SMC

COMPRESSED AIR DIGITALISATION

Boundless pneumatics

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FOR THE INDUSTRY OF TOMORROW

Expertise
Passion
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3 What is digitalisation?

4 Digitalisation in compressed air-driven systems

5 Understanding your digitalisation level

6 How to digitalise the compressed air in your factory

- 6 Starting with the basics - Upgrades
- 8 Realistic improvements
- 9 Practical updates to make benefits from digitalisation achievable
- 10 One step forward
- 13 Progressing digitalisation in your automation
- 14 Unleashing all the potential: consolidation of control and data acquisition
- 15 SMC's digital architecture
- 16 Visibility and control of plant wide compressed air distribution

17 Reaping the rewards of your digitalisation

18 Our support network

What is digitalisation?

Digitalisation refers to the collection of data and integration of digital technologies or tools into industrial processes, operations, and systems, transforming how industries produce goods, manage resources, and deliver services.

The **benefits** of digitalisation are:

- Enhance efficiency & productivity
- Enable autonomous operation
- Reduce operational costs
- Increase flexibility
- Make data driven decisions
- Create new business models that can adapt quickly to evolving market demands.

This transformation is often associated with the broader concept of **Industry 4.0**, the fourth industrial revolution, which marks the shift from traditional manufacturing methods to smart, connected, and data-driven processes.

Digitalisation is the backbone of Industry 4.0, enabling smart factories to leverage advanced technologies like IoT, AI, and big data for enhanced efficiency and innovation

Digitalisation in compressed air-driven processes

When applied to manufacturing processes using compressed air, digitalisation can significantly enhance **efficiency, reduce energy consumption, improve maintenance practices**, and **provide valuable insights** for optimising operations.

Compressed air is often considered the fourth utility in manufacturing, powering tools, machines, and automated systems. However, managing compressed air systems traditionally involves a lot of manual monitoring and maintenance, which can lead to inefficiencies and unnecessary costs. By applying digital technologies, manufacturers can optimise their compressed air usage and improve overall production performance.

It can be divided into three different stages:

Monitoring

- **Data acquisition:** collecting data from sensors, machines, and other sources
- **Real-time tracking:** monitoring the status and performance of equipment and processes in real-time
- **Visualisation:** using dashboards and visual tools to represent data clearly
- **Alerts and notifications:** setting up alerts for anomalies or deviations from expected performance.

Control

- **Parameter setting:** implement operating conditions based on process requirements
- **Feedback and adjustment:** establish feedback loops where data from KPIs is used to make real-time adjustments to the automation system.

Optimisation

- **Historical data analysis:** storing and analysing historical data to identify trends and patterns
- **GAP analysis**
- **Predictive maintenance programmes:** using data analytics to predict and prevent equipment failures
- **Energy efficiency and CO_2 reduction programmes:** identifying and implementing cost-saving measures
- **Resource management:** optimising the use of resources such as energy, materials, and labour.

Understanding your digitalisation level

Each factory has its own particularities, meaning that the digitalisation solutions need to be carefully tailored to **match the needs of each case**. For example, we cannot assume a basic process with manually-operated devices and visual monitoring has the same demands as a factory using fieldbus communication and SCADA systems.

Here are some indicators that can help identify the level of digitalisation within a line or factory:

	Pressure and flow control	Monitoring	IO-Link	Fieldbus system	Wireless system	Data management and cloud connectivity	Predictive maintenance programme
1 Basic or no digitalisation	Manual	Visual	X	X	X	X	X
2 Reasonable digitalisation	Digital	Digital	●	●	X	X	X
3 Advanced digitalisation	Digital	Digital	●	●	●	●	X
	Digital	Digital	●	●	●	●	●

Practical updates to make benefits from digitalisation achievable

Progressing digitalisation in your automation

Visibility and control of plant wide compressed air distribution

Let SMC help you progress to the next level of digitalisation

How to digitalise compressed air in your factory

1 Basic or no digitalisation

Starting with the basics

Introducing digitalisation into a factory can seem like a daunting process. However, starting with a few key steps will make the process much more manageable. Begin by **transitioning the visual and manual operations to digitally monitored parameters**, such as pressure, flow rate, compressed air condensation level and temperature…

Implementing these **simple and affordable changes** will help you to centralise maintenance tasks and reduce man hours. It will also provide valuable benchmark information that can help to monitor process conditions and detect any anomalies.

Upgrades

Filter clogging inspection

Visual inspection

Main line filter with clogging switch
AFF Series

High-precision digital pressure Switch
ISE20/ZSE20 Series

Benefit with digitalisation:

- **Remotely identity an excessive pressure drop.**

Upgrades

Pressure monitoring

Pressure gauge

Pressure sensor monitor IO-Link
PSE Series

Benefit with digitalisation:

- **Get a visual and electrical signal when pressure is outside of the optimum range.**

Pressure regulation

Manual pressure regulator

Electro-pneumatic regulator IO-Link
ITV Series

Benefit with digitalisation:

- **Pressure can be remotely configured and monitored with high precision.**

Flow rate control

Speed controller

Flow controller for air IO-Link
PFCA7 Series

Benefit with digitalisation:

- **Purge or blow rates can be adjusted to suit different processes without manual intervention.**

Realistic improvements

Humidity monitoring

Condensation checker IO-Link
PSH Series

Benefit with digitalisation:

- **Allows for the compressed air moisture level to be checked continually to alert of potential dryer problems and prevent equipment damage.**

Conditional monitoring

Analogue auto switch
D-MH1 Series

Benefit with digitalisation:

- **Monitoring of actuator speed and minor positional changes enables preventative maintenance.**

Flow & temperature monitoring

Digital flow switch for large flow IO-Link
PF3A□H Series

Benefit with digitalisation:

- **Highlights the development of potential leaks or flow anomalies and detects any compressor issues.**

Cycle count

Fieldbus unit
EX600 Series

PROFINET EtherNet/IP OPC UA IO-Link

Benefit with digitalisation:

- **Remote monitoring of high cycling equipment in operation and logging of running time allows predictive maintenance**
- **High data volume processing**
- **Enables cloud-based data management.**

Vacuum efficiency

Vacuum unit, ejector system for manifold
IO-Link
ZK2□A Series

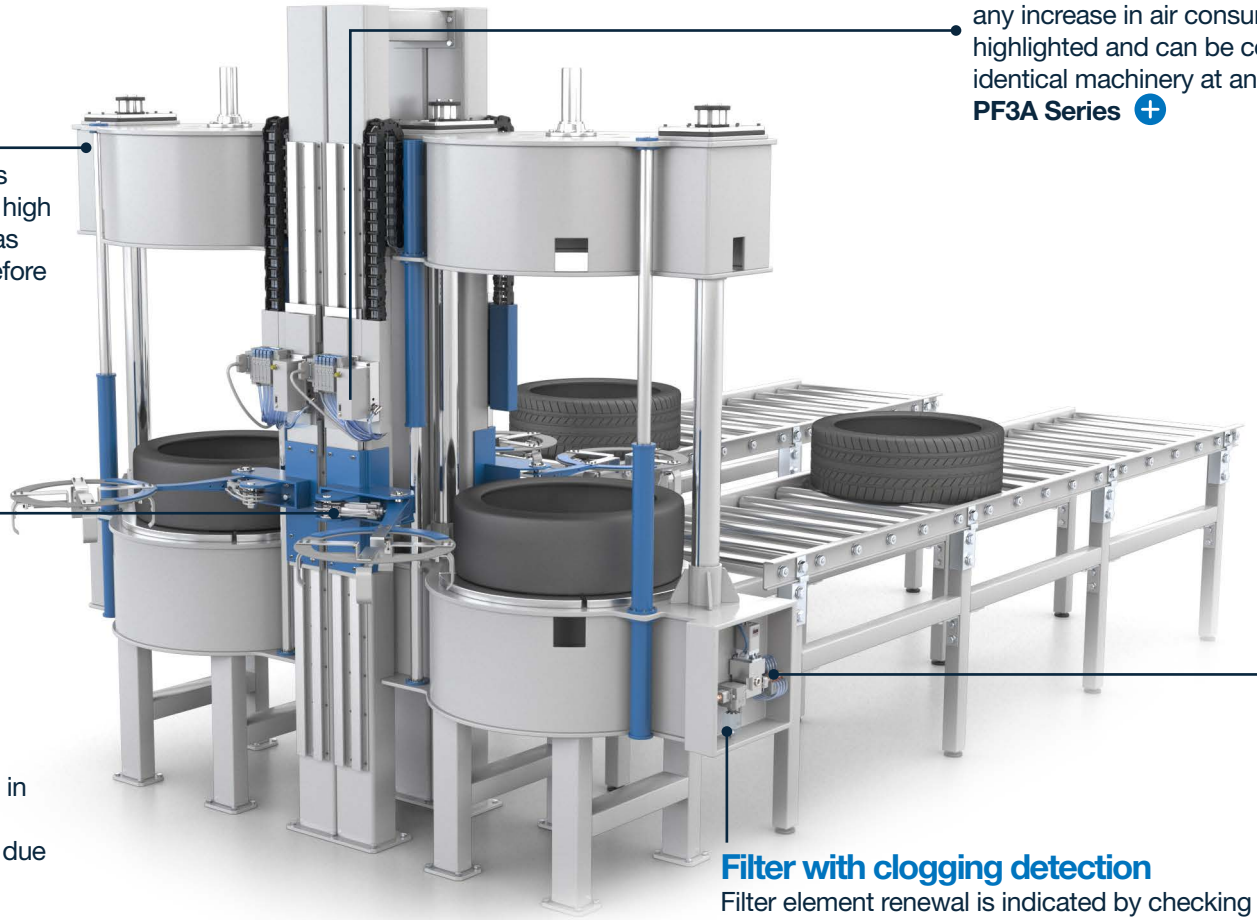
Benefit with digitalisation:

- **Integrated monitoring ensures compressed air is only used to generate vacuum during transfer only when required.**

SMC's IO-Link products can help you improve your productivity and reduce your costs by simplifying installation, granting dynamic production processes and reducing downtime with real-time diagnostics. Learn more about our IO-Link solutions

Practical updates to make benefits from digitalisation achievable

At SMC, we understand that making widespread changes can be impractical. Focusing initially on individual machine processes and their potential for improvement is a helpful starting point. The examples shown here are just some of the successful changes SMC helped to implement in automated machinery used for tyre manufacturing.



Machine consumption monitoring

After benchmarking during commissioning, any increase in air consumption is highlighted and can be compared to identical machinery at any time.

PF3A Series

Critical component leak detection

Localised air consumption rates caused by leaks in actuators in high temperature mould release areas are checked and highlighted before they become critical.

PF2M7 Series

Remote pressure control

Control pressures at lift stations are adapted to suit the various products processed making the machinery adaptable.

ITV Series

Actuator performance tracking

Precise stopper actuators used in lift operations give feedback on changes in positional accuracy due to wear before a failure occurs.

D-MH1 Series

Filter with clogging detection

Filter element renewal is indicated by checking for unacceptable pressure drops.

AFF Series

2 Reasonable digitalisation

One step forward

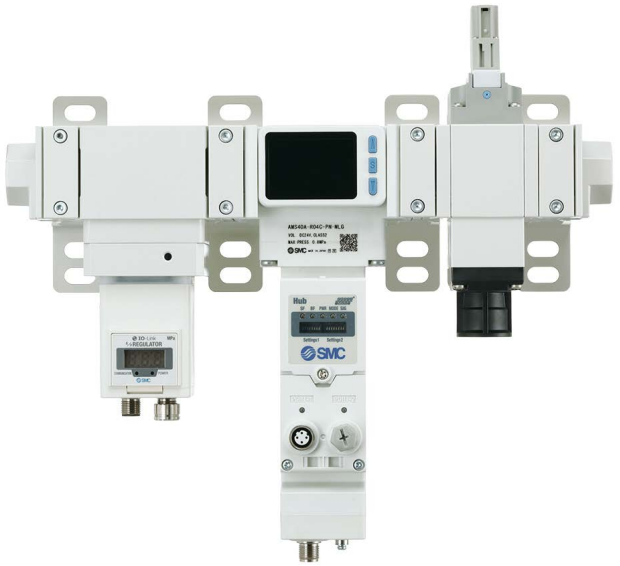
In today's rapidly evolving industrial landscape, even factories with a degree of digitalisation can find significant opportunities for improvement. By upgrading key components, you can enhance your factory's efficiency and maintenance capabilities. Implementing **advanced technologies** (IO-Link, Fieldbus communication, wireless) not only streamlines operations but also reduces downtime and maintenance costs. This proactive approach ensures that the factory remains competitive, agile, and ready to meet the demands of the future.

Pressure regulator

Digital fow switch

Residual pressure release, 3-port solenoid valve

Pressure switch

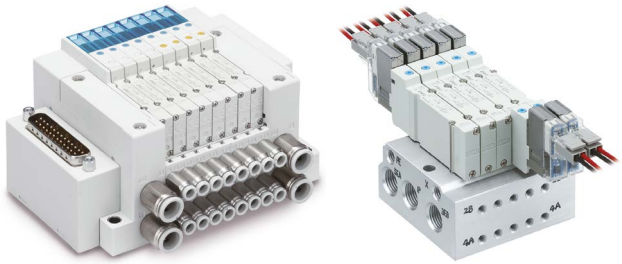


Air Management System
AMS20/30/40/60 Series

PROFINET EtherNet/IP EtherCAT IO-Link

Benefit with digitalisation:

- **Automatically triggers standby or isolation modes based on signals, increasing the efficiency of the process**
- **Fieldbus communication for data transmission.**



Standalone valve manifold

Centralised wiring valve manifold with fieldbus unit
EX600 Series

Benefit with digitalisation:

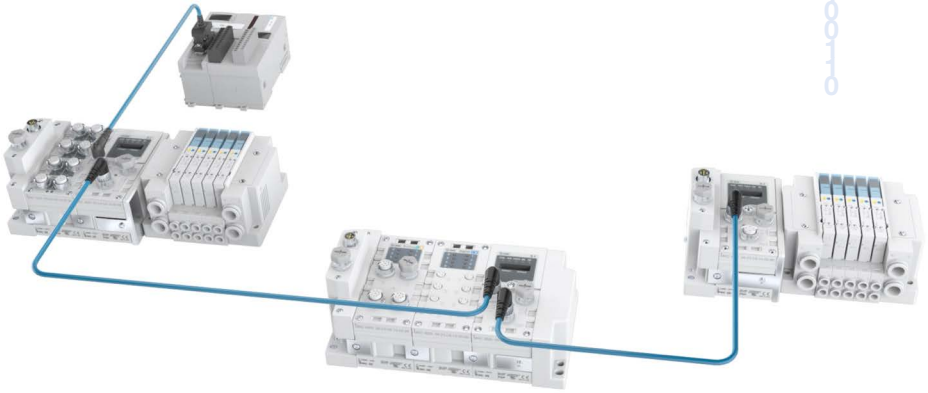
- **Fieldbus communication**
- **Control input/output modules with fault detection monitoring**
- **High data volume processing**
- **Enables cloud-based data management.**

Valve manifold system with wireless fieldbus Unit with OPC UA capability
EXW1/EX600-W Series

PROFINET EtherNet/IP EtherCAT OPC UA IO-Link

Benefit with digitalisation:

- **Decentralisation and connection to propriety sensors**
- **Maintenance cost reduction**
- **Scalable across factory sites in different locations.**



Decentralised valve manifold system with fieldbus unit
EX600 Series

Benefit with digitalisation:

- **Easily expandable network allowing I/O factory wide coverage. Wiring, diagnostics and data traffic is simplified.**

Reliability for peace of mind

Improving safety indirectly impacts efficiency. Digitalisation brings reduced accident potential, repair demands and overall production uptime whilst protecting operators from identified risks.

Air supply with dump control and pressure recognition

Pressure relief 3-port valve

Soft start-up valve

Pressure switch

Safety exhaust with soft start up and monitoring
VPX400 Series

Benefit with digitalisation:

- **Integrated pressure buildup, fault detection, dual redundancy and high-speed air dump on demand.**

Progressing digitalisation in your automation

By advancing the principles of digitalisation further, more complex systems or processes can be improved. Examples where products have been used successfully with the support of SMC are shown in relation to automated food packaging. Lines of identical machines can be improved, monitored and compared.

Centralised fieldbus communication

Pressure regulation, control valves, and vacuum ejectors are controlled over fieldbus which also communicates with data from IO-Link positional sensors.

JSY Series
EX600 Series

Energy consumption control

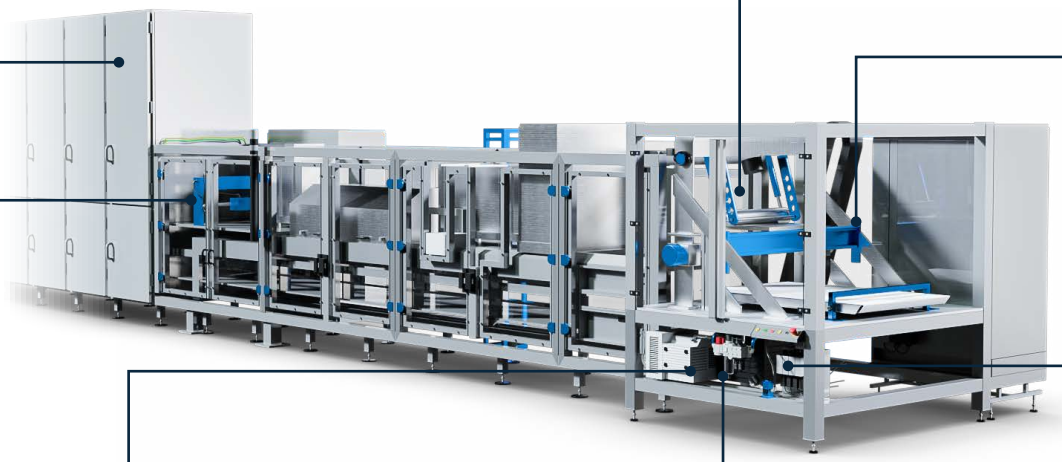
Vacuum pick and place of packed product only consumes air should losses in suction cups be detected.

ZK2A Series

Optimisation of air flow

The air blow used for cooling and drying is set depending on production type and size.

PFCA7 Series



Humidity monitoring

Changes in the supplied air temperature and moisture level, which are critical to product quality are alerted before problems occur.

PSH Series

Convenient health checking

Any changes to local pressures resulting from line pressure drops are signalled remotely and also highlighted to local operators by incorporating LCD displays with “NO-GO” colour change.

ISE20 Series

Safety monitoring

Operational safety is periodically checked to prevent machines from running in an unsafe condition.

VPX400 Series

Automated air management

The supplied air pressure is automatically reduced when operation is paused. When practical, air is entirely isolated.

AMS20/30/40 Series

3 Advanced digitalisation

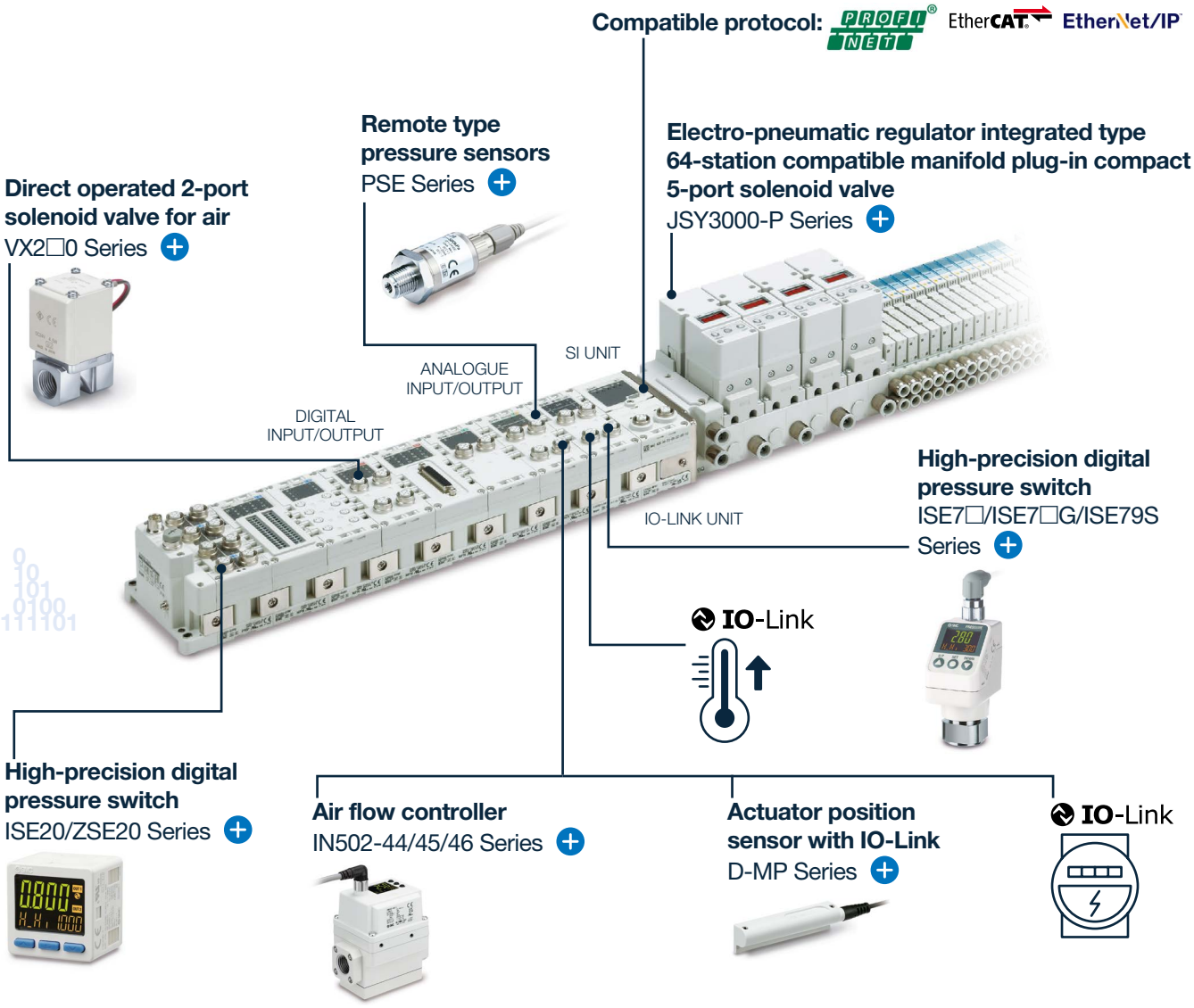
Controlling individual solenoid valves on a network is a well-established practice for reducing wiring and simplifying system expansion. But why stop there? The network interface can also control components like pressure regulator and flow controllers, while output blocks can switch devices such as liquid valves, and data collected from inputs can be easily accessed and shared. IO-Link opens up even more control possibilities for the integration of proprietary equipment.

Unleashing the full potential: consolidation of control and data acquisition

Electropneumatic regulators

Sensors and switches

Valve manifold

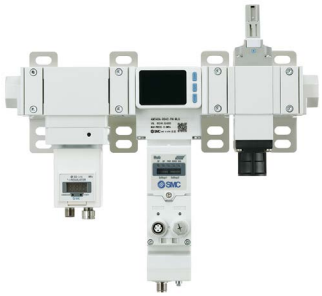


SMC's digital architecture

If you are already leveraging digitalisation in your factory, you are well on your way to optimising your operations. However, to truly unlock your factory's full potential, consider escalating to a comprehensive **Digital Architecture**. SMC's DA involves creating a cohesive digital environment where all systems and processes are interconnected. This integration allows for real-time data collection, analysis, and decision-making, leading to improved efficiency, predictive maintenance, and overall performance. Wireless connecting devices and the exchange of data over OPC UA broadens the architecture further.

Key to industry 4.0, OPC UA provides open-source communication standard for data exchange. It is completely independent to vendor and can become the cornerstone of a digital architecture.

- Access and sharing of data collected in global locations
- Cross software platform
- Easily expanded
- Closed network or internet
- Inbuilt security.



Air Management System

Air Management Hub

Compact wireless fieldbus system
Base unit with built in OPC UA server
EXW1 Series

Air Management System
AMS20/30/40/60 Series

Compact wireless fieldbus system
Output remote unit
EXW1 Series

Compact wireless fieldbus system
IO-Link remote unit
EXW1 Series

Visibility and control of plant wide compressed air distribution

Compressed air is often delivered around the factory for use on demand, generally unchecked and largely uncontrolled at the distribution network level. Reliance on individual machines using the air in an efficient manner cannot be assumed – especially as equipment ages or its use changes. Through digitalisation, users can easily gather accurate pressure and flow data from all air users instantly, helping to identify consumption anomalies. **Sharing data from facility to facility, regardless of location,** allows users to optimise production and improve efficiency as well as replicating ways of working.

Remote, wireless centralised IO-Link communication

Data to and from localised sensors used in processes unrelated to pneumatics is also accessible.

EXW1-RL Series

Remote output/input control

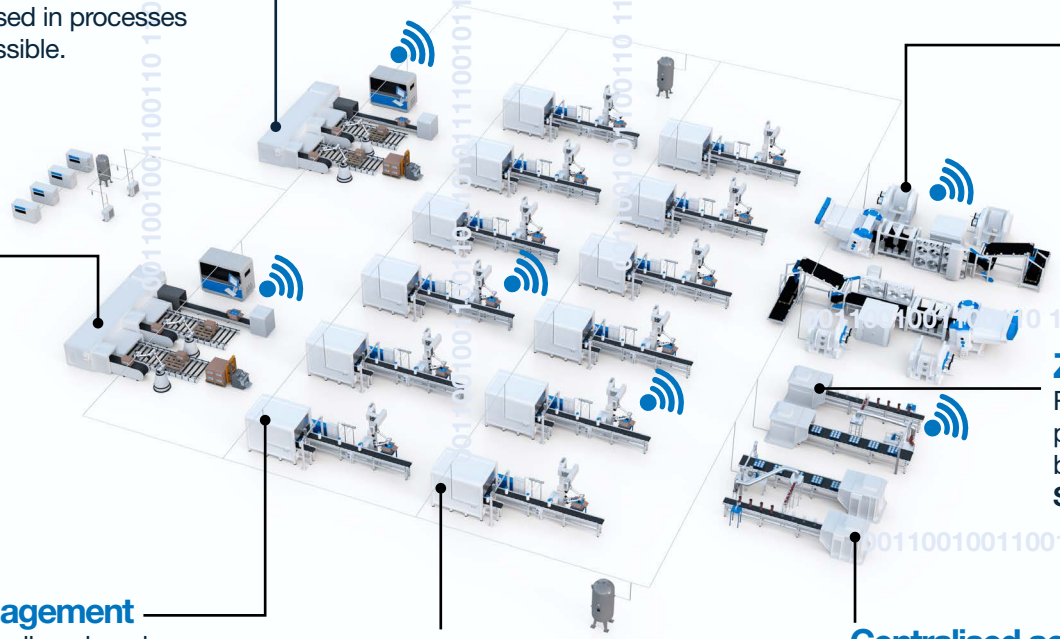
Traditional control of (and signals from) proprietary switchgear used around the plant can be accommodated.

EXW1-RD Series

Automated machine air management

The supplied air pressure is automatically reduced when operation is paused. When practical, air is isolated entirely.

AMS20/30/40 Series



Zone metering

Air consumption by different lines or areas of the plant can easily be monitored.

PF3A□H Series

Centralised wireless data collection

Information such as running pressure and consumption is gathered for collation and comparison. Users in factories in other locations can also access this data.

EXW1 Series

Zone pressure regulation

Rather than an indiscriminate supply, pressure is controlled at specific levels based on production line demands.

Series VEX-X115

Centralised actuation control and monitoring

Fieldbus systems at machine level allow the consolidation of both pneumatic controls and monitoring signals.

EX600 Series

Reaping the rewards of your digitalisation

With routine **data collection and analysis**, the possibilities are endless. AI programmes can base their decisions on the scrutiny of reliable data. Techniques can be used to future-proof equipment such as the development of a digital twin where physical world data is used to safely simulate and identify the impacts of “what if” scenarios. Now that the factory has elevated its digitalisation level, it’s time to make the most of it.

Predictive maintenance

Use data to predict when machines are likely to fail or require maintenance. This helps in scheduling maintenance activities proactively, reducing downtime and extending the lifespan of your equipment.

EXAMPLE Counting the operation cycles of known worn parts to plan proactive rather than reactive maintenance.

Process optimisation

Analyse data to identify bottlenecks and inefficiencies in your production processes. By understanding where delays or issues occur, you can implement changes to streamline operations and improve overall efficiency.

EXAMPLE As processes run, identify when and where excessive pressure drops occur as processes run to highlight inefficiencies.

Quality control

Monitor data to ensure that products meet quality standards. By tracking variables such as temperature, pressure, and speed, you can detect anomalies early and take corrective actions to maintain product quality.

EXAMPLE Detect machinery actuator control changes (speed and position) to forewarn of potential changes in quality.

Energy management

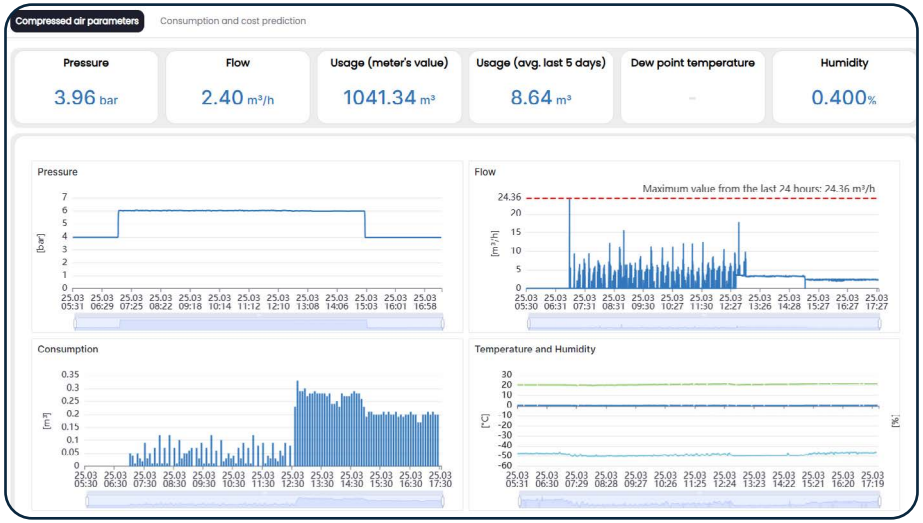
Use data to monitor energy consumption and identify areas where energy use can be reduced. This not only lowers costs but also supports sustainability initiatives.

EXAMPLE Benchmark and monitor consumption of new machinery to identify any changes quickly.

Inventory management

Analyse production data to forecast demand and manage inventory levels more effectively. This helps in reducing excess inventory and minimising stockouts.

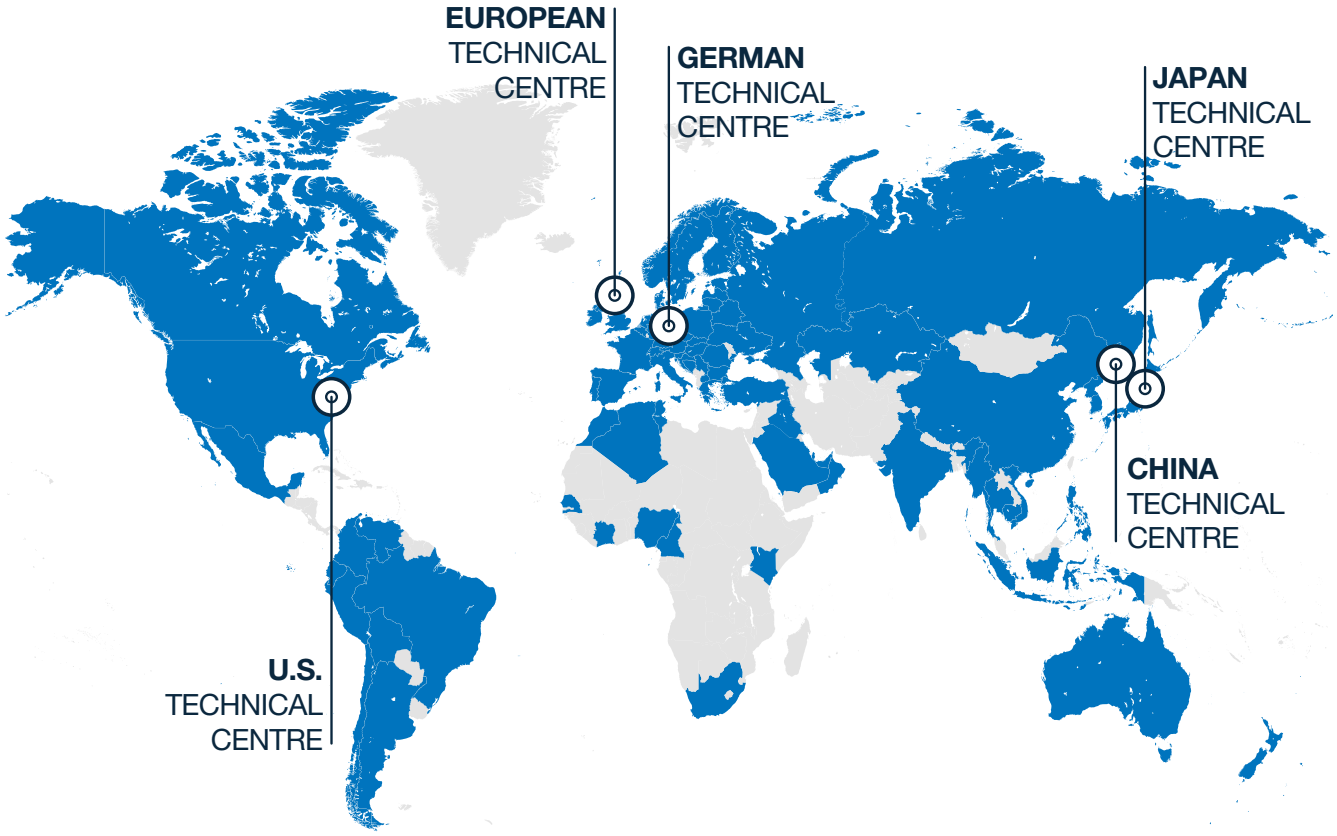
EXAMPLE Collecting factory wide production data to consolidate, predict and streamline inventory replacement.



Our support network

SMC's worldwide commitment

One of the things we do best at SMC is **being close to our customers**. Local support, on a global scale.



With **support** in over **500 locations** across **80 countries** and regions **worldwide**, our sales force of **7000 experts** maintains **close communication with customers**.

Expertise
Passion
Automation

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