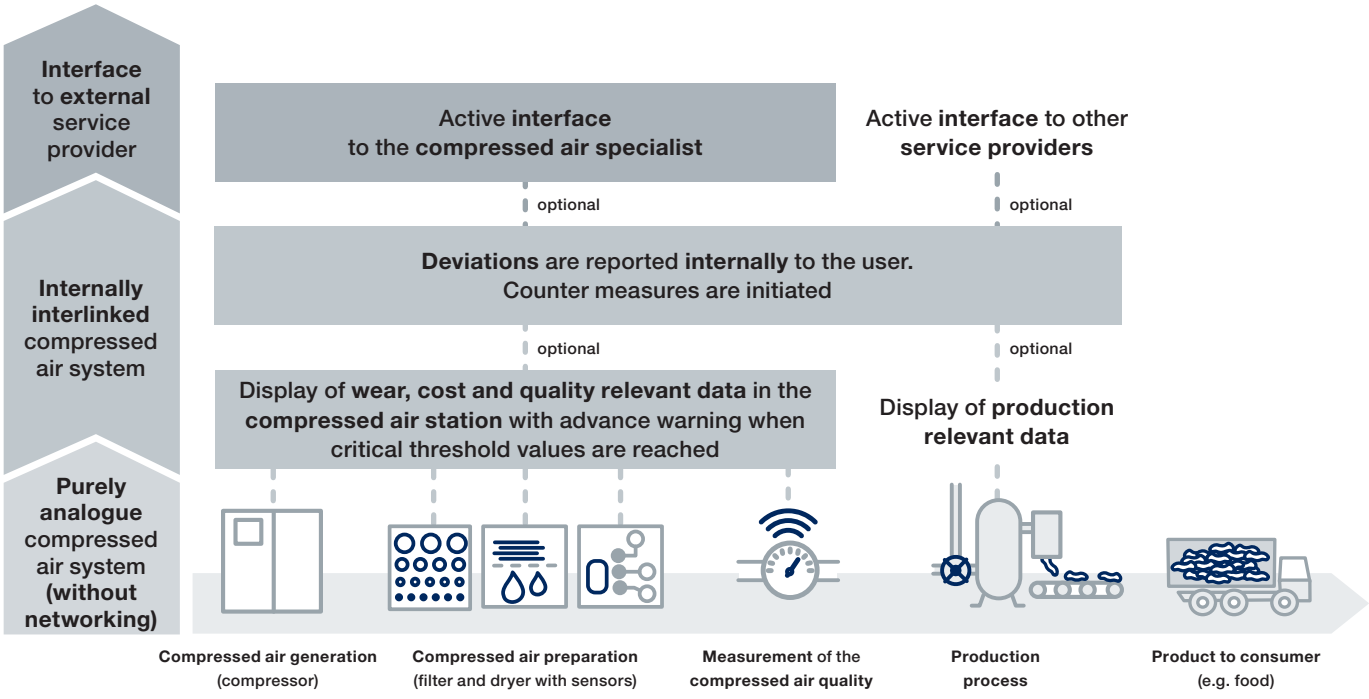

Fig. 2: **Possibilities of networking using the example of a compressed air system**

Source: BEKO TECHNOLOGIES

1.2 How can I achieve this?

Networking achieves cost savings in energy and service costs through the following influences.

Influence on energy costs using the example of a compressed air system

Continuous online monitoring influences energy costs as follows:

- Systematic cost control by displaying the current costs and showing the savings
- Detection of leakage loss/ pressure losses and narrowing of search areas
- Detection of differential pressure changes and filter change frequency with the consequence of a timely filter change
- Optimised and future-oriented compressor and plant control (i.e. faster adjustment to future requirements such as providing air at an early stage)
- Higher-level control enables better communication and integration of compressors old and new, with utilisation according to efficiency
- Technical optimisation of the compressor or the compressed air preparation by replacement or retrofitting with modern energy-efficient technology (e.g. replacement with energy-efficient eMotor for older compressors)
- Constant monitoring of compressed air purity minimises the risk of contamination and damage to products, e.g. in the food or pharmaceutical industry
- Feedback as to whether the overall system design (incl. multi-pressure systems) fits the current needs of the user and whether a structural change is necessary

Influence on service costs using the example of a compressed air system

The use of condition-based maintenance (Condition Monitoring/ Predictive Maintenance) allows deviations from the optimal plant condition to be detected early and countermeasures to be initiated. Expensive failures and downtimes are avoided.

Maintenance intervals are no longer time-controlled, but are based on individual component wear and actual requirements. This results in better planning of service and spare parts (time/cost saving), as shown in figure 3.

Advantages of Condition Monitoring/Predictive Maintenance:

- Utilisation of the wear stock (cost saving)
- Detection of abnormal wear (process reliability)

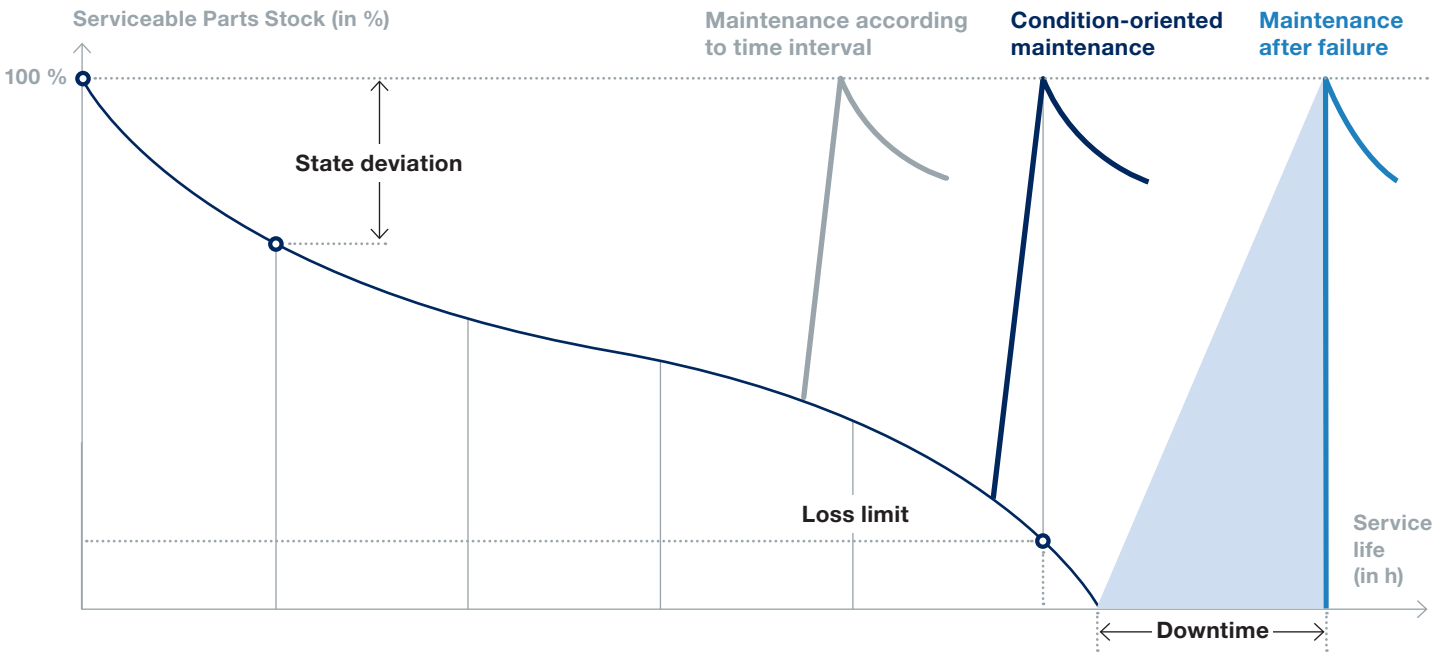

Fig. 3: **Degradation curve of the degree of wear of a component**

Source: BEKO TECHNOLOGIES

Proactive real-time monitoring for absolute security!

1.3 How do I proceed?

I make my machines/systems suitable for Industry 4.0; data can then be recorded, read out and analysed.

In co-operation with my compressed air technology consultant and my IT manager, I check and identify existing technology, networkability and network security. I consider these from the beginning of my entire development process.

1.4 How do I achieve networkability and network security?

The high safety standards for industrial machines and OT networks must also be maintained when they are networked. I can reliably guarantee this by taking appropriate technical and operational measures.

By isolating the monitoring components from the control components and segmenting the network with strict access controls, I can ensure that the monitoring system does not interfere with the control system or gain unauthorised access to other components in the OT network.

Typical information security measures such as access controls and encryption complement these security measures to protect the confidentiality, integrity and availability of data.

2. Where do I stand regarding Industry 4.0 (actual state)?

Together with my compressed air specialist consultant I take stock of the situation.
The following key questions can support me in this:

- ☐ Are sensors/actuators already integrated in my system and do I receive evaluations/ visualisations based on the data obtained?
- ☐ Does my system react independently on the basis of the acquired data?
- ☐ Does my plant have an industrial ethernet interface or is there internet access?
- ☐ Is there sufficient automated data storage for operating data and can I access or receive regular reports as required?
- ☐ Are the operating conditions continuously recorded and can I use a predictive service as a result?
- ☐ Is my plant protected by independent analysis and measures?
- ☐ Is my system integrated into the IT service infrastructure of the service provider?
- ☐ Do I already receive digital product-related services such as digital operator models, software updates etc.?

VDMA Leitfaden Industrie 4.0 offers me a **further orientation** with its toolbox for products.

Smart Compressor Service 4.0

3. How do I actually secure my solution?

IT security plays an important role in the implementation of a network. It is important to clarify the responsibilities for IT security with the parties involved. The following responsible parties must be involved in the implementation of a digital service (predictive maintenance)

- Me as a user
- My IT department
- External service provider (service provider/ manufacturer of compressed air systems)

The necessary protective measures for a monitoring solution must be selected on the basis of a risk assessment and agreed between my organisation and the external service providers. Standards and guidelines such as the VDMA recommendations provide a comprehensive overview of the risks and necessary measures.

Overview activities		Me as a user	My IT	External service provider
Risk analysis	Determination of protection goals	◉		
	Identification of threats		◉	
	Risk assessment	◉	◉	◉
Network segmentation	Use of isolation measures (e.g. firewall)		◉	
User accounts, credentials, authorisation and authentication	Individual user accounts	◉	◉	◉
Use of secure profiles	Confidentiality of communication with IP-based protocols		◉	◉
Protection of radio technologies	Wireless Access Management			◉
Secure remote access	Rules for establishing and terminating a remote access session		◉	◉
	Encryption of connections		◉	◉
Monitoring and attack detection	Monitoring of all accesses on machine components		◉	◉
	Virus scanner		◉	◉
Recovery plan	Creation of backup systems			◉
	Creation of regular backups			◉
Documentation	Interfaces		◉	◉
	Established processes			◉
	Machine inventory (hardware and software on the machine)			◉

Tab. 1: **Exemplary IT security measures for implementing predictive maintenance**

Source: inspired by recommendations for action for SMEs “VDMA Leitfaden Industrie 4.0 Security – Handlungsempfehlungen für den Mittelstand”

4. Conclusion – Compressed Air 4.0: predictive and interlinked intelligence

The **networking** of the components of my compressed air system provides machine data of the individual components of my Industry 4.0 system. The comparison of the data of my own system with further information enables me to make a retrospective, but above all, forward thinking evaluation of my overall system by the intelligence implemented in the IT system, among other things. Through targeted recommendations for action and measures taken by my service provider/manufacturer, I obtain the best possible transparency regarding the operation of my system as well as potential savings through more efficient generation and processing of compressed air.

5. Bibliography with further references related to industry 4.0

- Orientation guide for introduction to medium-sized companies
  “VDMA Leitfaden Industrie 4.0 – Orientierungshilfe zur Einführung in den Mittelstand”
  (see also link to German website: https://www.vdma-verlag.com/home/artikel_71.html)
- Recommendations for SMEs
  “VDMA Leitfaden Industrie 4.0 Security Handlungsempfehlungen für den Mittelstand”
  (see also link to German website: https://www.vdma-verlag.com/home/artikel_73.html)

6. Information & Contact

CompAir

CompAir Drucklufttechnik
Gardner Denver Deutschland GmbH

Argenthaler Straße 11
55469 Simmern

iConn@gardnerdenver.com
Phone +49 (0)67 61 832-136

www.compair.com

Imprint

Editor
VDMA
Kompressoren, Druckluft- und Vakuumtechnik
Andreas Brand
Lyoner Straße 18
60528 Frankfurt am Main

Picture sources
Adobe Stock, CompAir, shutterstock

Status
February 2020

CompAir

www.compair.com www.linkedin.com/company/compair