# Driving Digital Transformation – Pneumatic Solutions

Gerson Silva – Business Development Manager - Machine Automation

November 23rd, 2022

EMERSON


# Company Profile

Emerson (NYSE: EMR) is a leading global technology, software, engineering and manufacturing company providing innovative solutions for customers in industrial, commercial and residential markets.

## OUR TWO GLOBAL BUSINESS PLATFORMS

**Automation Solutions** helps process, hybrid and discrete manufacturers maximize production, protect personnel and the environment while optimizing their energy and operating costs.

**Commercial & Residential Solutions** helps ensure human comfort and health, protect food quality and safety, advance energy efficiency and create sustainable infrastructure.

# Emerson 2021 AT-A-GLANCE

FOUNDED
**1890**

HEADQUARTERS IN
**ST. LOUIS, MO USA**

WORLDWIDE

**86,700**
EMPLOYEES

**170**
MANUFACTURING LOCATIONS

TWO BUSINESS PLATFORMS


AUTOMATION SOLUTIONS


COMMERCIAL & RESIDENTIAL SOLUTIONS

**$18.2 BILLION**
IN GLOBAL SALES
FISCAL YEAR 2021

**3 COVID-19 VACCINES**
PRODUCED USING EMERSON'S SOFTWARE

**+65** YEARS
PRESENCE IN LATIN AMERICA

NYSE:
**EMR**

INNOVATION
**EMERSON EMPLOYEES HELD**
**20K**
ACTIVE PATENTS WORLDWIDE IN 2021

**#181 FORTUNE 500**
AMERICA'S LARGEST CORPORATIONS BY REVENUE

## RECOGNITION - 2021

**TOP 50 EMPLOYERS**
WOMEN ENGINEERS MAGAZINE

**BEST EMPLOYERS FOR DIVERSITY**
FORBES MAGAZINE

**IoT ANALYTICS PLATFORM OF THE YEAR**
IOT BREAKTHROUGH

# Automation Solutions

Improving Process, Discrete Automation and Hybrid Industrial Manufacturing Performance with Measurable Results

## INDUSTRIES SERVED

- Life Sciences & Medical
- Chemical
- Power
- Food and Beverage
- Packaging, Pulp and Paper
- Marine
- Oil and Gas/Refining
- Mining, Minerals and Metal
- Water and Wastewater
- Automotive
- Industrial Energy
- Onsite Utilities
- Software

## PRODUCT BRANDS & SERVICES

Industrial Internet of Things
- Plantweb™ Digital Ecosystem

Software and Systems
- AMS
- DeltaV
- OSI
- Ovation
- PACSystems
- Zedi
- MoviCon
- Syncade

Measurement Instrumentation
- Rosemount
- Micro Motion

Fluid Control & Pneumatics
- ASCO
- AVENTICS

Valves, Actuators and Regulators
- Bettis
- Fisher
- Keystone
- KTM
- Vanessa

Materials Joining, Assembly and Cleaning
- Branson
- HTE

Electrical and Lighting
- Appleton

# Emerson – A Respected Heritage of Fluid Control & Pneumatics Solutions

**1888**
ASCO™ founded as a manufacturer of elevator, compressor and generator controls

**1910**
World's 1st industrial solenoid valve

**1952**
World's 1st billion cycle spool valve

**1984**
ASCO™ acquired

**1988**
Joucomatic™ acquired

**1998**
Sirai™ acquired

**2005**
Numatics® acquired

**2010**
World's 1st valve island with graphic display

**2016**
TopWorx™ and TESCOM™ added

ASCO · JOUCOMATIC · sirai · numatics · AVENTICS

EMERSON
FLUID CONTROL & PNEUMATICS

**1869**
Westinghouse Air Brake Company (WABCO) established

MECMAN

**1945**
AB Mekanprodukter, predecessor of AB Mecman, founded

**1989**
Rexroth acquires the pneumatics business of WABCO

MANNES-MANN

**1991**
Mannesmann Rexroth acquires AB Mecman

Rexroth
Bosch Group

**2001**
Merger of Bosch Automation and Mannesmann Rexroth

**2014**
AVENTICS GmbH

**2018**
AVENTICS™ acquired

# Driving Digital Transformation

EMERSON

# THE GOALS OF DIGITAL TRANSFORMATION

## SAFETY

**Risk identification and reduction**

- Capturing and trending safety stops and zone triggers to identify potential risk areas
- Eliminate unnecessary foot traffic and population density in the facility
- Cyber threat prevention and response 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

# What Are the Challenges Facing Manufacturers Today?

Emerson's solutions deliver the **flexibility and insights needed** to address your challenges

## OEE (Overall Equipment Efficiency)

Our programs are not delivering the expected returns

## Efficiency & Sustainability

We have reduced emissions and energy usage/costs but are being asked to do more

## Interoperability, Integration & Security

All devices should be capable of communicating with each other and our systems to see real transformation

# What Are the Challenges Facing Manufacturers Today?

Emerson's solutions deliver the **flexibility and insights needed** to address your challenges

## OEE (Overall Equipment Efficiency)

Our programs are not delivering the expected returns

## Efficiency & Sustainability

We have reduced emissions and energy usage/costs but are being asked to do more

## Interoperability, Integration & Security

All devices should be capable of communicating with each other and our systems to see real transformation

# OEE - Monitoring the Wear of Pneumatic Valves and Actuators

## Production Challenges

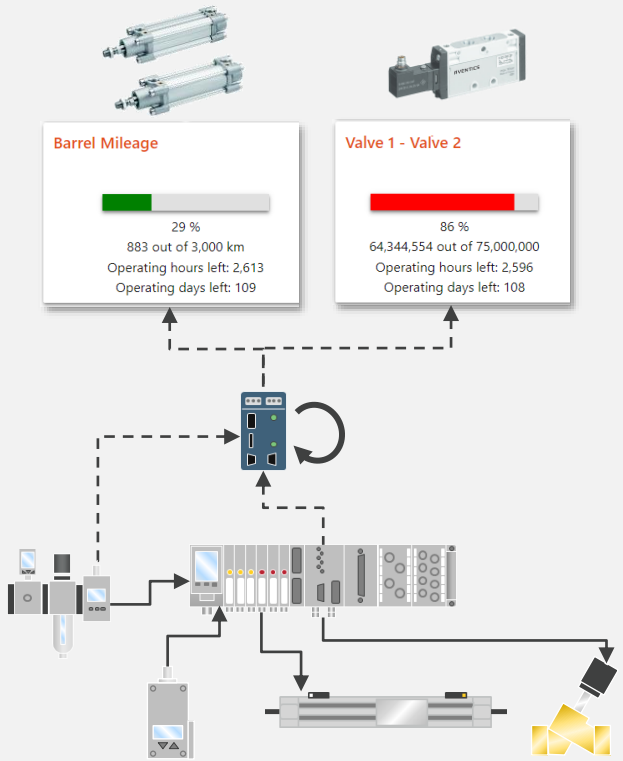
Pneumatic valves and actuators have a recommended lifecycle and are critical to various manufacturing processes

**When a Pneumatic Valve or Actuator wears down it causes:**

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

## Value Improvement Practice

Continuously monitor valve and actuator cycles and travel distance to infer device condition. A 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**

# What Are the Challenges Facing Manufacturers Today?

Emerson's solutions deliver the **flexibility and insights needed** to address your challenges

### OEE

Our programs are not delivering the expected returns

### Efficiency & Sustainability

We have reduced emissions and energy usage/costs but are being asked to do more

### Interoperability, Integration & Security

All devices should be capable of communicating with each other and our systems to see real transformation

# Efficiency & 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%**

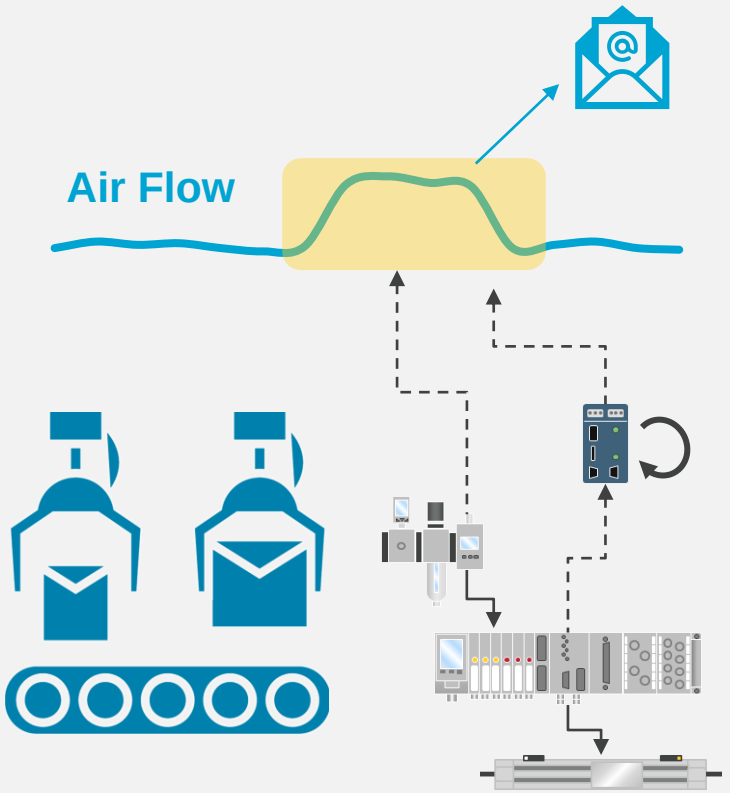
**of compressed air due to leakage**

**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**

# Efficiency & Sustainability - Optimized Compressed Air Consumption

## Production Challenges

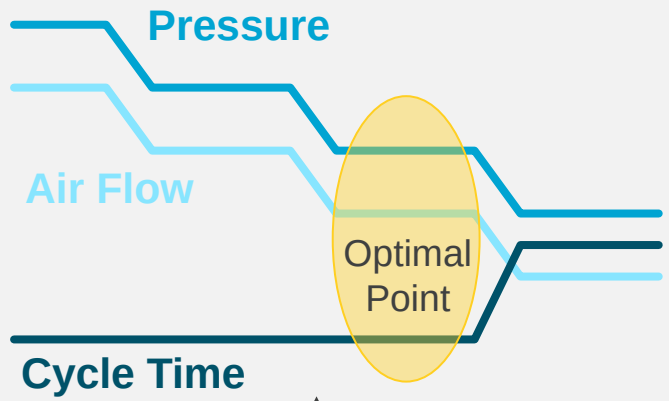
Consuming more compressed air than needed for a manufacturing process

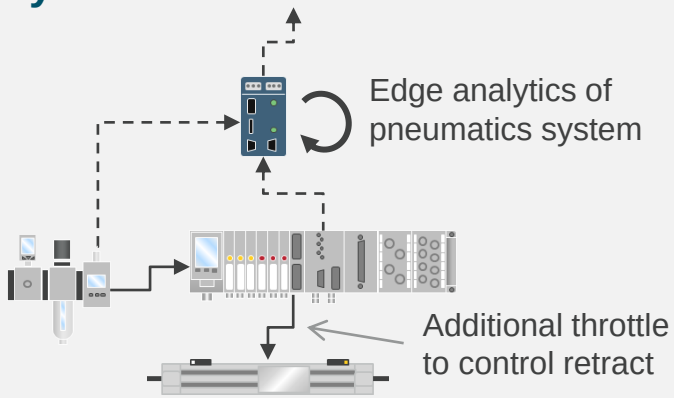
**Higher Energy Costs**

**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**

# What Are the Challenges Facing Manufacturers Today?

Emerson's solutions deliver the **flexibility and insights needed** to address your challenges

## OEE

Our programs are not delivering the expected returns

## Efficiency & Sustainability

We have reduced emissions and energy usage/costs but are being asked to do more

## Interoperability, Integration & Security

All devices should be capable of communicating with each other and our systems to see real transformation

# We Have Many Different Devices That Must Securely Communicate With Each Other

## Why is that a challenge?

We do not have an infrastructure in place that gives us the interoperability or security we need

We have many different devices with many different protocols

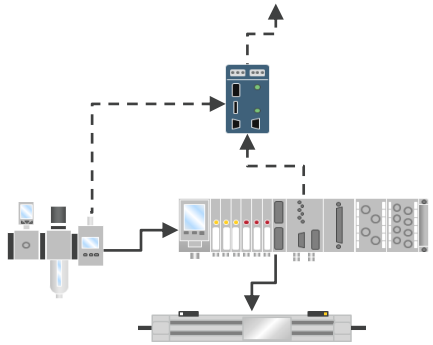
In the past we have not specified to our machine builders which device manufacturers should use or the protocol

Emerson's solutions have **key protocols and cybersecurity** embedded in the technology, enabling **secure device monitoring** and **overall machine connectivity**

### Open protocols

The use of devices with open protocols such as OPC UA and MQTT make it simple to gather the right data and deliver it to where it can be used

### Flexible architecture & devices



The use of intelligent devices connected through edge gateways to a cloud enable existing data to be collected and used to drive improvement

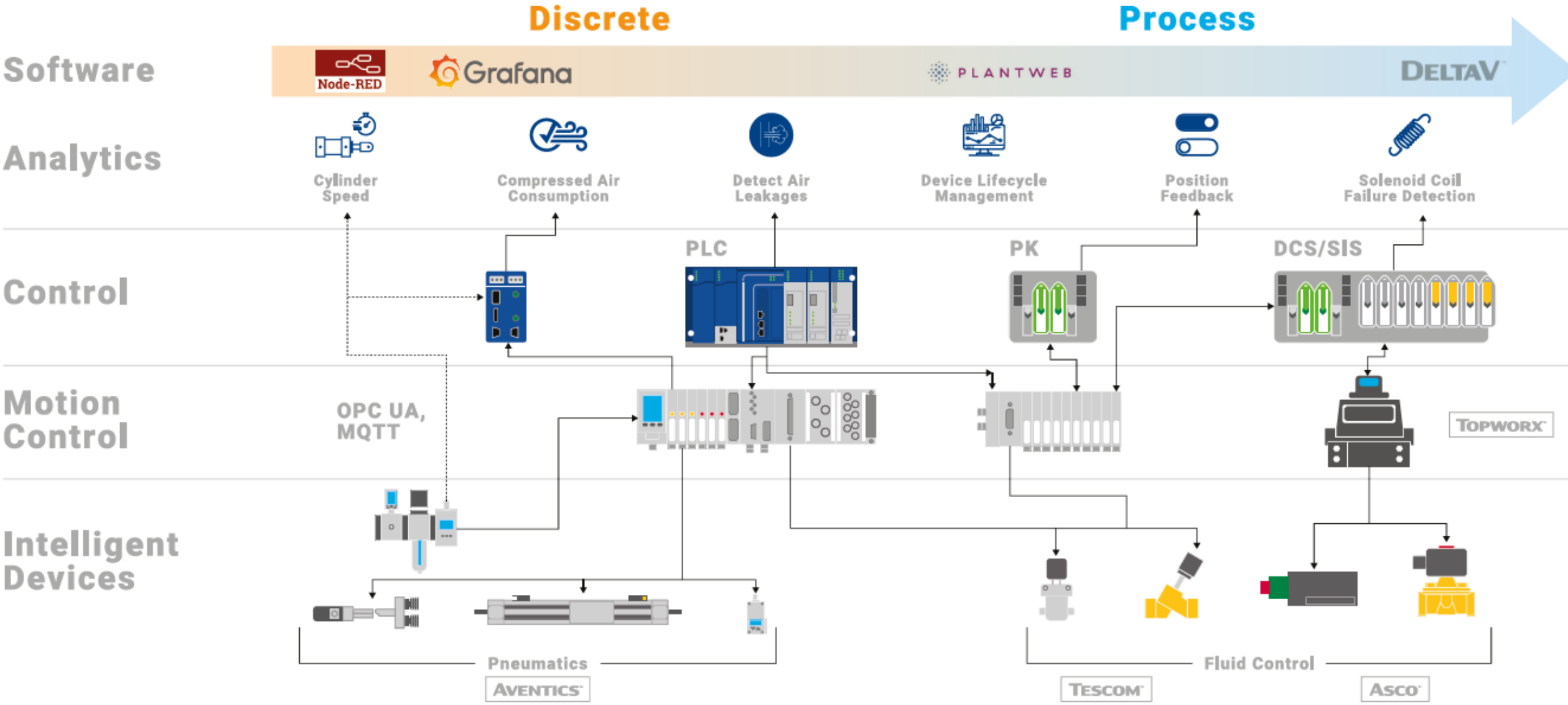
### Cyber security

The use of open protocols and cyber secure edge devices brings security and encryption by design

**Bringing Data Together May Require Minimal Investment**

WHY EMERSON

# Machine Control, Pneumatics and Fluid Control Technology Portfolio




Emerson. Consider it Solved™

WHY EMERSON

# Our Machine Control, Pneumatics and Fluid Control Technology Portfolio

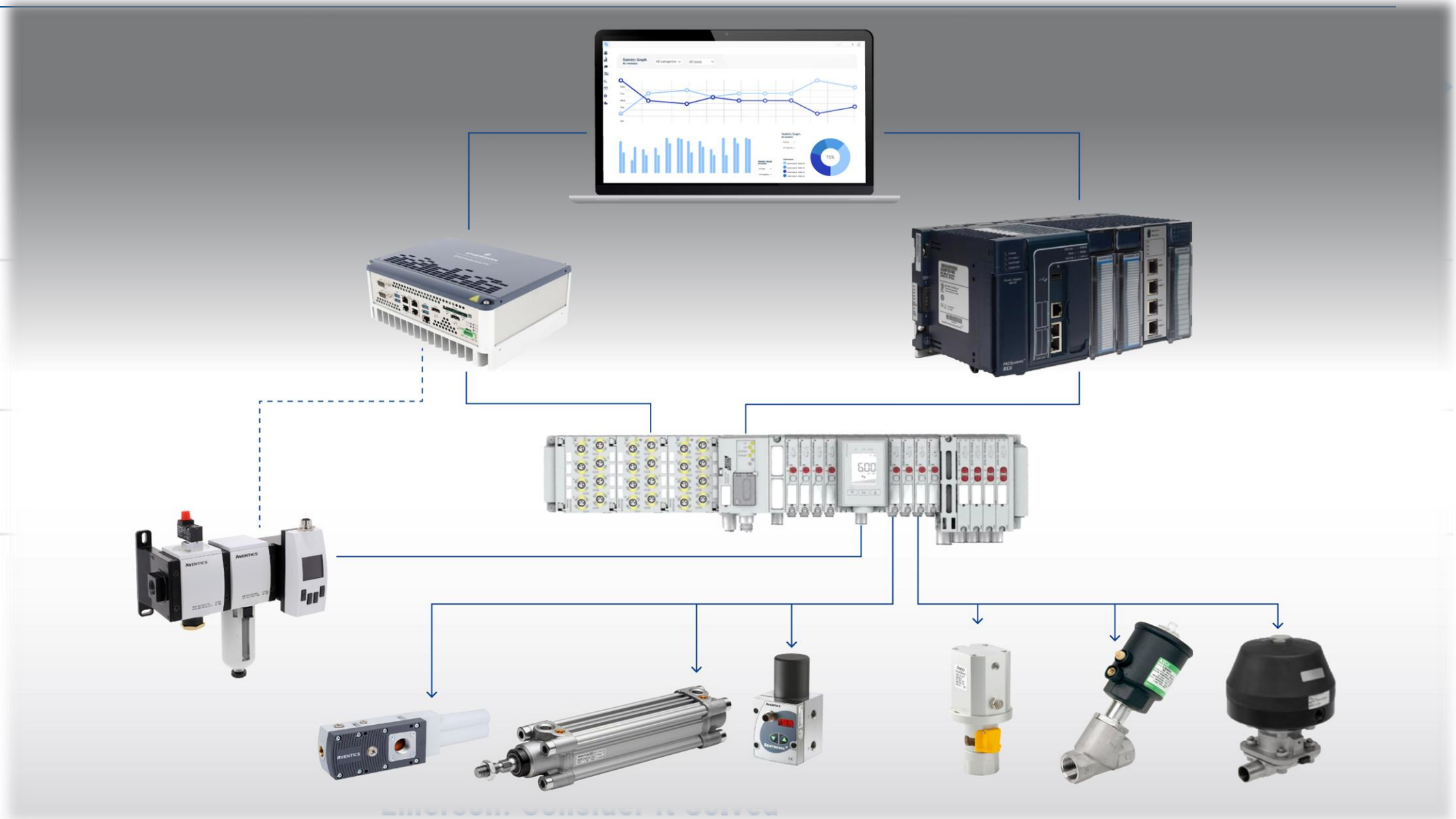
Software

Analytics

Control

Motion Control

Intelligent Devices

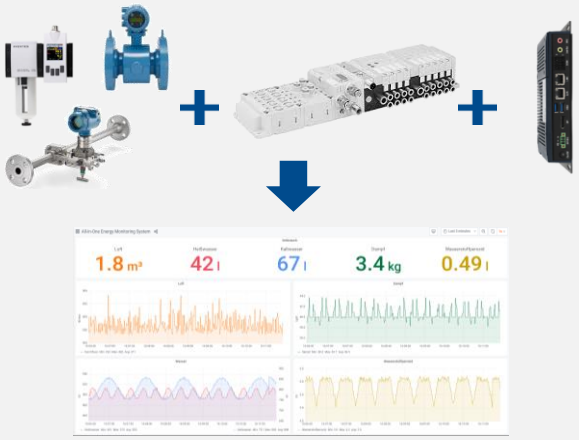


# Win Case Example

# **Multi-Media Monitoring for Filling** - End-User and OEM

## Application

**Filling Machine**

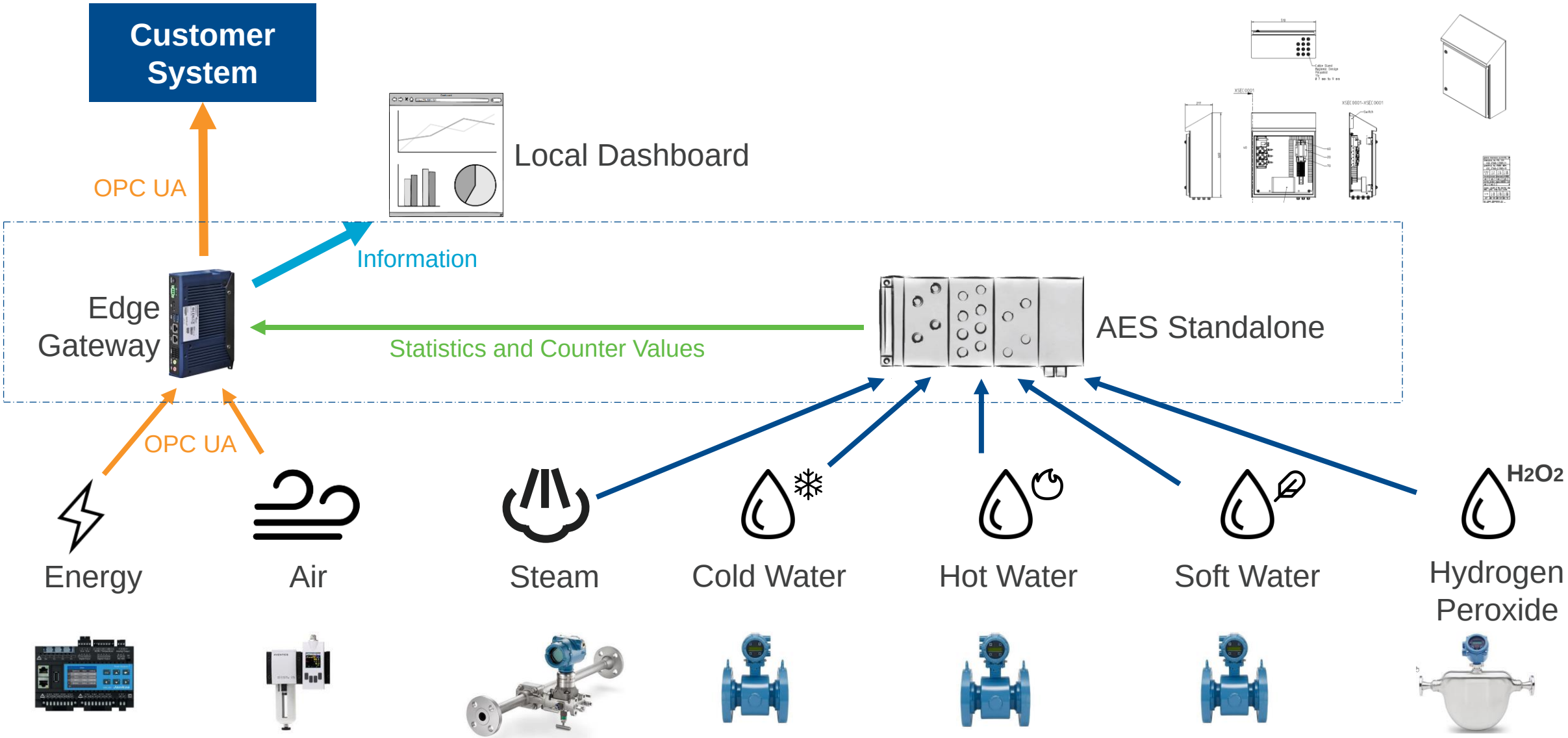



- **CHALLENGE**
  - OEM and End User wanted to be able to monitor all critical media's and energy on their filling machines
  - Struggled to find a partner that could provide the technology and relevant analytics to visualize the key data points for all media consistently
  - Guidance needed on architecture and how everything would fit together

- **SOLUTION**
  - AVENTICS AF2 Air Flow Sensor and AV Valve System with I/O
  - ROSEMOUNT Vortex Flow Meters
  - EMERSON RXi2 Edge Gateway

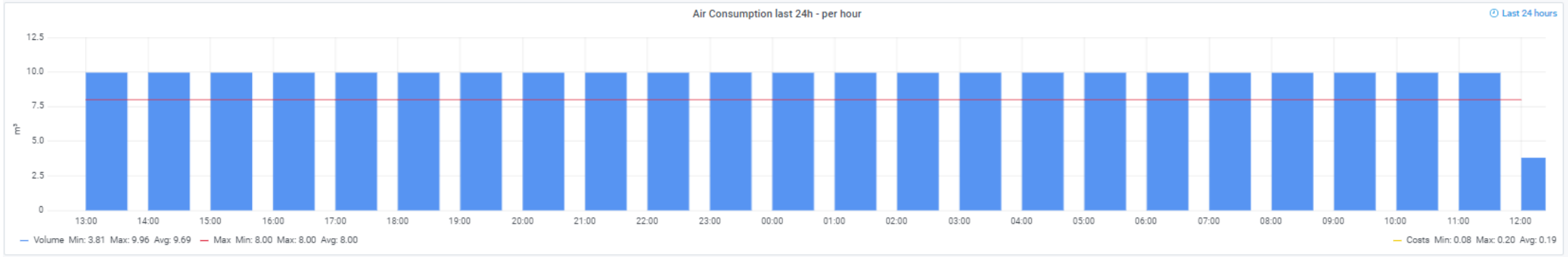
- **RESULTS**
  - ☑ Complete solution (hardware and software) provided by Emerson
  - ☑ Turnkey solution monitors Compressed Air, Steam, Water, Hydrogen Peroxide, and Electricity
  - ☑ Replicable system with specific bill of material and panels to order for additional projects – plug & play with local dashboard or cloud integration

# Energy Monitoring – All-In-One Architecture



# Fluid Control and Pneumatics Monitoring Analytics - Dashboard Example

## Air Consumption




**Last 24h**

| Volume [m³] | Price [$] | Energy [kWh] | CO2 [kg] |
|---|---|---|---|
| 243 | 5 | 24 | 10 |

**Last 7d**

| Volume [m³] | Price [$] | Energy [kWh] | CO2 [kg] |
|---|---|---|---|
| 1,824 | 36 | 182 | 73 |

## Leakage

**Leakage last 24h**

| Volume [m³] | Price [$] | Energy [kWh] | CO2 [kg] |
|---|---|---|---|
| 45 | 1 | 4 | 2 |

**Leakage last 7d**

| Volume [m³] | Price [$] | Energy [kWh] | CO2 [kg] |
|---|---|---|---|
| 354 | 7 | 35 | 14 |

**Leakage last 24h extrapolated to one year**

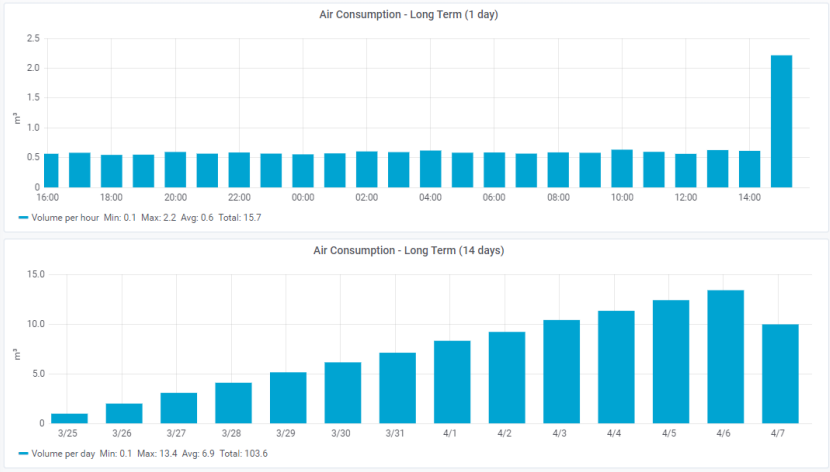
| Volume [m³] | Price [$] | Energy [kWh] | CO2 [kg] |
|---|---|---|---|
| 16,371 | 327 | 1,637 | 655 |

EMERSON

# Fluid Control and Pneumatics Monitoring Analytics - Dashboard Example

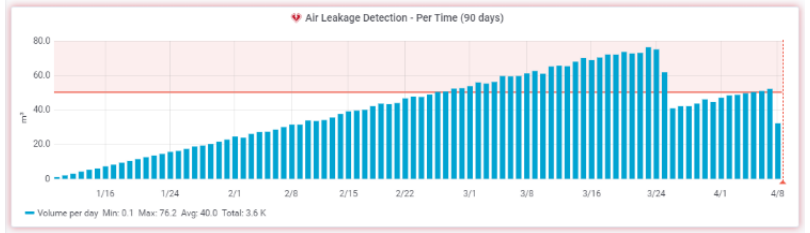
## Air Consumption

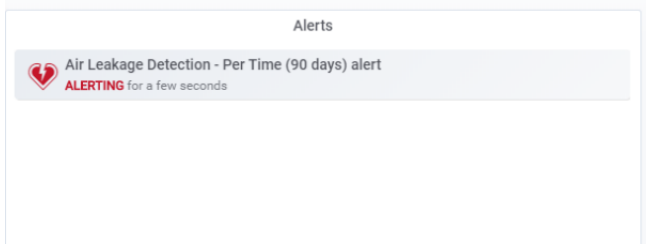
- Continuous monitoring and visualization of compressed air consumption
- Different scales available like per day, hour or process step
- Better inform the maintenance and production teams of potential issues with machine
- Help drive energy cost reduction and lower your CO2 footprint




## Air Leakage Detection

- Detect air leakage based on historical consumption patterns and parameters
- Continuous monitoring versus point-in-time or not checking altogether
- Set up alerts for maintenance and other teams
- Able to take corrective action, faster!




## Valve & Cylinder Monitoring

- Measure usage and cycle time
- Provide insight into remaining life of valves and cylinders
- Anomaly detection in manufacturing process


Cylinder Monitoring - Cycle Time Table

| Name | Min | Max | Mean | Current | Status |
|---|---|---|---|---|---|
| Dummy 1 | 50 ms | 950 ms | 499 ms | 718 ms | |
| Dummy 2 | 60 ms | 940 ms | 508 ms | 933 ms | |
| Dummy 3 | 70 ms | 930 ms | 497 ms | 18 ms | |
| Dummy 4 | 80 ms | 920 ms | 497 ms | 275 ms | |
| Dummy 5 | 90 ms | 910 ms | 494 ms | 754 ms | |

Valve Monitoring - Cycle Counter Table

| Name | Lifetime | Percentage | Current | Status |
|---|---|---|---|---|
| Valve 1 | 75.000.000 | 67 % | 50.001.682 | |
| Valve 2 | 75.000.000 | 86 % | 64.321.405 | |
| Valve 3 | 75.000.000 | 95 % | 71.432.407 | |
| Valve 4 | 75.000.000 | 99 % | 74.001.611 | |
| Valve 5 | 75.000.000 | 101 % | 76.000.537 | |

**Enable Remote Monitoring, Energy Consumption Reduction and OEE Improvements**

# Pneumatic Key Products - Digitalization, Efficiency & Sustainability

## AVENTICS™ Series AF2
## Air Flow Sensor

## AVENTICS™ AV03 Valve Systems
## with IIoT capabilities

## AVENTICS™ SPA
## Smart Pneumatics Analyzer

EMERSON™ | AVENTICS™


Emerson Confidential

# Next Steps

# Interested in How Emerson Can Help You with Digital Transformation?

## Next Steps

1. **Identify Resources to Involve**
2. **Schedule Workshop**
3. **Identify Problem Area & Solution**
4. **Implementation**

## Potential Resources to Involve

| Department | Why? |
|---|---|
| Reliability Department | Reliability + Production |
| IT Department | Data Analytics |
| Maintenance Department | Reliability + Production |
| Production Department | Reliability + Production |
| Engineering Department | Solution Focused |
| Process Group | Reliability + Production |
| HS&E Department | Safety |
| Energy / Utilities Group | Minimize Emission + Reliability |

EMERSON

EMERSON™

AVENTICS™

Gerson Silva
gerson.silva@emerson.com