

ALD Vacuum Technologies
High Tech is our Business



AUTOMATION & INDUSTRIAL IT



Harald Kirsch
Head of Automation & Industrial IT

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Business Development

ALD Vacuum Technologies
High Tech is our Business

ALD *EXPERT*



AUTOMATION & INDUSTRIAL IT



AMG TECHNOLOGIES

ALD Vacuum Technologies GmbH



GfE Gesellschaft für Elektrometallurgie mbH



AMG CRITICAL MATERIALS

Vanadium Superalloys	Tantalum & Niobium
Aluminum Alloys	Antimony
Lithium	Graphite
	Silicon

AMG ENGINEERING

KEY FACTS

- Over 100 years of experience in vacuum metallurgy and heat treatment
- Engineering facilities in Germany, France, USA, India and China
- Three heat treatment service centers in Germany, the U.S., and Mexico. New center in China opens 2020.
- Owns 85 patent families
- Approximately 900 employees

ALD IS A WHOLLY-OWNED SUBSIDIARY OF AMG

ALD Vacuum Technologies

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ENGINEERING – SUPPLY OF FURNACE SYSTEMS

AUTOMATION & INDUSTRIAL IT (A-II)



METALLURGY



HEAT TREATMENT



72% of revenues

SERVICES

SERVICE / SPARE PARTS



15% of revenues

HEAT TREATMENT SERVICES



13% of revenues

KEY FIGURES 2018

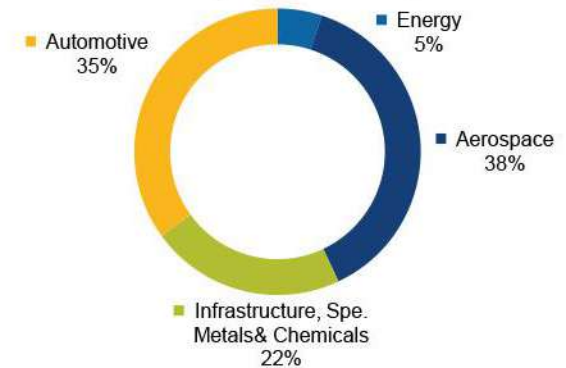
Turnover 264.0 US\$ m

EBITDA 36.8 US\$ m

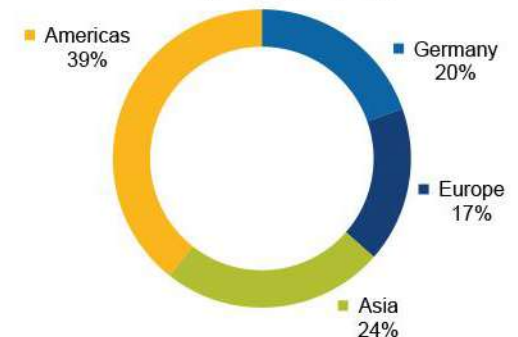
Employees ~ 900

More than 2,000 sold systems worldwide
(Asia 40 %, Europe 40 %, America 20 %)

Revenue by End Market, 2017



Revenue by Geography, 2018



AMG ENGINEERING'S BUSINESS PROFILE

AUTOMATION & INDUSTRIAL IT

CONSULTING

PRODUCTS

BUILDING IT/OT
CONVERGENCE
IN PRODUCTION
ENVIRONMENTS

SERVICES

ON PREMISE
HYBRID
PRIVATE CLOUD

BUSINESS DEVELOPMENT

ADDITIONAL
BUSINESS
POTENTIAL

NEW INSTALLATIONS

I-4.0 READINESS

EXISTING INSTALLATIONS

RETRO FIT

PRODUCTION OPERATION & PROCESSES

ALTERNATIVE MARKETS

BUSINESS MODEL – ARCHITECTURE OF VALUE CREATION

ALD Vacuum Technologies

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- Agile system and service design
- Access to proven value-added solutions
 - Intelligent Production Process Automation
 - Energy and Resource Management
 - Virtual System Lifecycle Management
- Continuous and central knowledge management for industrial environments
- Dynamic & device independent web interface

- Tailor-made Industry 4.0 solutions for special machine construction
- Access to industry and process-specific experience of ALD Automation & Industrial IT
- Productivity gains through the combination of technologies, experiences & remarkable process know-how

ALD EXPERT



STRONG DIGITAL STRATEGIC POSITIONING

A collection of eight white line-art icons on a red background, each enclosed in a hexagon. The icons represent various consulting and business concepts: a checklist with a magnifying glass, a gear with a magnifying glass, a hand pointing to a bar chart, a circuit board, a clock with an upward arrow, a grid with a magnifying glass, a hand holding a gear, and a microchip.

CONSULTING

**LET'S
TALK
ABOUT**

A grayscale image of a hand interacting with a tablet. The tablet screen displays a dashboard with various charts and graphs, including a bar chart and a line graph. The background is a light gray with a subtle network pattern.

**INTELLIGENT
PRODUCTION
PROCESS
AUTOMATION**

**LET'S
TALK
ABOUT**

A grayscale image of a hand holding a tablet. The tablet screen displays a complex 3D architectural or engineering model. The background is a light gray with a subtle network pattern.

**VIRTUAL
SYSTEM
LIFECYCLE
MANAGEMENT**

**LET'S
TALK
ABOUT**

A grayscale image of a hand holding a tablet, similar to the previous block. The tablet screen displays a complex 3D architectural or engineering model. The entire image is overlaid with a semi-transparent red filter.

**ENERGY &
RESOURCE
MANAGEMENT**

**LET'S
TALK
ABOUT**

A graphic for consulting services. On the left, there are eight hexagonal icons arranged in a circular pattern. The icons represent various business concepts: a checklist with a magnifying glass, a gear with a magnifying glass, a hand pointing up, a grid with a magnifying glass, a hand holding a gear, a target with an arrow, a circuit board, and a hand holding a document. On the right, there is a dark rectangular box with the word "CONSULTING" in white, and below it, the text "LET'S TALK ABOUT" in white.

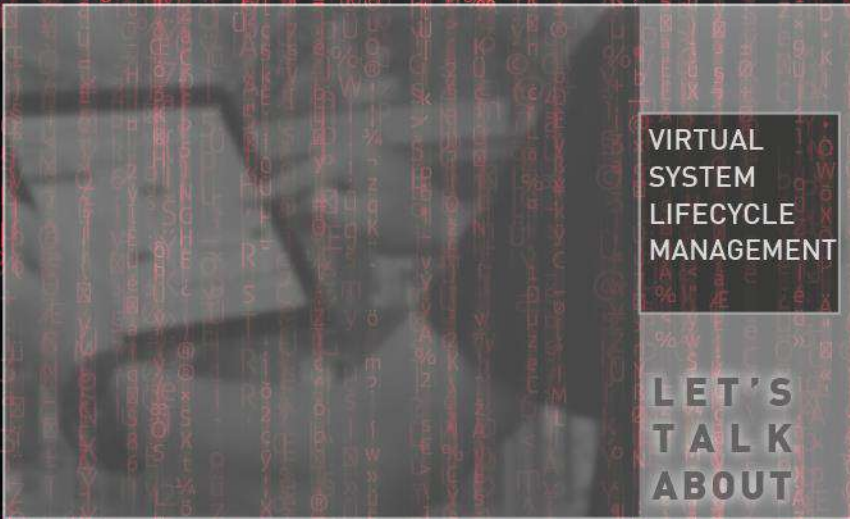
CONSULTING

**LET'S
TALK
ABOUT**

A graphic for intelligent production process automation. The background is a dark, industrial scene with a large, complex machine. On the right, there is a dark rectangular box with the text "INTELLIGENT PRODUCTION PROCESS AUTOMATION" in white, and below it, the text "LET'S TALK ABOUT" in white.

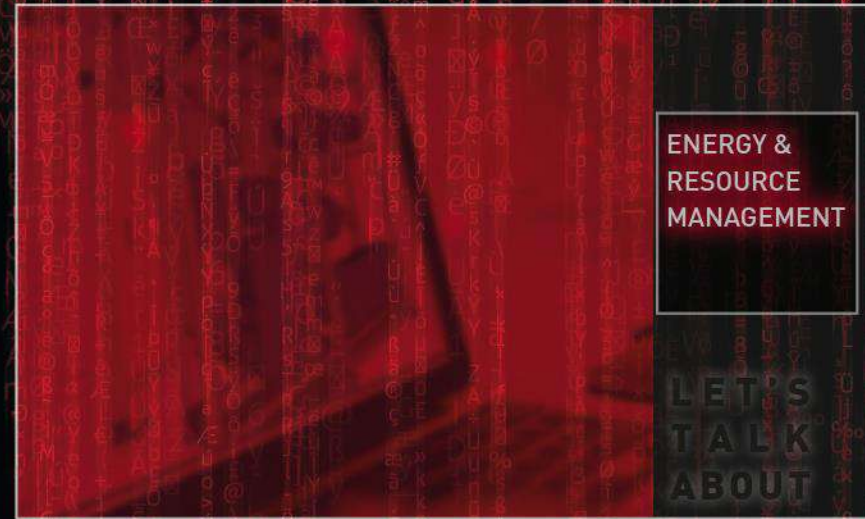
**INTELLIGENT
PRODUCTION
PROCESS
AUTOMATION**

**LET'S
TALK
ABOUT**

A graphic for virtual system lifecycle management. The background is a dark, industrial scene with a large, complex machine. On the right, there is a dark rectangular box with the text "VIRTUAL SYSTEM LIFECYCLE MANAGEMENT" in white, and below it, the text "LET'S TALK ABOUT" in white.

**VIRTUAL
SYSTEM
LIFECYCLE
MANAGEMENT**

**LET'S
TALK
ABOUT**

A graphic for energy & resource management. The background is a dark, industrial scene with a large, complex machine. On the right, there is a dark rectangular box with the text "ENERGY & RESOURCE MANAGEMENT" in white, and below it, the text "LET'S TALK ABOUT" in white.

**ENERGY &
RESOURCE
MANAGEMENT**

**LET'S
TALK
ABOUT**

MAIN RECEIVABLES FROM THE MARKET

- Many implementations fail because of slow transformation into the operative solution portfolio and the resulting missed business case
- The process of implementing generic solutions is too protracted and rarely reaches the expected innovation potential
- The expected degree of utilisation of generated data is too low, especially for intelligent data-based services
- The skills required for the development of digital solutions are increasingly becoming a bottleneck

EXAMINATION OF CUSTOMER REQUIREMENTS, EVALUATION OF THE CUSTOMER SITUATION & AGREEMENT ON THE IMPLEMENTATION STRATEGY



CYBER SECURITY



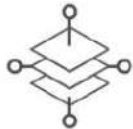
DATA ANALYTICS



DIGITAL READINESS



EDUCATION



LANDSCAPE ASSESSMENT



PROCESS ANALYSIS



SMART MEASUREMENT



STRATEGY ASSESSMENT



TECHNICAL ASSESSMENT

ALD Vacuum Technologies

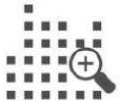
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CYBER SECURITY



DATA ANALYTICS



DIGITAL READINESS

Industrial safety concept for machines and systems in production environments

Potential analysis for continuous improvement, data-based maintenance cycles, optimisation and automation of processes

The Digital Readiness Maturity Methodology ensure the smooth integration of systems into an existing digital environment. At the same time, we provide the fact-based assessment basis for planning the necessary migration efforts

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EDUCATION



LANDSCAPE ASSESSMENT



PROCESS ANALYSIS

A qualification program, developed together with a renowned university, enables to find precise and appropriate decisions around "Digital Transformation" topics and the valuable use of the ALD EXPERT technology

Ensuring a strong IT/OT convergence and the consistent information flow between production systems and business applications

Investigation of the customer process and the system periphery as well as detailed recording of optimisation potential and collection of solution approaches

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SMART MEASUREMENT



STRATEGY ASSESSMENT



TECHNICAL ASSESSMENT

Development of a concept for the use of intelligent measuring systems and inform about the advantages, requirements and costs when planning the solution architecture

360° assessment of the customer situation and derivation of the digitalisation roadmap

Identification of the technological maturity and the definition of the required operational technology for the consistent and secure interoperability

360 ° MATURITY METHODOLOGY FOR MASTERING THE DIGITAL TRANSFORMATION

- Tailored consulting concepts to ensure the best possible application of ALD EXPERT technology
- Provides a secure basis for - fast, precise, valuable and appropriate - decisions on the use of the ALD Expert technology within the scope of the "Digital Transformation"
- Holistic view of current and future challenges - technical capabilities, business and production process impact, chances and risks
- Methodical knowledge transfer



CONSULTING

**LET'S
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**INTELLIGENT
PRODUCTION
PROCESS
AUTOMATION**

**LET'S
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ABOUT**



**VIRTUAL
SYSTEM
LIFECYCLE
MANAGEMENT**

**LET'S
TALK
ABOUT**



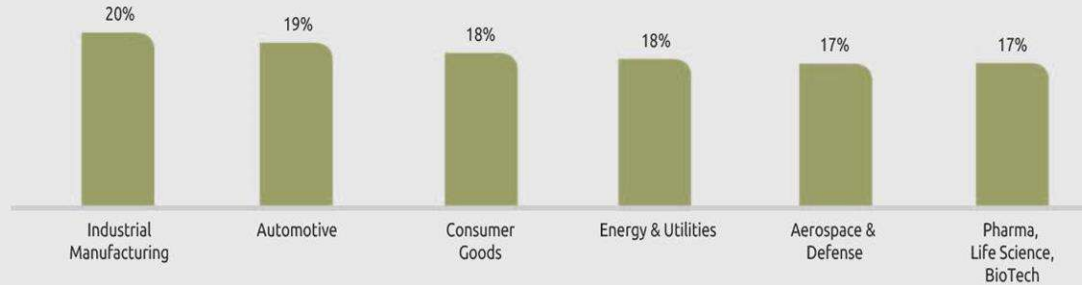
**ENERGY &
RESOURCE
MANAGEMENT**

**LET'S
TALK
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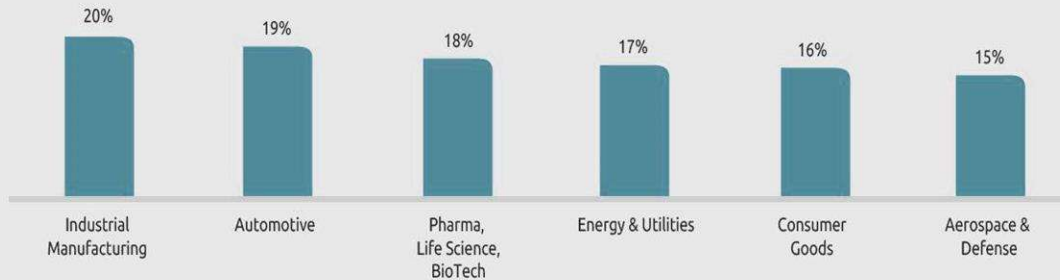
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Average realized overall productivity gains from smart factories so far



Average realized quality gain from smart factories so far



Source: Capgemini Digital Transformation Institute, smart factory survey, February-March 2017

Source: Capgemini Digital Transformation Institute, smart factory survey, February-March 2017

- **76% of manufacturers** either have a smart factory initiative or are working on formulating it
- **More than half of manufacturers (56%)** have aligned \$100 million or more towards smart factories
- **BUT:** The high level of ambition is clouded by the still low degree of utilisation of the generated data for intelligent, data-based services

Source: Capgemini, Digital Transformation Institute, Smart Factories

MAIN RECEIVABLES FROM THE MARKET

- Optimisation of the overall system effectiveness
- Ensuring the availability and optimised use of resources
- Long-term quality assurance and enhancement of products
- Reduction of unplanned system downtimes

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OPTIMISATION & AUTOMATION OF PROCESS & PRODUCTION SEQUENCES THROUGH THE USE OF INNOVATIVE & DIGITAL TECHNOLOGIES



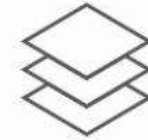
ANOMALY DETECTION



BATCH MANAGEMENT



CONDITION MONITORING



GRID



PROCESS DATA VISUALISATION



INTEGRATION UNIT



RECIPE MANAGEMENT

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ANOMALY DETECTION



BATCH MANAGEMENT



CONDITION MONITORING

Safe & fast detection of irregularities during the production process

Batch-specific tracking of process parameters for clear quality control of products

Monitoring of the system status on the basis of process & operating parameters in real time

ALD EXPERT**INTELLIGENT PRODUCTION PROCESS AUTOMATION**

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GRID

IloT platform that enables digital applications
and services with economies of scale



PROCESS DATA VISUALISATION

Visualisation of process and operating parameters
in real-time on almost any mobile device



RECIPE MANAGEMENT

Central creation, modification, release and synchronisation
of recipes across all systems

ALD EXPERT**INTELLIGENT PRODUCTION PROCESS AUTOMATION**

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ALD EXPERT GRID

EN

M. Administrator

Logout

Tue 09:32:16

Grid

Alerts

Help

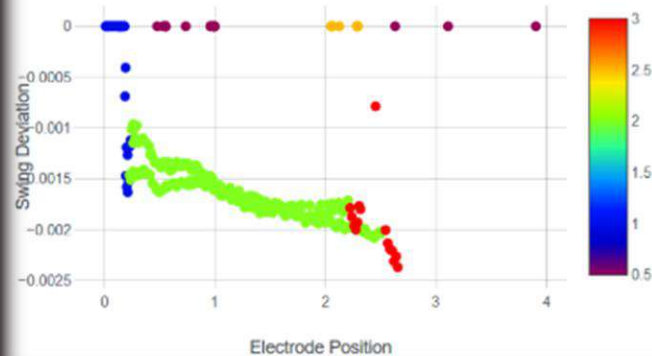
Electrode Position



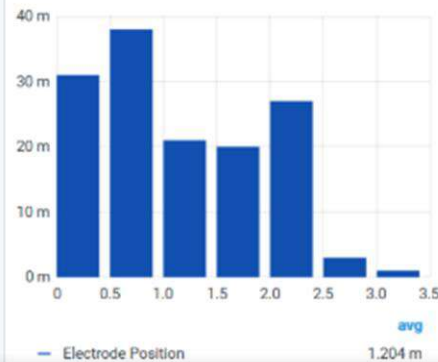
Swing Deviation



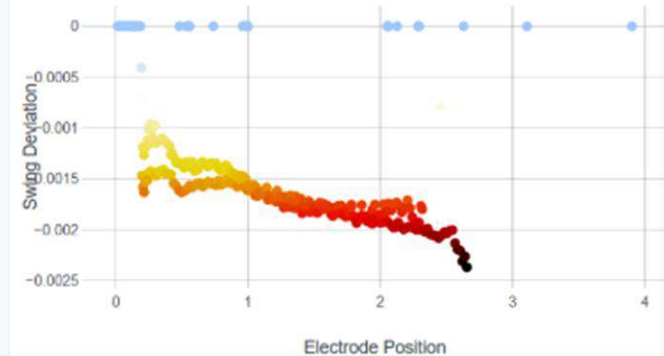
Electrode Position / Swing Deviation @ Process Phases



Electrode Position Histogram

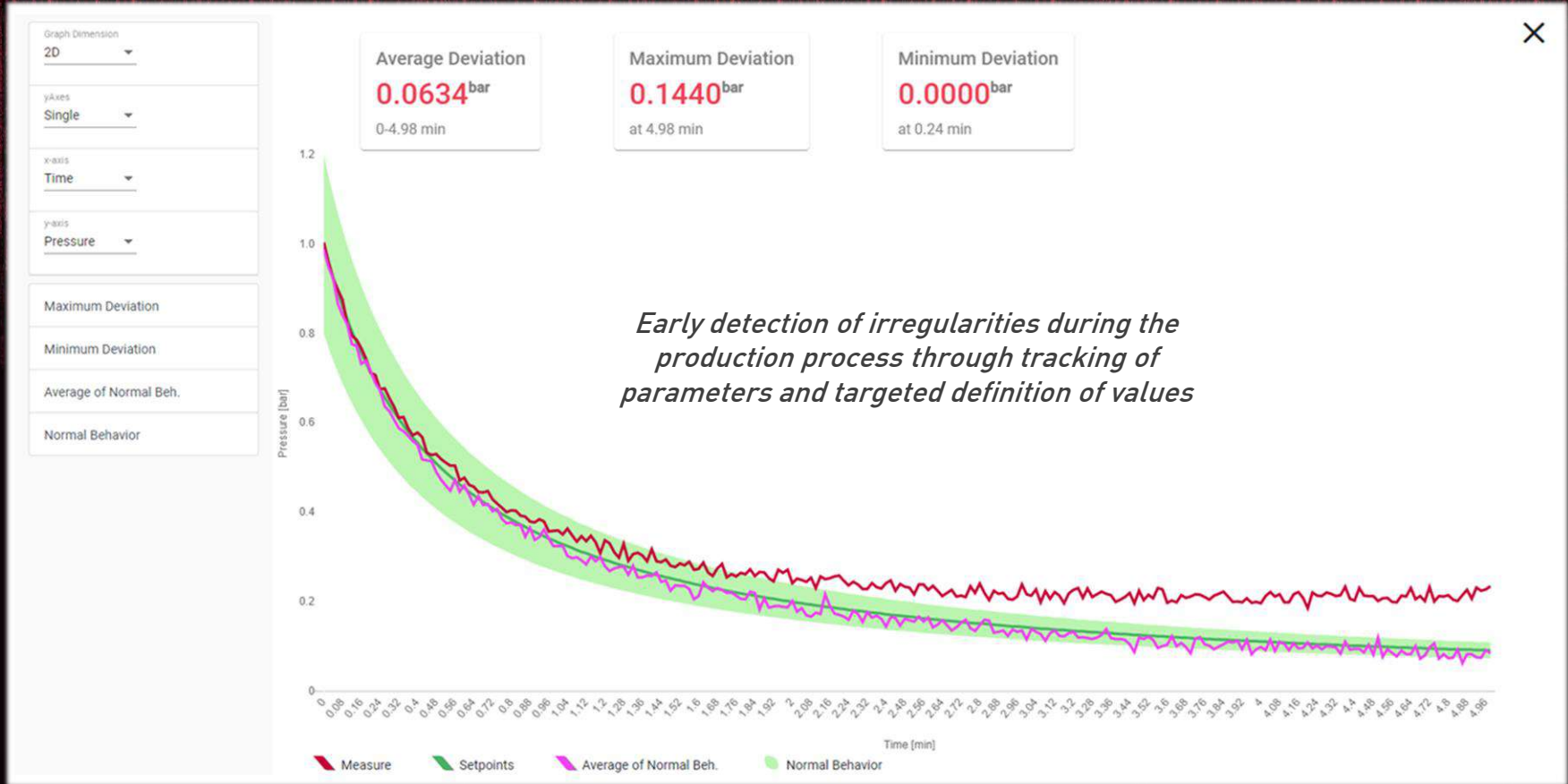


Electrode Position / Swing Deviation



Application example for condition monitoring of a melting plant

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INCREASING PRODUCTIVITY & SAVING COSTS

- Specifically programmed algorithms for the targeted evaluation of key figures using a high level of system and process know-how
 - Cost reduction by saving employee capacities for maintenance
 - Reduction of system downtimes
- Realisation of OEE improvement
 - Availability: Planning of maintenance windows
 - Performance: High performance through condition-oriented maintenance
 - Quality: Equipment has no negative influence on the process due to optimal maintenance



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LET'S
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INTELLIGENT
PRODUCTION
PROCESS
AUTOMATION

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VIRTUAL
SYSTEM
LIFECYCLE
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LET'S
TALK
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ENERGY &
RESOURCE
MANAGEMENT

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TALK
ABOUT

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- Energy turnaround also means a reduction in the amount of electricity fed into the grid in industry
- Digitalisation processes enable flexible production which makes the demand for electricity controllable

MAIN RECEIVABLES FROM THE MARKET

- Ensuring the availability and optimised use of resources
- Optimising and ensuring system availability
- Reduction of energy costs
- Certification of the production site according to DIN EN ISO 50001

MONITORING, EVALUATION & INTELLIGENT USE OF THE NECESSARY RESOURCES AT THE PRODUCTION SITE



RESOURCE MANAGEMENT



ENERGY MANAGEMENT

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RESOURCE MANAGEMENT



ENERGY MANAGEMENT

Recording and deployment optimisation of all resources
related to the system process

Recording and optimisation of the energy consumption of the
system and the entire production site

ALD EXPERT**ENERGY AND RESOURCE MANAGEMENT**

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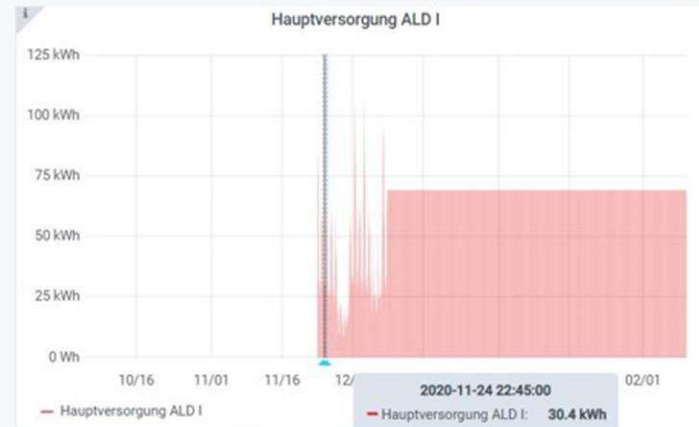
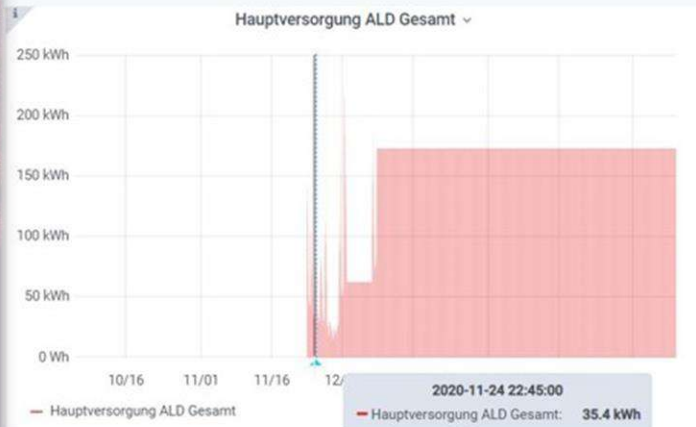
ALD EXPERT GRID

Schum, Frederic Abmelden

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Gebäude - Kumulierter Energieverbrauch (Ausgewählter Ze...

Büros

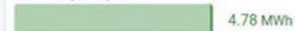


Spulenfertigung



Wärmepumpen - Kumulierter Energieverbrauch (Ausgewähl...

Wärmepumpe 1



Wärmepumpe 2



Wärmepumpe 3



Verschiedenes - Kumulierter Energieverbrauch (Ausgewähl...

Kühlwasserpumpen



Isolierstoffverteiler 1



Isolierstoffverteiler 2



Gebäude - Kumulierter Energieverbrauch (Gesamt)

Wärmepumpen - Kumulierter Energieverbrauch (Gesamt)

Verschiedenes - Kumulierter Energieverbrauch (Gesamt)

Wärmepumpe 1 70.16 MWh

Kühlwasserpumpen 2.56 MWh

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ALD EXPERT GRID

Mustermann, Max

Log Out

Do. 14:25:33



Cumulated EB Energy (Selecte...

420.68 kWh

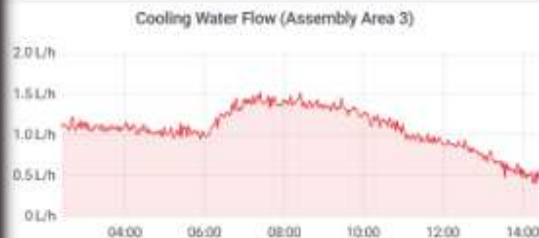
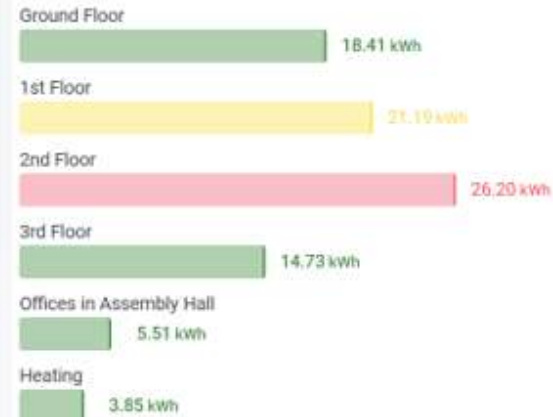
Cumulated Pump Energy (Sele...

491.09 kWh

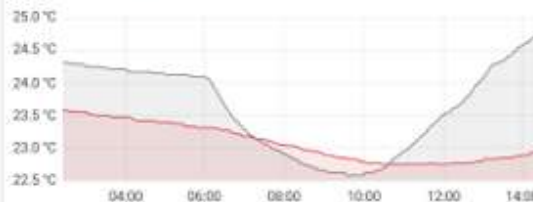
Current EB Active Power Total...



Cumulated Office Energy (Selected Timeframe)



Cooling Water Temperature (Assembly Area 3)



Cumulated Office Energy (total)



ENSURING DELIVERY & SAVING COSTS

- Gives hints on optimal batch distribution along all systems
 - Saving of main resources and thus money saving
 - Ensuring the availability of resources guarantees delivery capability
- Intelligent system for consumption monitoring and coordination of systems-operation to keep peak loads of electricity at a minimum
 - Saving energy costs
 - Securing operation of systems and thus product supply capability



CONSULTING

**LET'S
TALK
ABOUT**



**INTELLIGENT
PRODUCTION
PROCESS
AUTOMATION**

**LET'S
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ABOUT**



**VIRTUAL
SYSTEM
LIFECYCLE
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**LET'S
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**ENERGY &
RESOURCE
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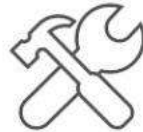
**LET'S
TALK
ABOUT**

MAIN RECEIVABLES FROM THE MARKET

- Too theoretical methods in a quite static environment
- The highly fragmented automation landscape prevents consistent data structures
- Unilateral separated communication structures
- Lose on the way - i.e. the life cycle of a system - the relation to the actual situation
- Spotted view to the system lifecycle phases
- Systematically knowledge drain

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SEAMLESS & OBJECT-RELATED DOCUMENTATION FROM THE DESIGN PROCESS, OVER THE ENTIRE SERVICE LIFE OF THE SYSTEM, UP TO SCRAPPING



MAINTENANCE MANUAL



WEBSHOP

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MAINTENANCE MANUAL



WEBSHOP

Mobile access to role and system-specific maintenance instructions, including predictive suggestion service respectively ontologies for the optimal execution of maintenance tasks

Fast ordering of spare parts and consumables with up-to-date information on prices, availability and delivery time

ALD EXPERT**VIRTUAL SYSTEM LIFECYCLE MANAGEMENT**

HOLISTIC LIFECYCLE MANAGEMENT & INTELLIGENT MONITORING FOR HIGHLY CUSTOMISED SYSTEMS

- Precise assessment of a system's current and future capabilities during its lifecycle
- Early discovery of system design - and operational deficiencies by observing development stages before physical processes and products are turned into production
- Optimisation of user-friendliness, controllability and revision safety
- Continuously improve designs and models through data collection, field feedback and easy linking to engineering details
 - Single point of truth for core KPIs
 - Cost of quality
 - Overall equipment effectiveness
 - Maintenance costs
- Holistic and intuitive access to mission critical information



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