WHITE PAPER

Increase efficiency across the board

Control, document and improve
industrial production processes with MES

ARBURG

CONTENTS

Keywords: #increasedefficiency #productionquality #processoptimisation #systemavailability #transparency #employeeacceptance

EXECUTIVE SUMMARY

In today's industrial production, a continuous flow of data and information is essential for identifying and eliminating bottlenecks and inefficient process steps without having to invest additional working time. A modern Manufacturing Execution System (MES), such as the ARBURG host computer system (ALS), plays a crucial role in creating transparency in production by ensuring that the production sequence is precisely controlled and monitored. ALS, which can be expanded on a modular basis, is a flexible entry-level solution with manageable investment costs. The long-term benefits come from transparent processes that guarantee the overall effectiveness of production on a long-term and future-proof basis.

This white paper uses the ARBURG host computer system (ALS) to show how errors in the production sequence can be identified and automatically corrected without the need for manual adjustments to the setting parameters. Case studies illustrate how the system can improve efficiency and quality in different production environments.

This white paper is primarily aimed at:

- Plant managers and production managers who are looking for ways to increase overall efficiency, reduce production downtime, and optimise resource utilisation.
- IT and process experts who are involved in the integration and implementation of host computer systems and looking for modern solutions for the automation and digitalisation of production processes.
- Process engineers and lean experts who lead continuous improvement initiatives and are looking for ways to streamline production sequences and reduce waste.
- Quality managers who are committed to workplace safety as well as quality and environmental standards.
- Machine operators who want to work more efficiently and keep an eye on overall productivity.

CONSISTENT PROCESSES IN A VOLATILE ENVIRONMENT

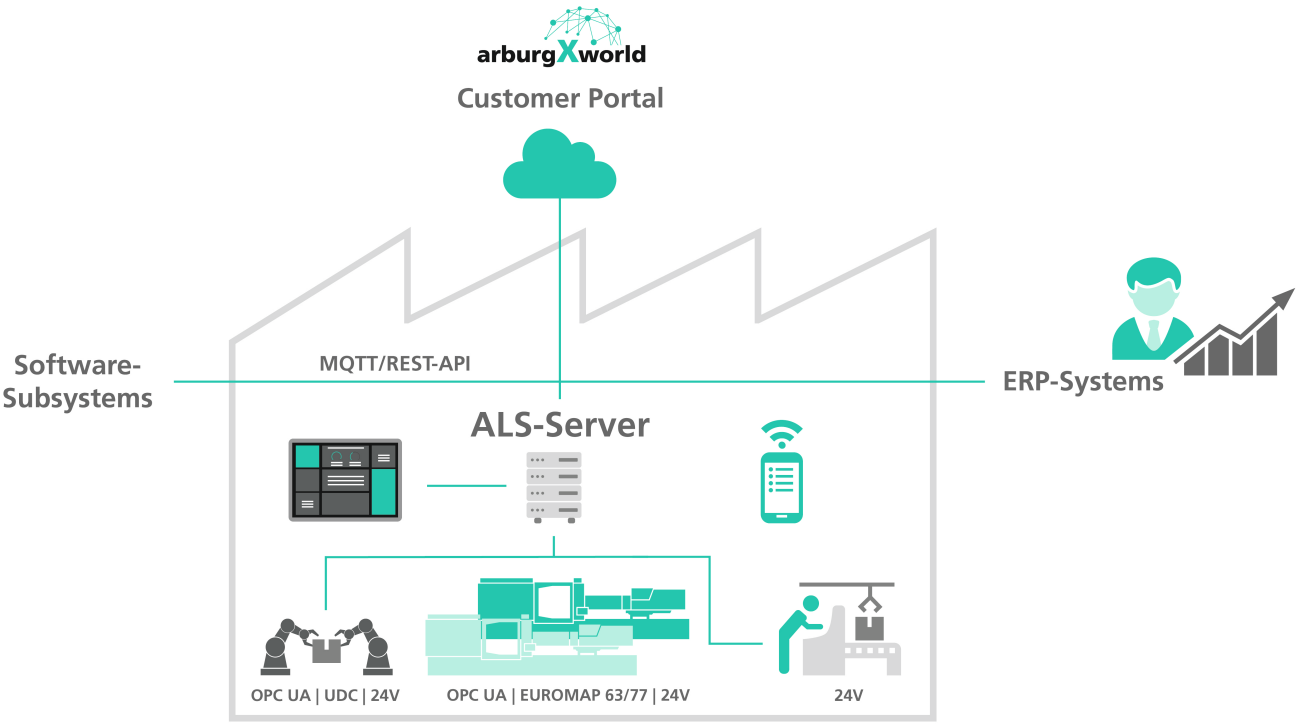
Industrial manufacturing companies use Manufacturing Execution Systems (MES) to assist with the planning, control and monitoring of production processes. MES help increase production efficiency, optimise production sequences, record real-time data, improve quality and ensure that products are traceable.
Complex production environments for high-precision components in particular require precise control of the production processes. The MES developed by ARBURG, known as the "ARBURG host computer system (ALS)", enables non-transparent sequences to be identified and neutralised through continuous monitoring and control.

Non-transparency in production – a source of many problems:

- Waste of resources: machine standstills are not immediately detected, regular double occupancy or dead times
- Waste of time: long set-up times, long searches for process parameters during troubleshooting
- Isolated solutions: too little communication between company divisions hampers optimisation potential
- Quality problems: quality standards are not met, high rejection rate, documentation is not fully verifiable, fewer orders
- Lack of agility: decisions to adapt to changing conditions are made too slowly because important indicators (KPIs and production reports) are available too late or not at all.

THE ARBURG HOST COMPUTER SYSTEM

The ARBURG host computer system (ALS) addresses these challenges by enabling transparent production, completely aggregating machines and systems (regardless of manufacturer), as well as moulds, peripheral equipment and devices, robots and manual workstations. Detailed planning of production and upstream and downstream sequences is carried out using so-called modules. This precision planning is the core function of an MES, as this task is often too detailed and therefore complex for higher-level ERP, PDA or PPC systems. ALS is hosted locally at the location, which enables high security standards and the possibility of real-time communication. The ALS modules are configured individually so that they automatically forward important information to the respective target locations – this could be push messages to the shift supervisor's mobile phone, key indicators on OEE, or spare parts orders to the PDA system. ALS also takes over the seamless documentation of product and production information as well as the provision of configuration files or maintenance manuals regardless of location – in other words, "paperless manufacturing".



THE IDEAL INTRODUCTION TO DIGITALISED PRODUCTION

Getting started with digitalised production is a major challenge for many companies. The gradual integration of a Manufacturing Execution System (MES), such as the ARBURG host computer system, is a crucial factor in making this transition a success. The guiding principle here should be: **"Think big – start small".**
It is important to develop a comprehensive vision for the digital transformation, but at the same time to start with manageable, controllable projects. The following is an example of a project process that shows what this kind of step-by-step approach can look like in practice.

Step 1: The optimum start

Getting started with an ALS system is easy with the entry-level package, and the system's modular design means it can be built up step by step. We recommend starting a pilot project with ALS in areas where bottlenecks or problems are already known so that the optimisation potential can be exploited. This way, you can quickly gain initial experience that can be transferred to other areas. A gradual rollout offers the advantage that the investment costs always remain manageable and measurable successes can be achieved quickly.

The "ALS Basic" entry-level package already offers many options for utilising the potential of ALS at a low price. For example, process data can be recorded, evaluated and analysed automatically and in real time. This information provides an indication of the overall equipment effectiveness (OEE) and forms the basis for using ALS throughout production.

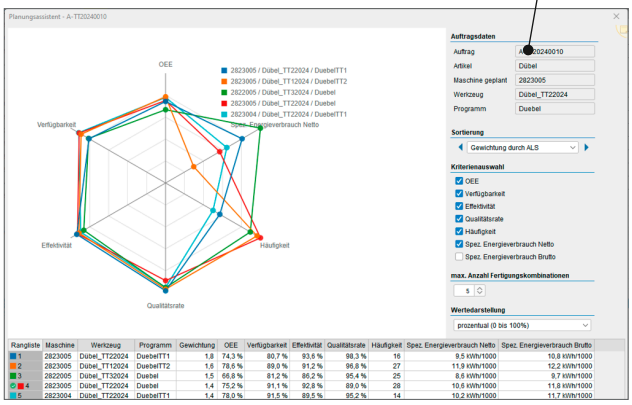
Step 2: Continuous expansion

Once some initial experience has been gained, the rollout to other assembly machines or manual workstations can be planned. Gradual expansion makes it possible to continuously optimise the system and increase efficiency across several areas. Employee feedback is crucial during this process. Their feedback will help to promote acceptance of ALS and ensure smooth implementation. In addition, comprehensive employee training is crucial to ensure that they are familiar with the system and use it effectively. This ensures that employees recognise the full potential of ALS and are properly informed about updates or new functions as part of the system's continuous development.

APPLICATION SCENARIOS FOR THE ARBURG MES

Thanks to our many years of experience in plastics processing and injection moulding, all the essential functions are already included in the modular ALS, meaning that no customising is necessary. Besides its previously mentioned scalability, ALS also has industry-standardised interfaces such as EUROMAP 77, EUROMAP 63 and OPC-UA to make it easy to connect different components and devices.

AI-supported analysis of the best-fit machine ("Orders" module)

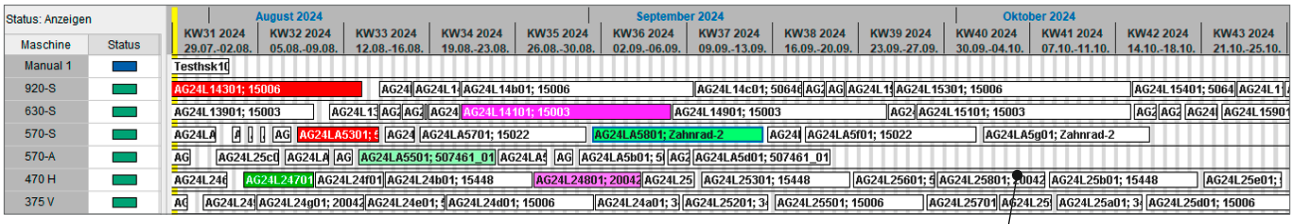


Transparent manufacturing

Many parameters such as capacity utilisation, materials, manpower and prioritisation must be incorporated into order planning. ALS provides support here by displaying resource conflicts and calculating recommendations.

Benefits:

- No double occupancy or dead times
- Dynamic adjustment of the incorporated parameters as required



A constant overview of important orders, e.g. visualisation in planning chart ("Orders" module)

When an order is transmitted, ALS transfers information about the order and the associated data set to the machine fully automatically and sets monitoring or maintenance intervals in the production cycle.

Benefits:

- Machine programmes can be managed centrally and transferred directly to the machines.
- Compliance with the obligation to provide evidence through automatic data logging plus evaluation and analysis of production (KPIs, quality parameters, machine data, etc.)
- All information on the order, production progress, set-up times and maintenance is available centrally.

Maintenance intervals are set automatically and do not disrupt the production phases ("Maintenance" module)

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253148		Technical service - 250 operating hours	gemeldet		Technical Service	20	B-std.		234	324	-90	ab letzter Quittierung	0:30
2801001		Technical Service	gemeldet			einmalig	Tage		03.11.2021		-999 Tage	-	0:00
2822005		Werkerselbstprüfung	gemeldet			1	B-std.		4161	4356	-195	ab letzter Quittierung	0:00
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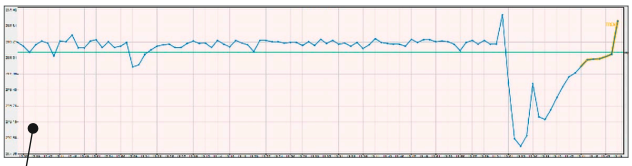


Control board recognises patterns and provides predictive assistance ("Quality" module)

In production, adhering to deadlines is essential so that all orders can be completed on time and in line with customer requirements. The ALS quality monitoring system provides continuous run/trend analyses for important parameters centrally and regardless of location. In addition, process parameters from the injection moulding machines are evaluated in real time so that, in an emergency, action can be taken before bad parts are produced. This data is of course not only recorded, but also stored on local servers. As a result, it is possible to document important process data without additional database systems.

Benefits:

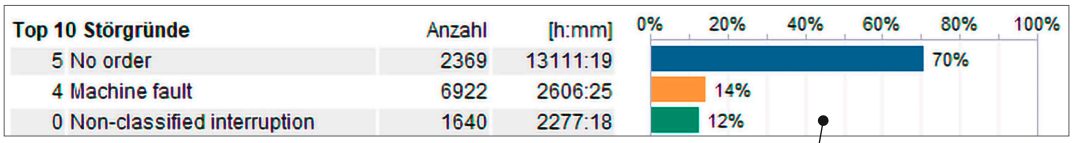
- High degree of reliability in production even during unmanned shifts
- Long-term trends can be identified at an early stage
- Important process parameters and quality measurements verifiably documented and linkable

Future-proof manufacturing

By recording and analysing faults in detail, bottlenecks and inefficient process sequences can be identified and rectified. This continuous improvement in production makes production processes future-proof in the long term.

Benefits:

- Avoid bottlenecks and guarantee production output
- Long-term optimisation of production through ability to plan at an early stage



Causes of errors visualised ("Reports" module)

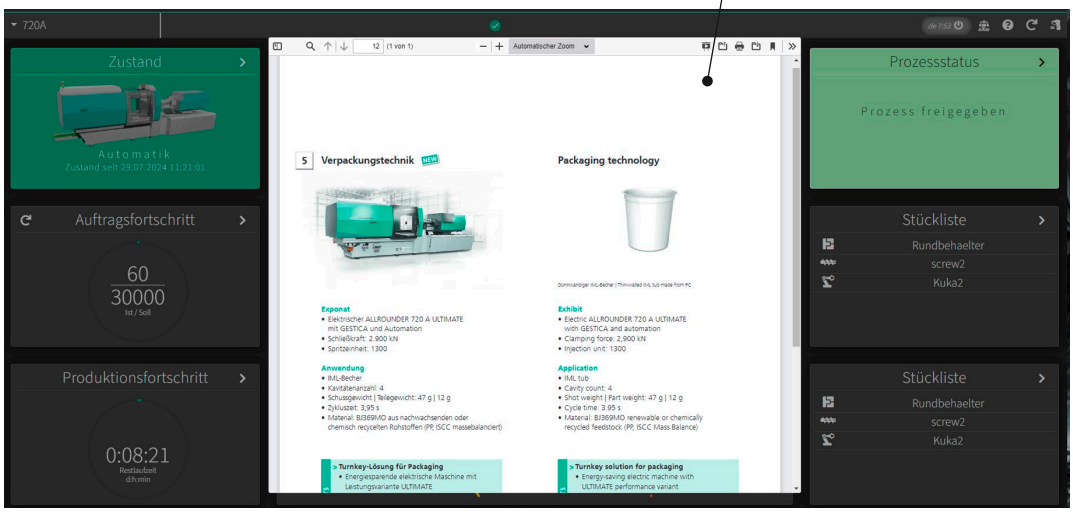
Paperless manufacturing

The transparent, centralised provision of data by ALS improves production organisation and other company processes. Relevant production documents can be customised in ALS to suit the respective order and made available regardless of the media. This not only makes work easier and saves time, but also increases reliability – because it ensures that the correct and current document is always displayed.

Benefits:

- No searching for paper documents
- The latest information is always available

Relevant production document available digitally ("Documents" module and "Mobile License Package")



USER EXPERIENCES – PROVEN INCREASE IN OEE

In a representative survey of ALS users, 92% of users reported significant improvements (approx. 30% of users had 1 - 20 machines, approx. 40% had 21 - 50 machines and approx. 30% had more than 51 machines). The improvements were achieved in various areas. Three examples are analysed in more detail below:

Set-up times reduced

Efficiency during set-up plays an important role in the total output and quality of a production plant. Even small improvements and the correct implementation of the right ALS modules can have a positive impact on productivity and costs.

Before implementing ALS, a medium-sized contract manufacturer stored the data sets of its 24 injection moulding machines on memory cards and the internal company network. Data security and different version statuses led to inefficiencies, particularly when setting up the mould and the machine. Since machine data sets have been stored centrally in ALS, search times and errors caused by outdated programs have been greatly reduced and paperless manufacturing further advanced. This saves an average of 6 minutes of operator time and 6 minutes of machine time – for every set-up process. With 12 set-up processes per day and 250 working days, this saves 600 person and machine hours per year.

This one application case results in an annual saving of EUR 18,000 (based on hourly person and machine rates of EUR 30 each).

Reduce standstill times

Regardless of the industry, standstill times generate the greatest preventable costs in production. Horizontally and vertically interlinked processes within the company are essential for minimising standstill times in the long term. An MES plays an important role here, because this is where the important information comes together.

An ALS customer from the mobility industry uses 60 machines, half of which generated an alarm every day on average. Before ALS was introduced, the average standstill time per alarm was 15 minutes. After implementing ALS, the company was able to reduce the average standstill time by 80 per cent (to 3 minutes per alarm).

This application results in a total annual time saving of 1,300 hours or EUR 78,000 (based on hourly person and machine rates of EUR 30 each).

Automatic production data acquisition

A customer from the consumer goods industry with 80 injection moulding machines and a 3-shift operation had to deploy one full-time employee per shift (at an hourly rate of EUR 30) to manually read out data from each individual machine, transfer it to Excel and analyse it. This work procedure was fully automated with ALS. Production data is now recorded in real time, clearly processed and available across the board.

Automating this process with ALS has enabled costs to be optimised by EUR 157,500 per year. Thanks to automation, employees are no longer busy inputting data manually, and can instead use their working time more productively for more important tasks.

Conclusion

Although the actions taken by the survey participants were varied, on average they led to a measurable improvement in efficiency. This was demonstrated by overall equipment effectiveness (OEE), which improved by 26.5 per cent on average.

This improvement in effectiveness is initially offset by the investment costs required to install and establish an MES. However, investments in digitalisation measures lead to a significant increase in productivity in the long term. Traditional production processes often show a steady but only slight increase in productivity. However, if digitalisation projects such as ALS are implemented in production, users quickly see a significantly greater increase in productivity for a comparable amount of time and effort.

This underlines the importance of the ARBURG host computer system and other digital services as powerful tools for optimising production processes and securing the future of a company.

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682735_EN_092024 · Subject to alterations
Printed in Germany