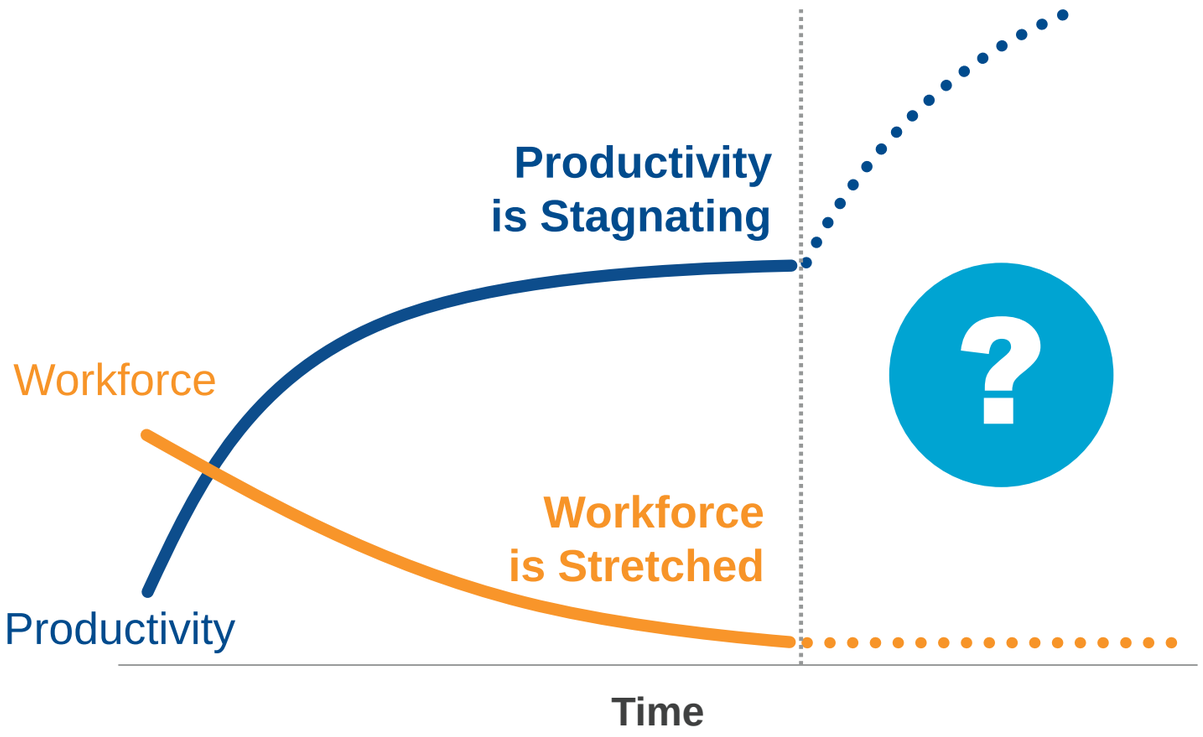
Accelerating Digital Transformation

Emerson

Manufacturers Must Transform Operations, But How?



*"We have had **process control for a long, long time**… now we can **extend** that to a much **wider range of possibilities**"*

– CTO

*"We're staffed to run, **not staffed to change**"*

– Operations Manager

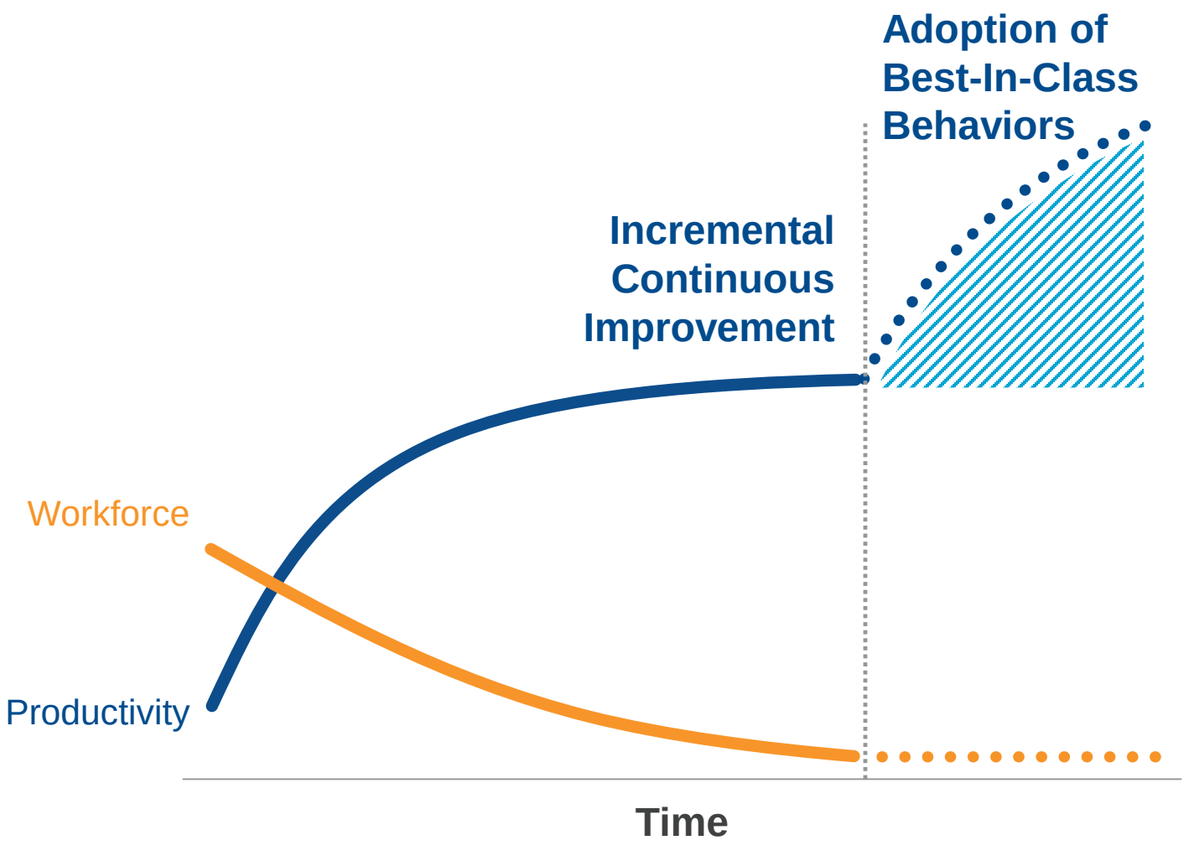
*"[Digital investments] **it's literally just to stay competitive**"*

– CEO

No Matter Where you are on the Productivity Curve, you can Transform your Operations

Source: Harris Insights & Analytics Digital Workforce Study (2017)

Digital Transformation Enables Companies to Achieve & Sustain Top Quartile Performance



5 ESSENTIAL COMPETENCIES OF DIGITAL TRANSFORMATION

- Automated Workflow
- Decision Support
- Workforce Upskilling
- Mobility
- Change Management

THE GOALS OF DIGITAL TRANSFORMATION FOR OPERATIONS

SAFETY

Zero injuries. Zero incidents.

- Employees removed from hazardous activities
- Constant monitoring of worker and plant health
- Threat prevention and response – cyber, physical – is automated, part of culture

RELIABILITY

No unplanned downtime at minimal cost

- Analytics predict health of all equipment
- No reactive repair: pre-failure corrective action by automated closed-loop systems
- Reducing machinery downtime

PRODUCTION

Production optimized to market conditions

- Continuous visibility enables active business management
- Business areas optimized in real-time across interconnected systems
- Increasing OEE and productivity in key applications

ENERGY & EMISSIONS

Recognized sustainability leader

- Continuous analytics predict and prevent releases
- Energy consumption measured and dynamically optimized with production
- Reducing CO2 footprint

WORKFORCE

Empowered workers drive even more value

- All routine tasks automated: staff takes larger role in meeting KPIs
- Collaboration embedded in culture and work processes
- Faster, better decisions supported by analytics and on demand expertise
- Career-long development and certification through virtual tools

Goals of Digital Transformation

Ensure Safety

Safety Shut Off

- Zone Safety
- Dump Valves

Safety Feedback

Optimize Production

Increased Productivity

Increase OEE ⬆

Productivity $= \frac{Output}{Input}$

Improve Reliability

Predictive Maintenance

Preventative Maintenance

Reduce Downtime

Minimize Emissions

Sustainability

Energy Optimization

Lower Energy Cost

CRITICAL SUCCESS FACTORS OF DIGITAL TRANSFORMATION

Technology decisions driven by

BUSINESS OUTCOMES

SCALABLE

approach, guided by vision,
instead of doing it all at once

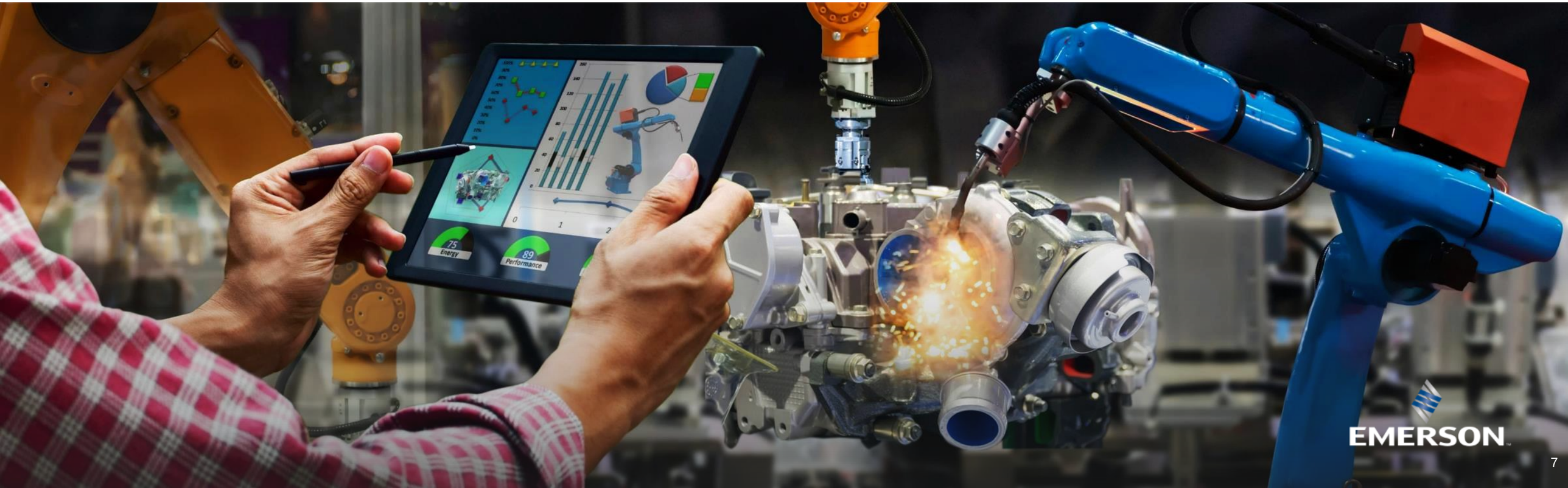
Technology investment is also seen as a

PEOPLE investment

Connecting people, machines and data to drive smarter and more efficient outcomes

Achieving greater visibility and control while reducing downtime and increasing productivity

Meeting the IIoT demands of customers around the world as they realize digital transformation



EMERSON

Our Strengths Are Our Technology, People, and Ability to Create Value for Our Customers

DATA MANAGEMENT

Reservoir Modeling

Control Engineering

Operations & Alarm Management

Training & Simulation

Advanced Process Control

Real-time Optimization

Planning & Scheduling

Energy Management

Plant Asset Management

Asset Integrity Management

ENGINEERING & DESIGN | CONTROL SOFTWARE | PRODUCTION MANAGEMENT | ASSET RELIABILITY & PERFORMANCE

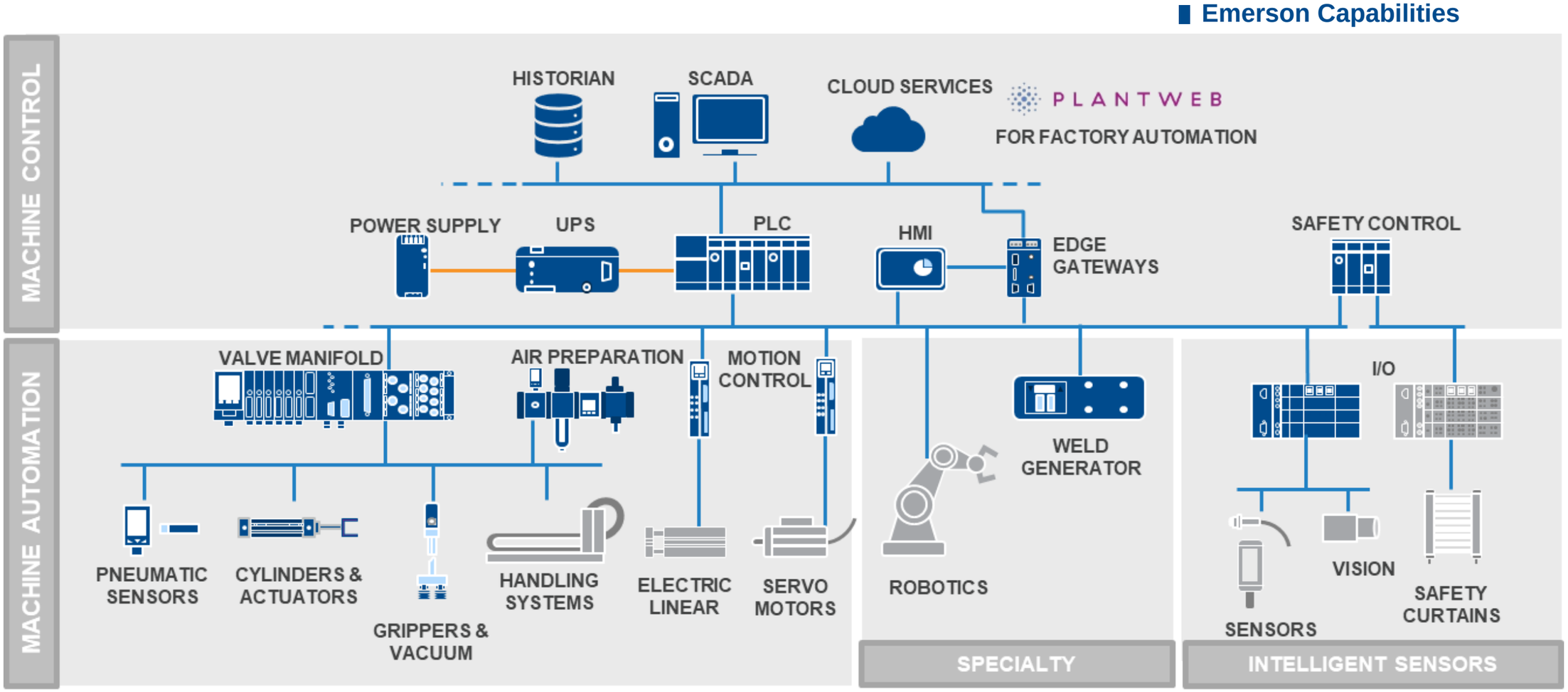
CONTROL

PROCESS CONTROL & SAFETY SYSTEMS | WELLHEAD CONTROL | MODULAR CONTROL | PROGRAMMABLE LOGIC CONTROLLERS | MACHINERY HEALTH

FIELD DEVICES

MEASUREMENT & FLOW | ANALYTICAL | FINAL CONTROL | FLUID CONTROL & PNEUMATICS | MOTION CONTROL

Emerson Has a Comprehensive and Highly Differentiated Portfolio for Discrete Manufacturing Customers

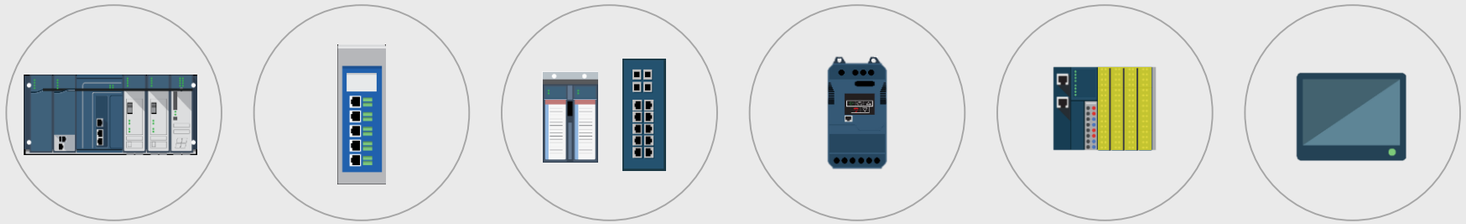


Access to All Technology to Provide Optimal Solution for Your Applications and Pain Points

WHY EMERSON

Our Machine Control, Pneumatics and Fluid Control Portfolio

PROGRAMMABLE AUTOMATION CONTROL



PLC | EDGE | I/O & SWITCHES | MOTION | SAFETY | HMI

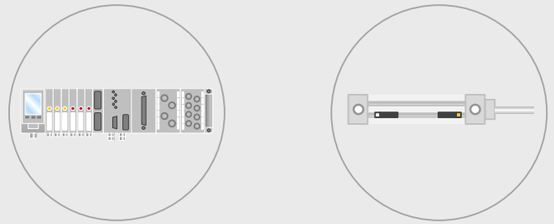
INDUSTRIAL COMPUTING

INDUSTRIAL PC | PANEL PC | COM EXPRESS

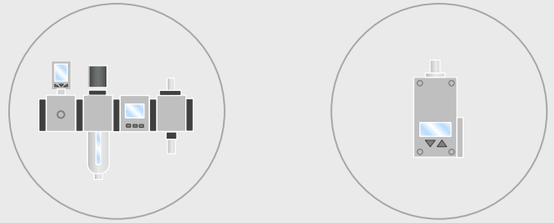
SOFTWARE

EQUIPMENT INSIGHT | SCADA | HISTORIAN

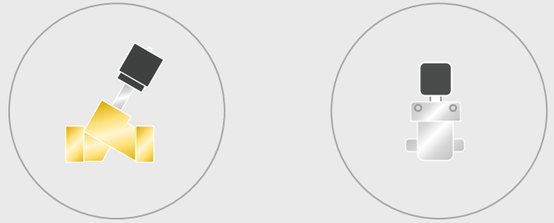
FLUID CONTROL & PNEUMATICS



VALVE ISLANDS | CYLINDERS



AIR PREPARATION | PROPORTIONAL



SOLENOIDS | HIGH PRESSURE

WHY EMERSON

Our Expertise

Emerson offers access to experts, knowledge and tools **to help you realize your IIoT and Industry 4.0 needs**

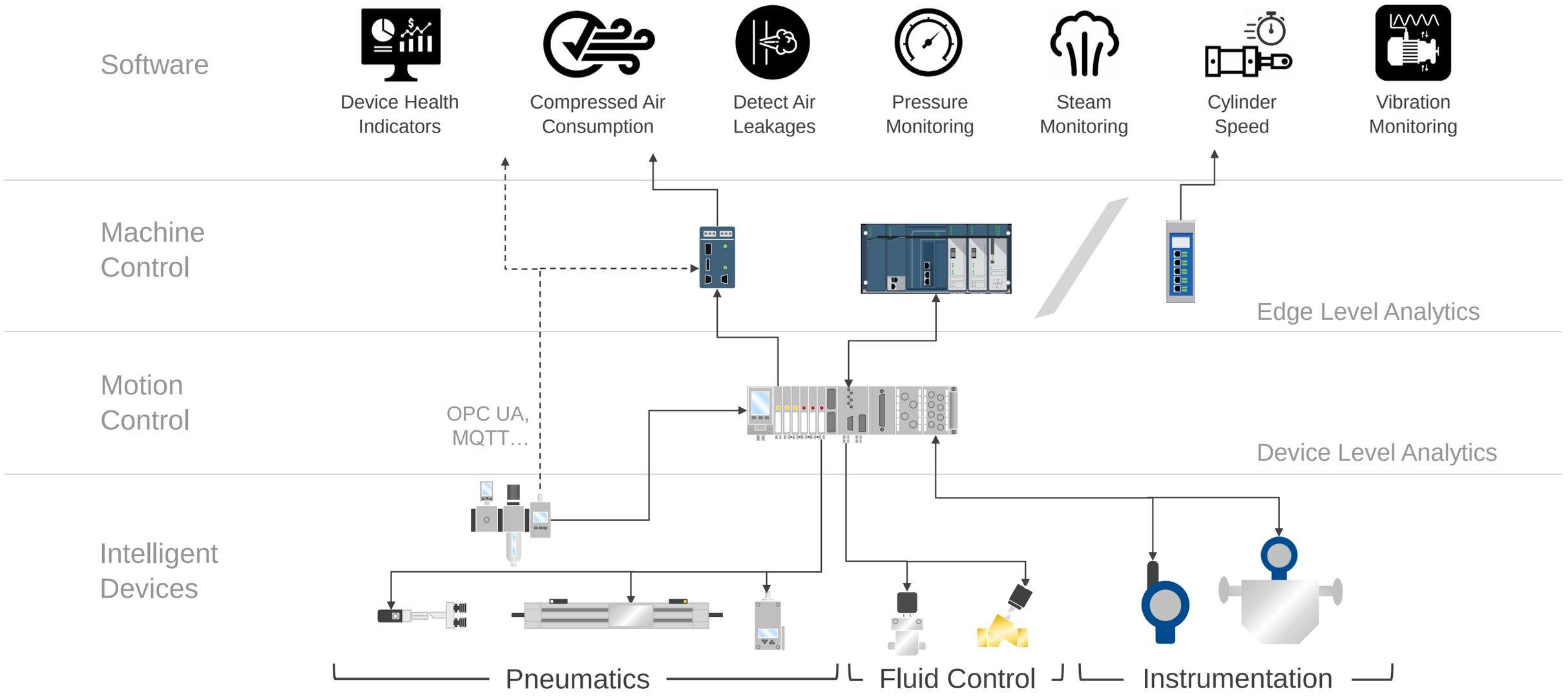
Our experts will help you find the right solution, integrate it efficiently, safely and securely so you can focus on the demands of your business. Emerson partners with you for full lifecycle management of your solution.

Control, Pneumatics and IIoT platforms

Education and Training

Services and Integration

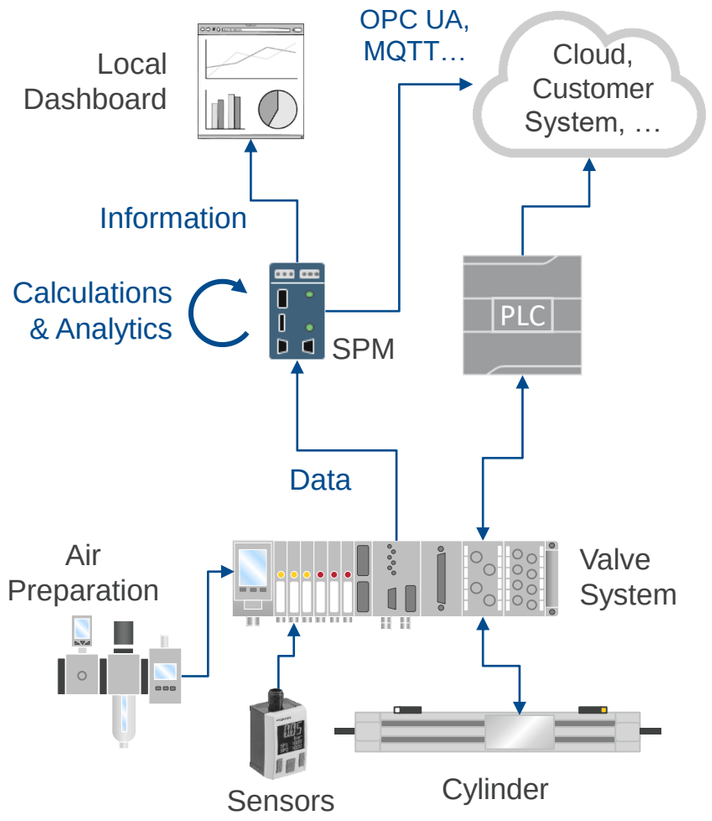
Emerson Has the Technology and Expertise to Deliver Insightful, Value-Driven Software Solutions for Manufacturing



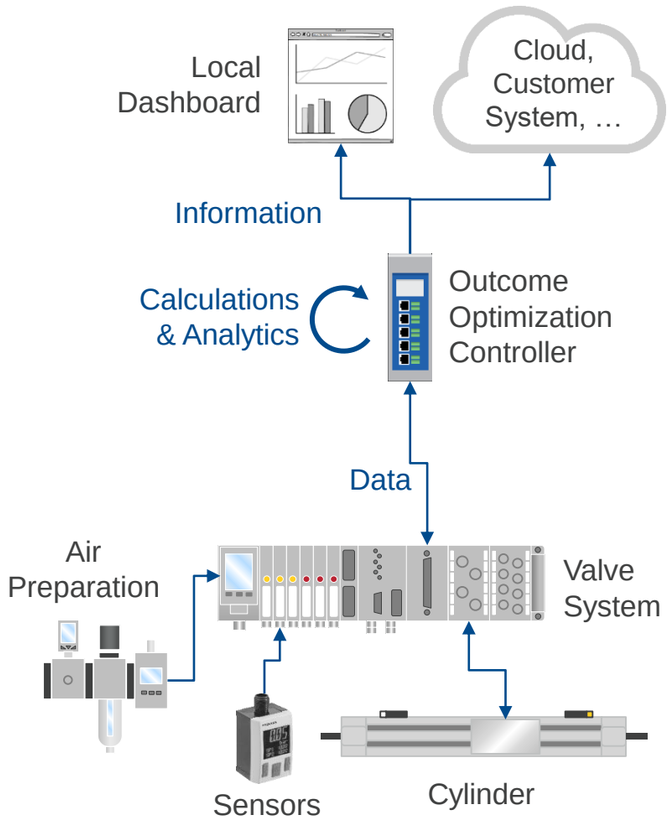
Flexible Technology Architecture that Can Retrofit to Existing Machines or Combine Machine Control and Edge Analytics into One Controller

Architecture

PLC Agnostic & Scalable Edge Devices



All-in-one Edge Device



Benefits

- Scalable edge computing – applications and analytics can grow without any changes to executing technology
- Smart Pneumatics Monitor (SPM) easily retrofits to existing machines and architecture
- PLC agnostic
  - No change to PLC sequence required
  - Works on greenfield & brownfield applications
  - Change dataflow without stopping the machine
- Outcome Optimization Controller combines Machine Control and Edge Analytics into one device
- Cyber secure by design
- Easy data configuration with Node-RED
- Supports IIoT protocols like OPC UA, MQTT, …

Flexible Software Solutions Can Be Visualized Using On-Prem Dashboards, Cloud or Existing Software Platforms

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Value Improvement Practices

Sustainability

Detecting Compressed Air Leakages in Pneumatic Systems

Production Challenges

Many companies use technicians to test for air leakages periodically, using ultrasonic equipment. Large leaks lead to machine downtime and increase in costs.

Manufacturing plant typically loses

30%

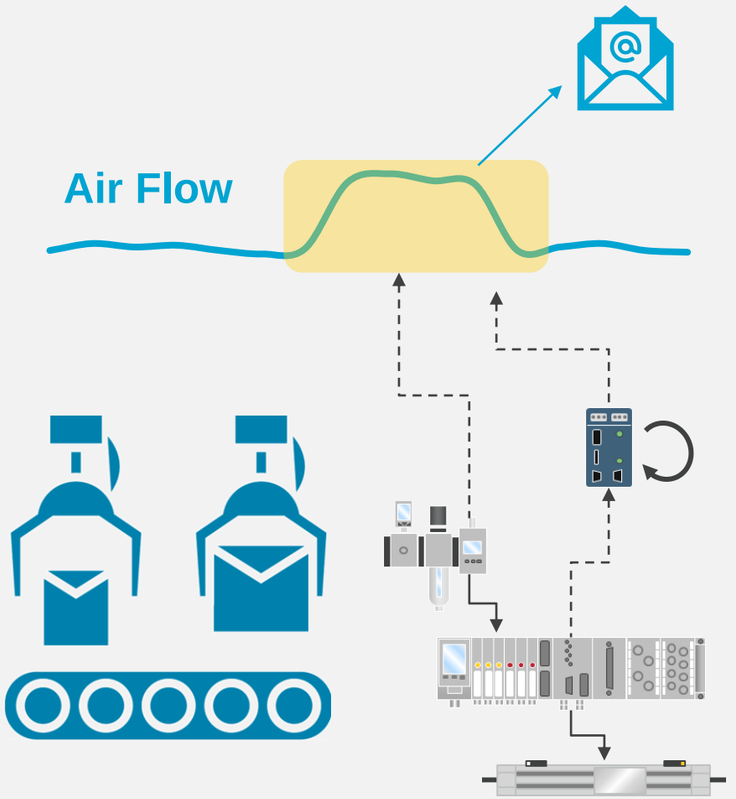
of compressed air due to leakage

Air Leakage Leads to:

- **Machine Downtime**
- **Increased Energy Costs**
- **Wasted Energy**

Value Improvement Practice

Continuously monitor the flow of air to detect leakages in real-time. Identify the machine and send alerts directly to maintenance staff to investigate.



Impact on Operations

Address compressed air leakages earlier and improve OEE (Overall Equipment Efficiency)

Reduce Planned and Unplanned Downtime

10-20% **Reduction in compressed air energy spend**

10% **Reduction in CO_2 Footprint**

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Sustainability

Optimized Compressed Air Consumption

Production Challenges

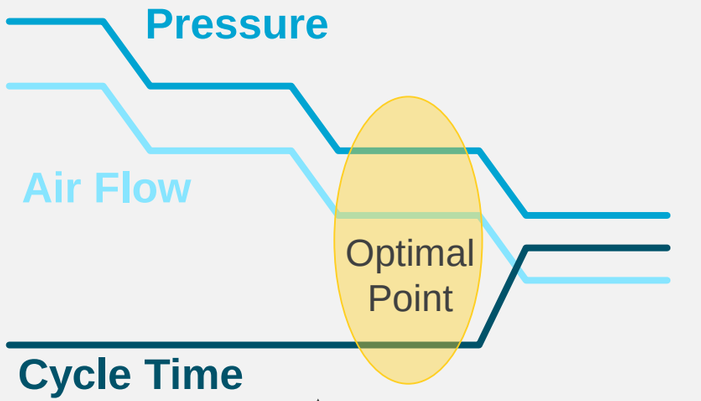
Consuming more compressed air than needed for a manufacturing process

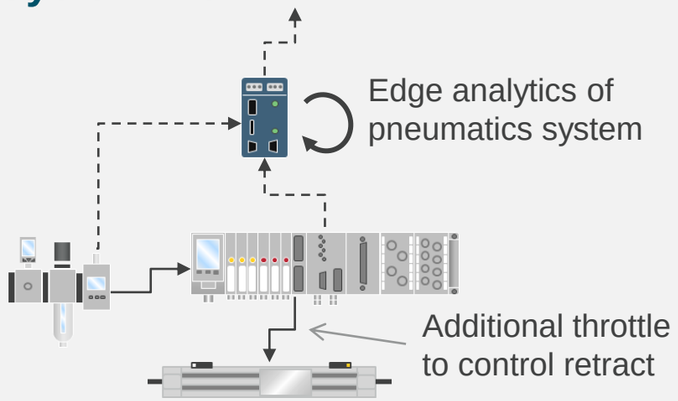
Higher Energy Costs

Higher CO_2 Emissions

Value Improvement Practice

Reduce overall pressure of pneumatic system, thus reducing the flow of compressed air, while maintaining the same cycle time





Impact on Operations

Maintain current cycle times in production, but lower energy consumption, costs and CO_2 emissions

10-20%

Reduction in compressed air consumption and energy costs

10%

Reduction in CO_2 Footprint

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Reliability

Monitoring the Wear of Pneumatic Valves and Actuators

Production Challenges

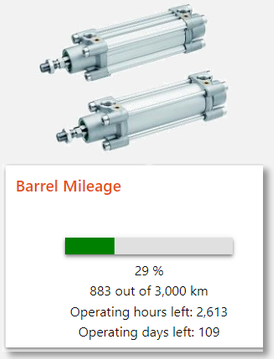
Pneumatic valves and actuators have a recommended lifecycle and are critical to various manufacturing processes

When a Pneumatic Valve or Actuator wears down it causes:

- **Decrease in Cycle Time**
- **Unplanned Downtime**
- **Potential Quality Issues**

Value Improvement Practice

Continuously monitor the cycles of the valves and actuators. Visual indicator notifies maintenance when a part should be checked and possibly replaced.



Impact on Operations

Improve OEE (Overall Equipment Efficiency) by more proactively and efficiently replacing pneumatic devices

- **Prevent a Decrease in Cycle Time**
- **Reduce Unplanned Downtime**
- **Improve Overall Throughput**

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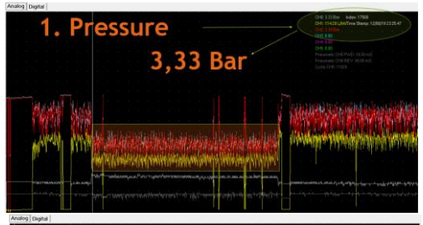
Previous IIoT Implementations

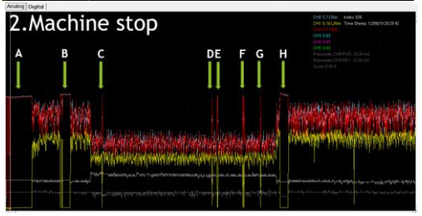
Ice Cream Manufacturing
- End-user

Application

Ice Cream Machine

- **CHALLENGE**
  - Leakage in pneumatic system is causing huge energy loses & it is difficult to identify the cause/location of the leakage is affecting the overall machine OEE
  - Long troubleshooting and production downtime due to large amount of pneumatics components within the system
- **RESULTS**
  - ☑ Quick and easy analysis of machine performance (machine & cylinder cycle time etc)
  - ☑ Identification of the cause of faults (pressure, flow etc.)
  - ☑ Predictive maintenance of cylinders to prevent unplanned downtime
  - ☑ Monitoring of energy consumption to detect pneumatic leakage





Variable to Prevent		Lost Production	Sales Gain by Preventing
Machine Failure	30 min / month	($172K)	$172K
IIoT Investment (CPL 410, Software/Analytics)			($40K)
		Payback Period	**2.8 Months**

Milk Production
- End-user

Application

Milk Filling Machine

Inputs	Value
Production sites	7
Milk per year	2,3 billion liter
Machine air consumption	2.990 l/min
Consumption according to spec sheet	1.300 l/min

- **CHALLENGE**
  - Customer is concerned with annual air consumption / energy use for production of milk of up to $105K if air usage for machine increases by 1,690l/min
  - Currently customer does not measure air consumption & does not have an overview of the overall process
- **SOLUTION**
  - Installed AF2 Air Flow Sensor equipped with OPC UA to continuously monitor and visualize compressed air flow on machines
- **RESULTS**

☑ Quick and easy analysis for energy monitoring (Flow & Pressure of Air) + Over consumption / deviation from recommended pressure, flow etc. on machine

☑ Monitoring of energy consumption to detect compressed air leakage

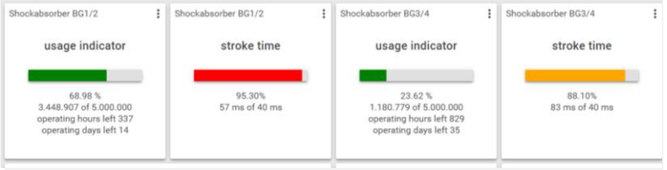
Per Machine	Variable to Prevent	Assumption Per Year	Additional Savings / Invest.
Detecting Leakages	↑1690 l/min	778.752 m³	$17K – $105K
		Average Savings	~$50K
		IIoT Investment	($15K)
		Payback Period	**3.6 months**

Factory Automation
- End-user

Application

Manufacturing Machine

ST4-2P Two point sensor



- **CHALLENGE**
  - Frequent changing of rodless cylinders due to shock absorber failure
  - Expensive parts replacement and long downtime
- **RESULTS**

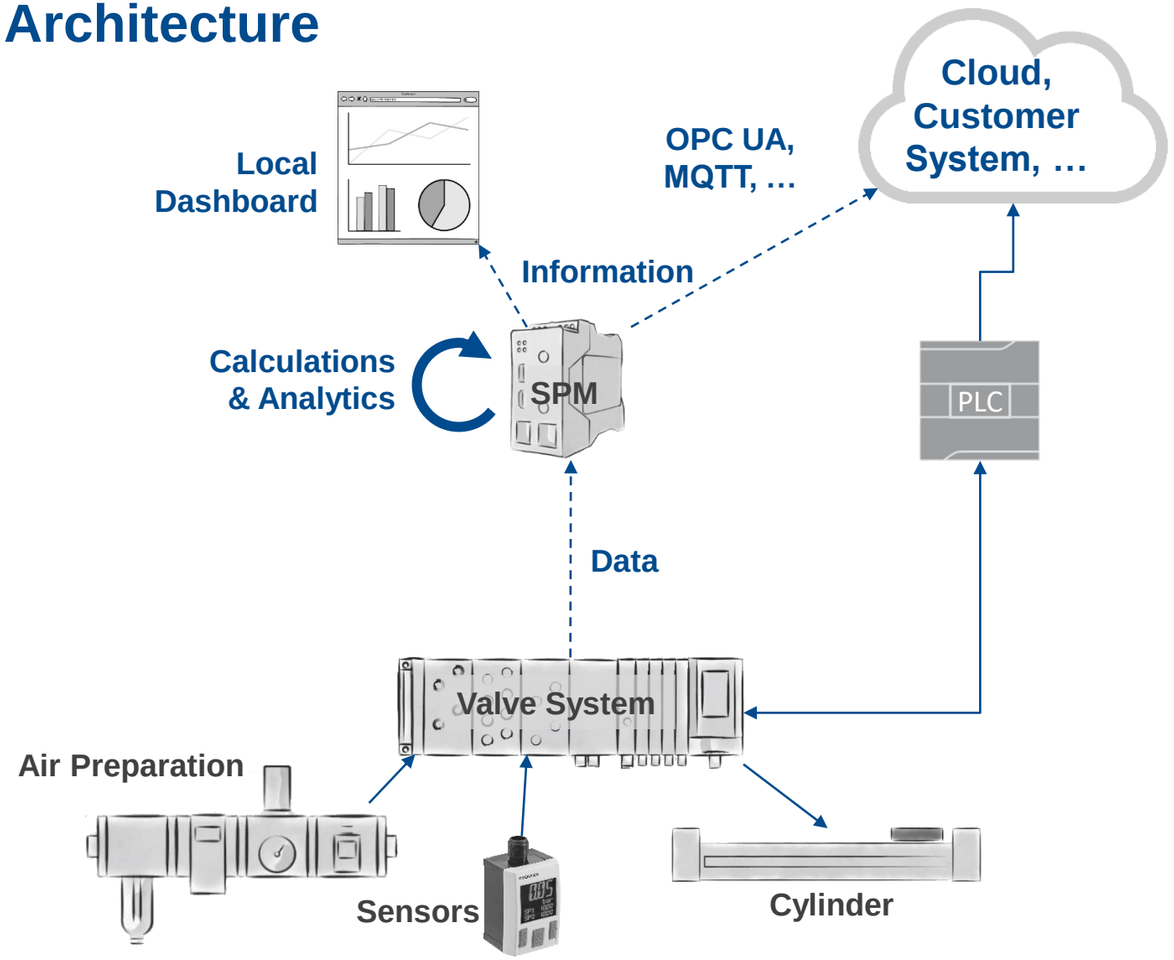
☑ SPM will trigger an alarm signal when the damper speed increases (meaning – deterioration of damper absorber)

☑ Provides predictive maintenance to prevent replacement of costly rodless cylinders

Annual Scenario	Unit per year	Unit Cost	Total Cost
Without IIoT – Replacement of Rodless Cylinder & Damper	3	$5,400	$16,200
With IIoT – Replacement of Damper Absorber	6	$200	$1,200
		Total Saving without including downtime & labor cost	$15,000
		IIoT Investment (Gateway, Dashboard, Alert)	($15,000)
		Payback Period	**1.0 year**

Smart Pneumatics Monitor (SPM) Easily Retrofits to Existing Machines

Architecture



Benefits

- PLC agnostic
  - No change to PLC sequence required
  - Works on greenfield and brownfield applications
  - Can change dataflow without stopping the machine
- Predefined analytics by design
- Easy data configuration with Node-RED
- Edge computing for advanced analytics and calculations
- Supports open IIoT protocols like OPC UA or MQTT
- Flexible information aggregation to upper systems like clouds or customer systems
- Local dashboard

Flexible Software Solutions Can Be Visualized Using On-Prem Dashboards, the Cloud or Existing Software Platforms

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Combining our Pneumatics and Control Solutions We Can Help Customers Solve Critical Discrete Manufacturing Pain Points

Predictive Maintenance

- Compressed air leakage
- Pressure monitoring
- Condition monitoring – cylinders / valves / shock absorbers

Energy Efficiency and Sustainability

- Compressed air consumption
- Reduce CO_2 footprint
- Energy optimization

Improve Throughput

- Irregularities in product quality (driven by anomalies in the manufacturing process)
- Cycle time monitoring

Secure Connectivity

- Have the key protocols and cybersecurity embedded in technology that enables secure device monitoring and overall machine connectivity (OPC UA, MQTT, REST)

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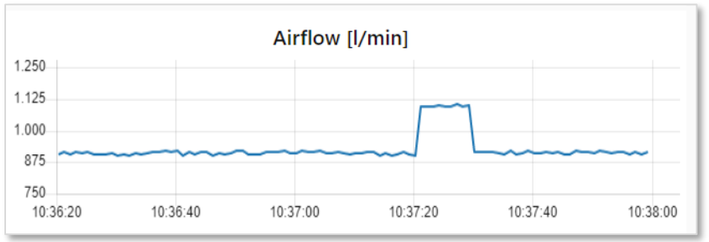
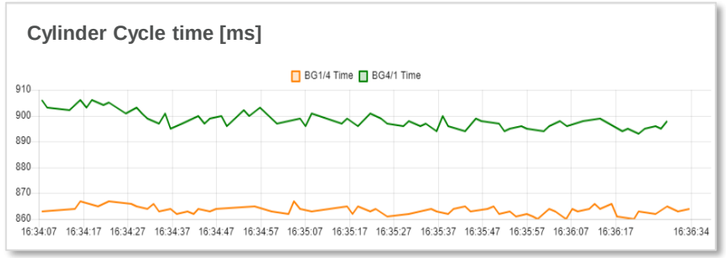
Software Solutions for Pneumatic Applications

Air Leakage Detection



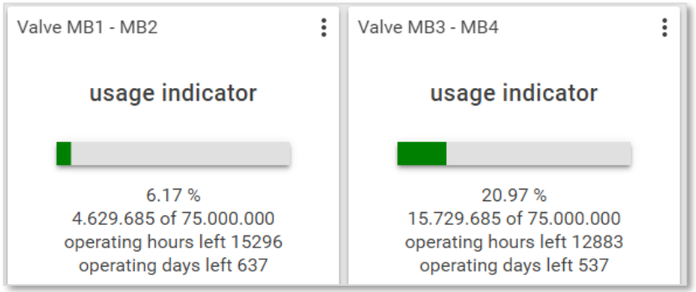
- Detect compressed air leakages during manufacturing processes
- Energy savings
- Fits for Brownfield and Greenfield machines

Cylinder Monitoring



- Detect anomalies in manufacturing process driven by cylinder movement
- Measure usage and cycle time to monitor wear
- Provide insight into remaining life, enabling less unplanned downtime

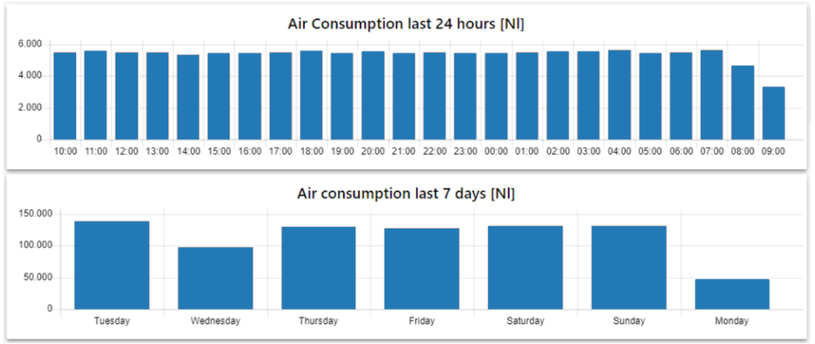
Valve Monitoring



- Counting switches of the valves to monitor wear
- Combined with cycle indicators will provide insight into remaining life, enabling less unplanned downtime

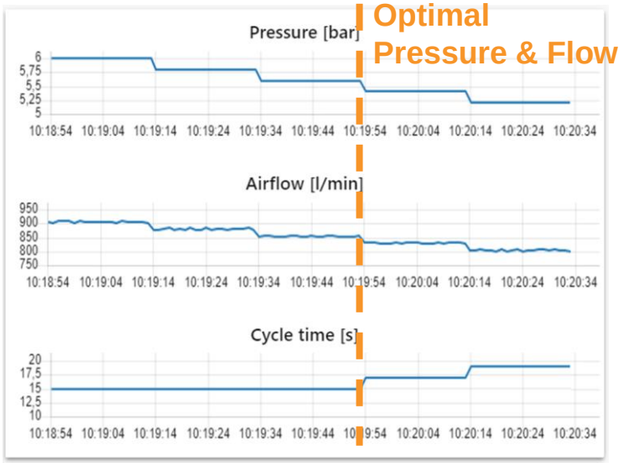
Software Solutions for Pneumatic Applications

Air / Energy Consumption



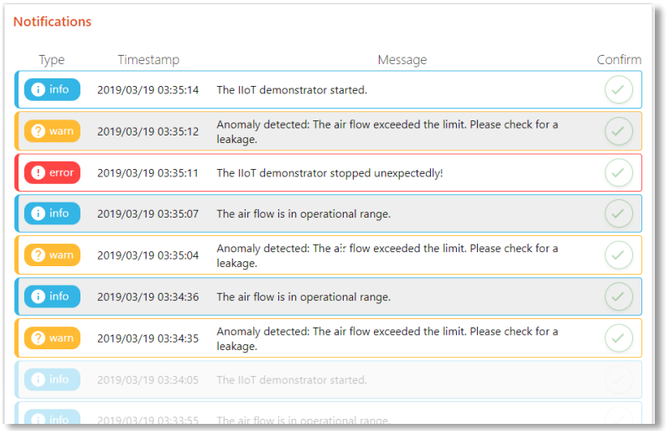
- Continuous monitoring and visualization of compressed air consumption
- Different scales like per day, hour, piece or process step
- Better inform the maintenance and production teams of potential issues with machine

Energy Consumption Optimization



- Reducing pressure in the system, leads to less airflow and energy costs, but keeps optimal cycle time
- Easily identify the optimal parameters to keep cycle times high and lower costs

Notifications / Alerts



- Notification overview for detecting leakages and anomalies during manufacturing
- Email alerts when a critical threshold is breached in the manufacturing process

Intelligent Devices That Enable Digital Transformation and Software Solutions

Outcome Optimization Controller

- Control and Edge Analytics combined into one device
- IPC for machine control and optimized smart analytics at the edge

Edge Gateways

- Full portfolio of edge gateways to meet your specific analytics requirements
- Optimizes data at the edge for visualization of devices and processes
- Various levels of processing power and memory

AF2 Air Flow Sensor

- Continuous monitoring of volume, pressure and air flow
- Retrofit to any machine
- Enables manufacturers to easily detect compressed air leakage
- Equipped with OPC UA to connect directly to the cloud or customer’s software platform

Smart Pneumatics Analyzer

- Retrofit opportunity to test air consumption of an existing machine
- Visualization of air flow statistics & performance
- Preconfigured dashboards & analytics

Partnering with Our Customers for

SUCCESSFUL DIGITAL TRANSFORMATION

TECHNOLOGY

Comprehensive portfolio

ROADMAP

Destination
Start
Tangible Path

EXPERTISE

Industry
Automation
Domain
Digital