



// Optimization with *SEOS*

Efficient and safe control
of stacker cranes

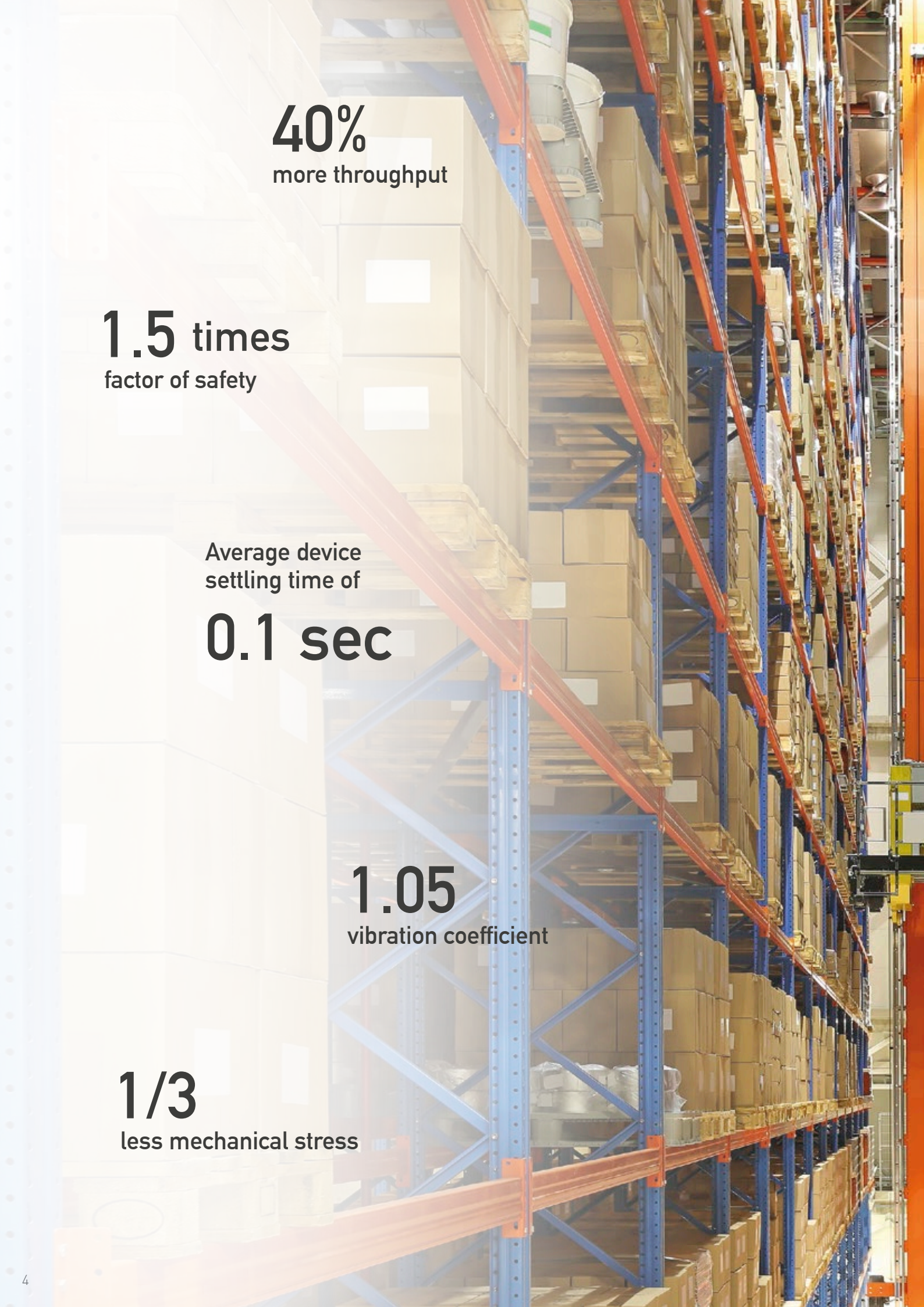




Safety, throughput and energy efficiency are central requirements for automated stacker cranes. With the easily integrated *SEOS* technology these aspects can be further improved. The newly developed software is able to precisely calculate a forecast of the movement of the mast. With this information the drive engine can be controlled in such a way that vibrations are avoided. Both operators and manufacturers of stacker cranes can integrate the software into existing and new systems without great effort.

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40%
more throughput

1.5 times
factor of safety

Average device
settling time of

0.1 sec

1.05
vibration coefficient

1/3
less mechanical stress

// Advantages

Higher throughput

As a result of the optimal control with *SEOS* oscillations of the mast and waiting periods are eliminated and the acceleration is increased. These measures increased the throughput of existing plants by 40%.

More safety

With *SEOS* vibrations of the stacker crane can be avoided. Even at dynamic speeds with high acceleration the movement is smooth and well-controlled. The mechanical factor of safety of conventional systems could be increased by 1.5 times.

Shorter device settling time

Through the combination of a precise forecast calculation of the mast movement and an anti-vibration controller, the waiting times of existing plants could be almost eliminated. After arriving at the target position the average waiting times were 0.1 seconds.

Reduced vibration coefficient

Conventional drive control systems usually achieve a vibration coefficient of 1.5. With the *SEOS* technology this coefficient can be reduced to 1.05. Hence, the mechanical stress of the stacker crane is lowered and performance improvements are possible.

Less mechanical stress

SEOS automatically accelerates and decelerates the stacker crane in an intelligent way. Since vibrations are avoided, the mechanical cyclic stress at existing plants could be reduced by 35%. Hence, mechanical components are protected and the wear and tear is reduced.

Less energy consumption

Shorter movement times and a reduction of peak loads lead to a lower energy consumption. On existing plants the energy consumption could be reduced by 1/4. The combination of *SEOS* and particularly, tuned mast designs, can all lower energy consumption further.

Increased acceleration

A precise forecast calculation of the mast movement and an anti-vibration controller eliminate vibrations and enable a load and time optimal control of the stacker crane. Hence, with *SEOS* the acceleration of conventional plants could be increased by 65% on average with a peak of a 115% increase.

Higher construction height (for manufacturers)

Since vibrations can be avoided with *SEOS*, it is possible to increase the construction heights of conventional high-bay warehouse designs without jeopardising the stability of the system. This enables manufacturers of stacker cranes lightweight designs of stacker cranes to have higher market coverage with existing designs and a reduction of construction costs.

Fast commissioning time (for manufacturers)

With conventional drive control systems the commissioning engineer usually has to adjust the control parameters by extensive trial and error. In contrast, *SEOS* can automatically estimate optimal parameter settings via its integrated modelling and optimization. In this way, manufacturers of stacker cranes save on time and costs.



Reduction of energy
consumption by

1/4

65 to 115 %
increased acceleration

40% increase of
construction heights

30%
reduction in
commissioning time

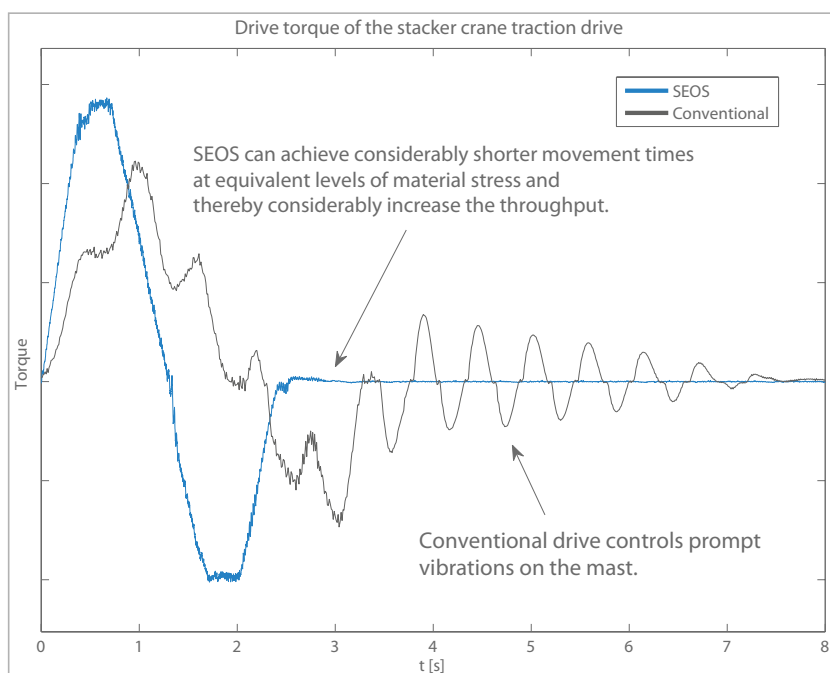
// Functioning of SEOS

SEOS stands for Speed and Energy Optimization System. The software enables an optimal, vibration-free control and regulation of stacker cranes.

Conventional drive control systems cause vibrations of the mast and customary feedback controllers cannot damp these vibrations fast enough. Previous approaches, such as anti-pendulum drives or creep speeds, are either expensive or slow.

With *SEOS* however, active vibration reduction can be used to improve numerous central requirements on the stacker crane: Alongside an increase of the throughput, at the same time, energy costs can also be saved with the *SEOS* technology. The smooth and controlled operation of the stacker crane additionally leads to more safety in the warehouse.

The basis of the software is a computer model of the stacker crane. In this way, an exact forecast calculation can be made of the vibrations of the entire stacker crane – from the chassis to the mast to the top crosshead. Through the optimization of this movement, a fast and also vibration-free trajectory can be generated. Based on this, the drive motor is controlled in such a way that vibrations of the mast do not occur in the first place. The software takes account of material limits; this allows the safe and controlled operation of the stacker crane.







// Easy integration

The *SEOS* software can be easily integrated into new plants, but also existing stacker cranes can be extended and enhanced.

It can be used by manufacturers, as well as operators, of stacker cranes.

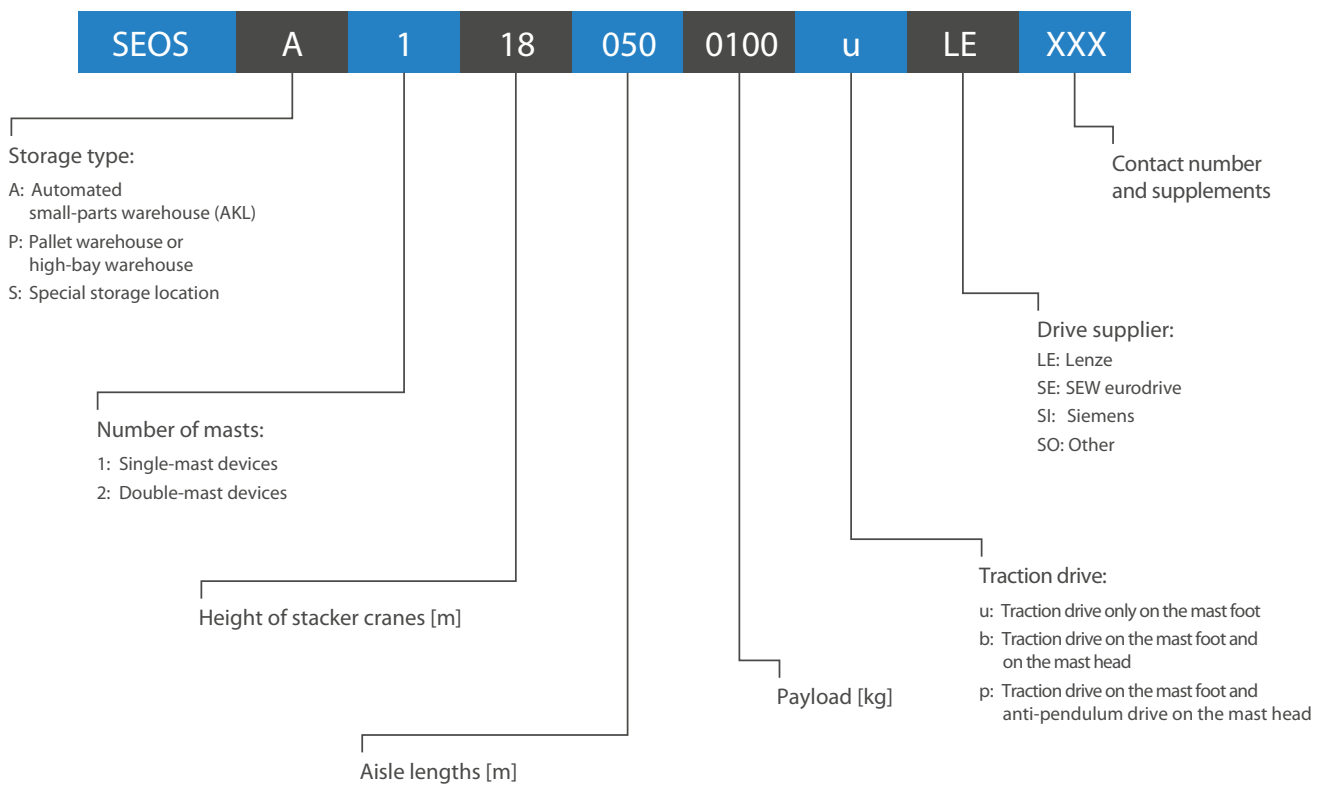
Before installation the targets and requirements are defined together with the customers. In a first meeting the already implemented hardware and available interfaces are clarified. Installed engines and inverters can be further used without any changes. A major benefit of the software is its compatibility with all leading hardware manufactures. All safety devices, which are already in use, are not affected by the integration. If a PLC controller is available, then no additional hardware is required for *SEOS*.

If these parameters are defined, *SEOS* implementation can take place in the next step already. All required measures are performed by Berger Engineering on site. If a new PLC controller is necessary, it is connected to the inverter and the bus system is started. *SEOS* automatically adapts to the connected stacker crane, calculates optimal driving trajectories and is ready for use.



// Product types

SEOS was developed for various designs of stacker crane. Individual adaptations are possible by arrangement.





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Since 1989, the company Berger Engineering GmbH from the town of Simbach am Inn in Bavaria, Germany has been concerned with technologies from the field of industrial automation. With over 60 national and international patents, the company is successful in the fields of drive controls for stacker cranes, rail stamping machines and girder plants. An innovative and dynamic team, paired with professional development and 35 years of experience, as well as the close cooperation with customers and suppliers, are guarantees of success and outstanding quality.

With *SEOS* into a vibration-free future!



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