

Intelligent warehousing system

# Solutions for storage and retrieval units



# Your extensive solutions package from the industry expert

**As a leading specialist in automation and drive solutions, we offer you a broad product portfolio and an internationally positioned team of experts for the implementation of the often complex requirements in warehouse logistics. This allows you to benefit from long-standing industry experience and the latest know-how for the automation of intralogistics.**

**Working together, we will develop custom solutions for pallet and box storage and retrieval units (SRUs) that perfectly suit your needs:**

- **For all commonly encountered travelling and lifting unit concepts, e.g.:**
  - Travelling with two motors
  - Omega belt or friction wheel drives
  - Steel-rope drum or rotating belts
- **For normal operation and deep-freeze areas**
- **Including comprehensive safety functions for the protection of people and materials**
  - There is a European standard for storage and retrieval units, EN 528, a Machinery Directive that stipulates the specific safety requirements.

We have answers for all these challenges!

For efficient software engineering, Lenze FAST provides you with an application framework featuring an extensive toolbox. In the **Lenze FAST machine solution for storage and retrieval units** with ready-to-use software engineering modules, we have bundled functions to address the needs of next-generation storage and retrieval units.

It allows you to build on an existing yet flexible and easily expandable basic framework for the machine application and achieve the modularization of machine functions and standardization of interfaces. Ultimately, this reduces the time required, cost, and complexity of software engineering.

Pre-tested and documented software modules lead to better quality and optimized resource management. You can easily reuse, expand, and maintain them – efficiently, reliably, and safely. Furthermore, standards such as PLCopen ensure the open nature of our Lenze system.





## Optimized overall solution

- Mast oscillation compensation
- Brake Grind-in function and brake test
- Auto tuning
- Cloud access
- Platform for future topic such as condition monitoring and predictive maintenance





### Intelligent

Easy engineering by means of a centralized control architecture and a ready-made Lenze FAST machine solution:

- Easy project planning
- Shorter development times
- Optimized system performance
- Ready-made and proven solutions for the specific challenges of storage and retrieval units



### Dynamic

Optimized system performance thanks to state-of-the-art control technology:

- Mast oscillation compensation
- Load balancing for systems with two traveling drives



### Efficient

Intelligent energy management with two concepts that also win over system operators:

- Energy recovery
- Energy storage (Supercaps)



### Safe

Integrated safety technology protects people and equipment while increasing performance:

- SLS (Safely-Limited Speed)
- PDSS (Position-Dependent Safe Speed)
- SLP (Safely-Limited Position) – monitors the approach direction of the load handling device
- SBC (Safe Brake Control)



### Innovative

Solid foundation for the future of your system with reduced downtimes and servicing costs

e.g., thanks to:

- Remote access
- Condition monitoring
- Transparency of overall equipment effectiveness (OEE)





## Experience pays off

- Shorter development times
- Load balancing
- Condition monitoring
- Energy storage (Supercaps)
- PDSS (Position-Dependent Safe Speed)





# Centralized control architecture

**One motion controller for all the motion functions of your storage and retrieval unit (SRU) provides the most suitable topology.**

### Logic at a glance

- SRU drive control is managed entirely in the controller
- All data is stored on replaceable SD cards

### Quick and easy commissioning

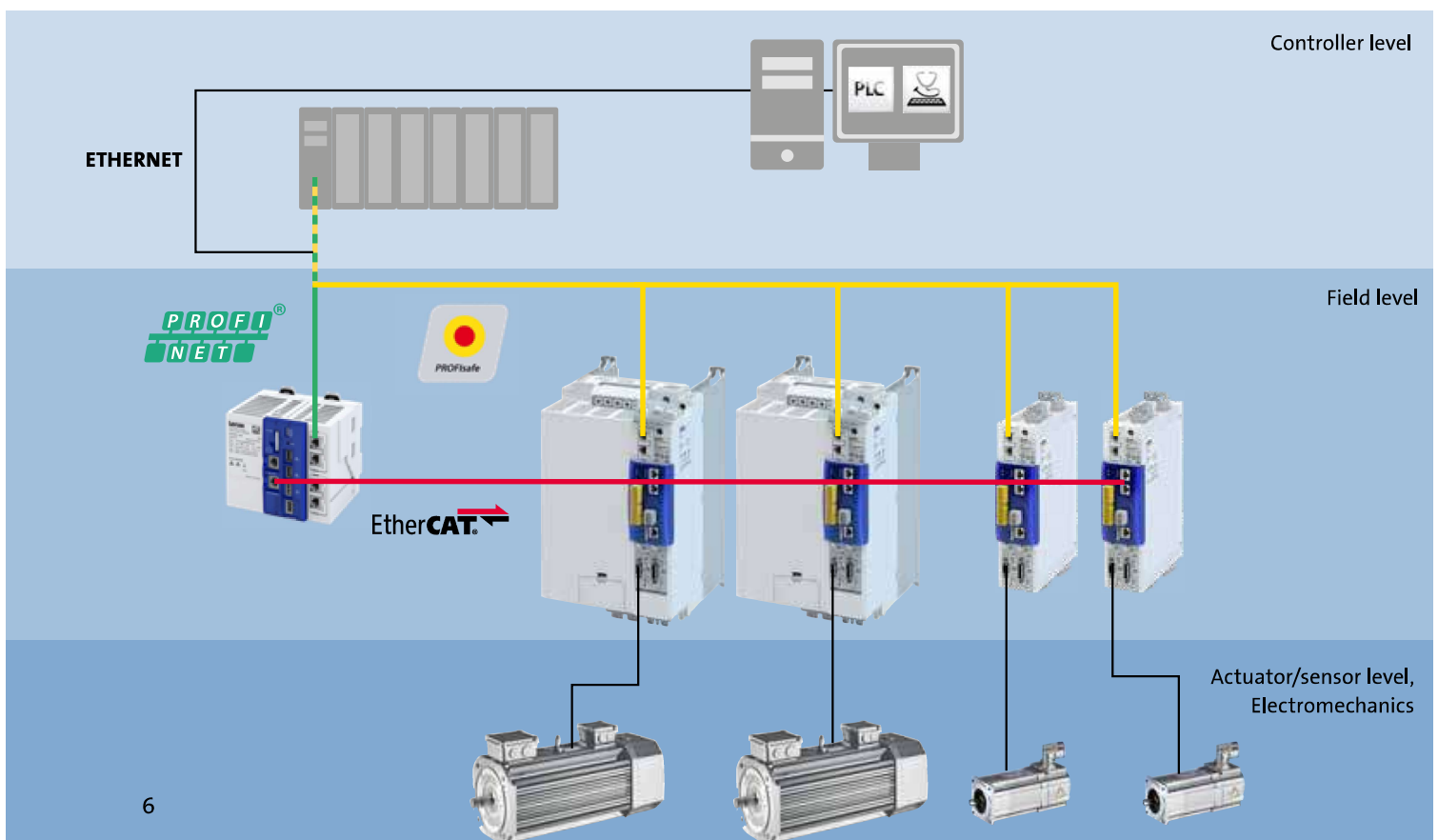
- Parameterization instead of programming
- Graphical user interface (GUI)

### Concise topology

- Easy replacement of the drive controller
- No lateral data traffic between the servo inverters

### Easy diagnostics

- The entire control system and safety of all drives in a single software project
- Simultaneous display of the oscilloscope signals of the entire storage and retrieval unit



# Lenze FAST machine solution for storage and retrieval units

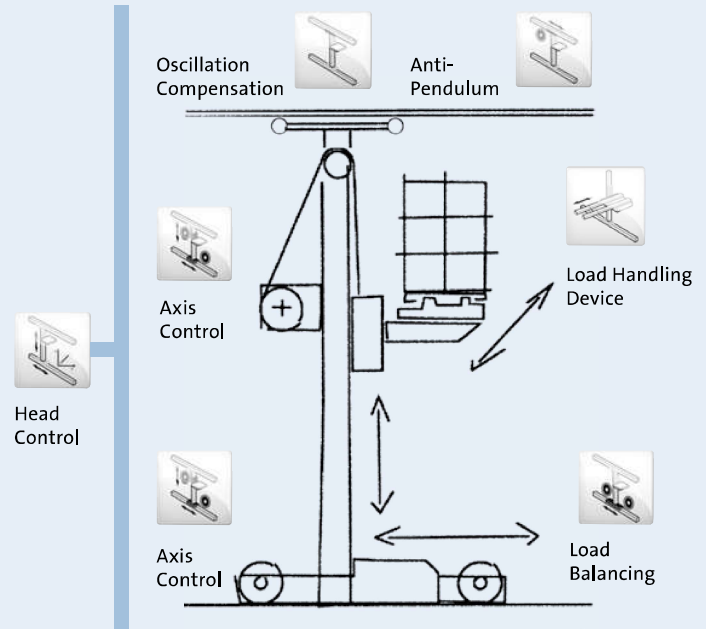
The Lenze FAST machine solution for storage and retrieval units is a ready-made PLC project for automation technology from Lenze, into which all ready-made drive concepts have already been integrated. Selection of the required components and adjustments is performed via simple parameterization.

We made it possible to execute the most important control commands independently of the higher-level controller by means of a graphical user interface which simplifies the commissioning. The open IEC 61131 environment also makes it possible to integrate your specific know-how or additional functions.

Auto tuning allows for further simplification during commissioning by automatically calibrating all drive parameters, leading to optimum, dynamic control performance. This applies to all components in the carriage and lifting unit.



## FAST Technology Modules





# Higher throughput, standards-compliant safety concepts

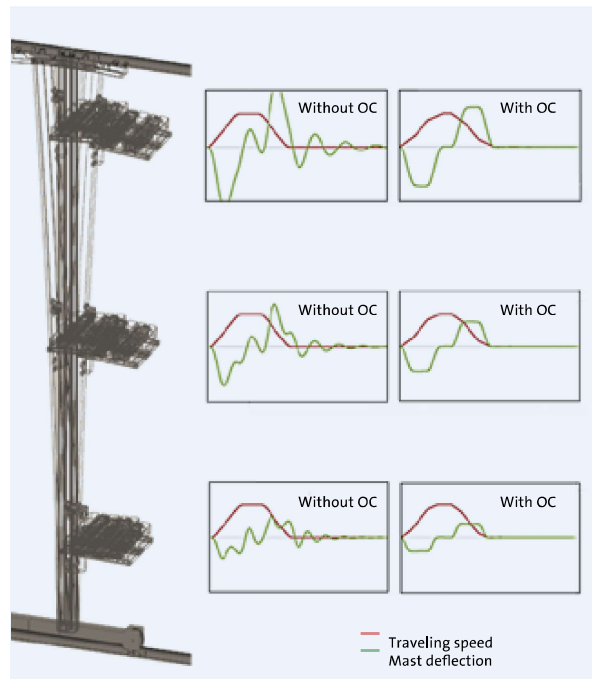
## Oscillation compensation reduces mast oscillations

The ready-to-use **Oscillation Compensation** software module integrated into the **Lenze FAST machine solution for storage and retrieval units** can significantly reduce mast oscillations. This increases the cost-effectiveness of the warehouse.

- System performance increases considerably
- Cycle times are significantly shortened
- More double cycles per hour can be carried out
- The mechanical alternating load and material fatigue of the mast are significantly reduced

This solution can be used with hoist, traveling, and telescopic drives. The height of the load handling device and hence the variable oscillation frequency of the mast are dynamically taken into account.

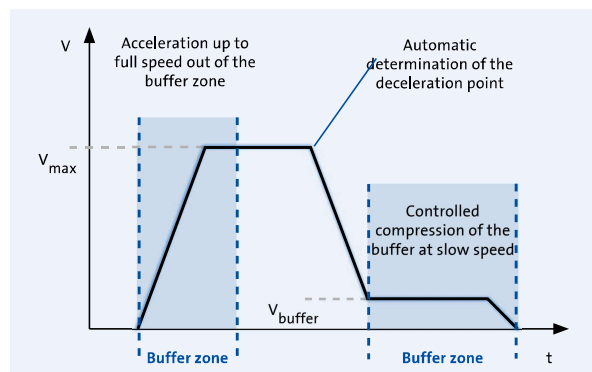
The **Oscillation Compensation** software module can be used both with pallet- and with Miniload-SRUs.



## Buffer travel with limited speed increases storage capacity

**Controlled compression of the buffer allows the buffer zone to be used as a racking area.**

- This allows the entire aisle length to be used which increases the storage capacity
- Acceleration to full speed when decompressing the buffer saves time
- The position for deceleration to the permissible buffer compression speed is determined automatically





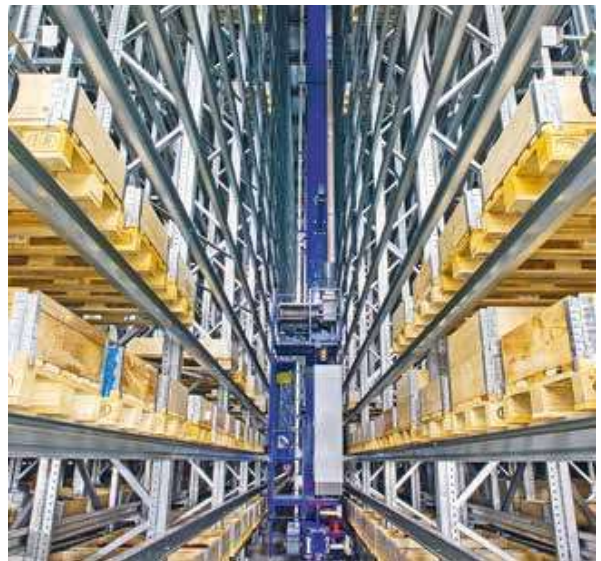
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## Load balancing increases performance and reduces cycle times

The challenge for pallet SRUs with two traveling drives lies in the mast tilting moment during acceleration and/or deceleration of the pallet SRU. The drives are mutually relieved so that the required drive force might not be fully transmitted to the rail (development of slip). Due to that, the pallet SRU may be unable to achieve the specified acceleration under all load conditions.

Our solution to this is the **Load Balancing** software module, which is also integrated into the **Lenze FAST machine solution for storage and retrieval units**:

- The drive of the relieved wheel only provides just enough torque such that no wear-inducing wheel slip occurs
- The resulting torque difference is transferred to the other engaged wheel
- At standstill, no tension due to torque differences occurs between the drive wheels
- Manufacturing tolerances in the running wheels (which are unavoidable) are automatically compensated for



With this concept, shorter cycle times and higher performance can be achieved with the right drive sizing compared to the “two motors on one inverter” concept.

## Power failure control ensures system availability

**Controlled shutdown of the drives in the event of a power failure by utilizing the kinetic energy without the immediate application of the brake offers significant advantages:**

- Less wear to the system thanks to reduced mechanical stress compared to emergency stop with mechanical brake
- Increased system availability, particularly in countries with unstable grids
- Less maintenance required for brakes and drive wheels



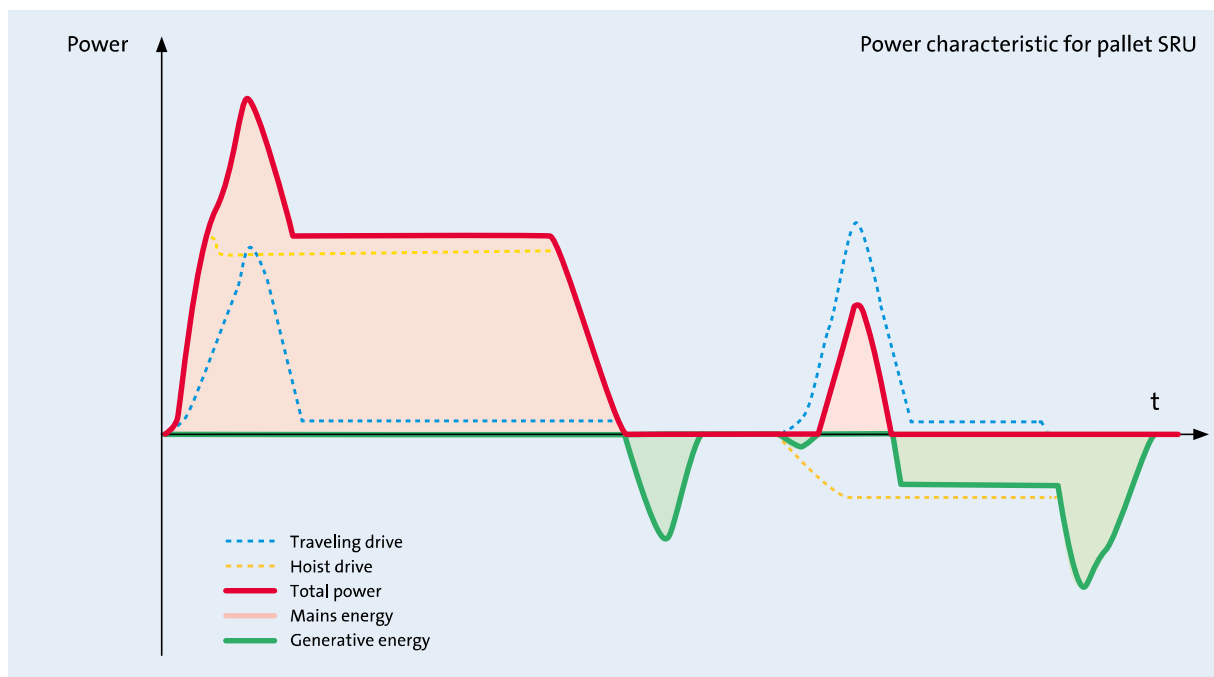
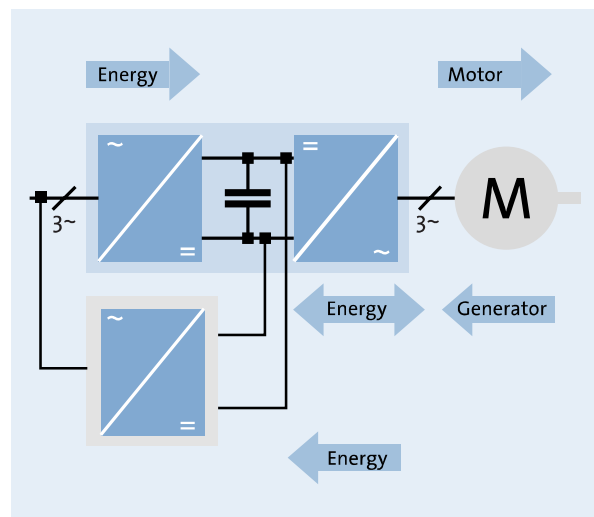


# Intelligent concepts for cost efficiency

## Regenerative module for the recovery of regenerative energy

### Lower costs, but more options:

- Innovative technology enables significantly smaller and lighter designs with integrated filters and chokes
- Dedicated power recovery function
- Depending on the type of SRU (box or pallet), up to 25% or more energy can be saved compared to operation with brake resistor
- Extremely straightforward commissioning, no parameterization, no bus, no tools
- Connection of additional brake resistors to the inverter to cover low-energy power peaks and power failure situations
- Power can easily be increased by connecting regenerative modules in parallel

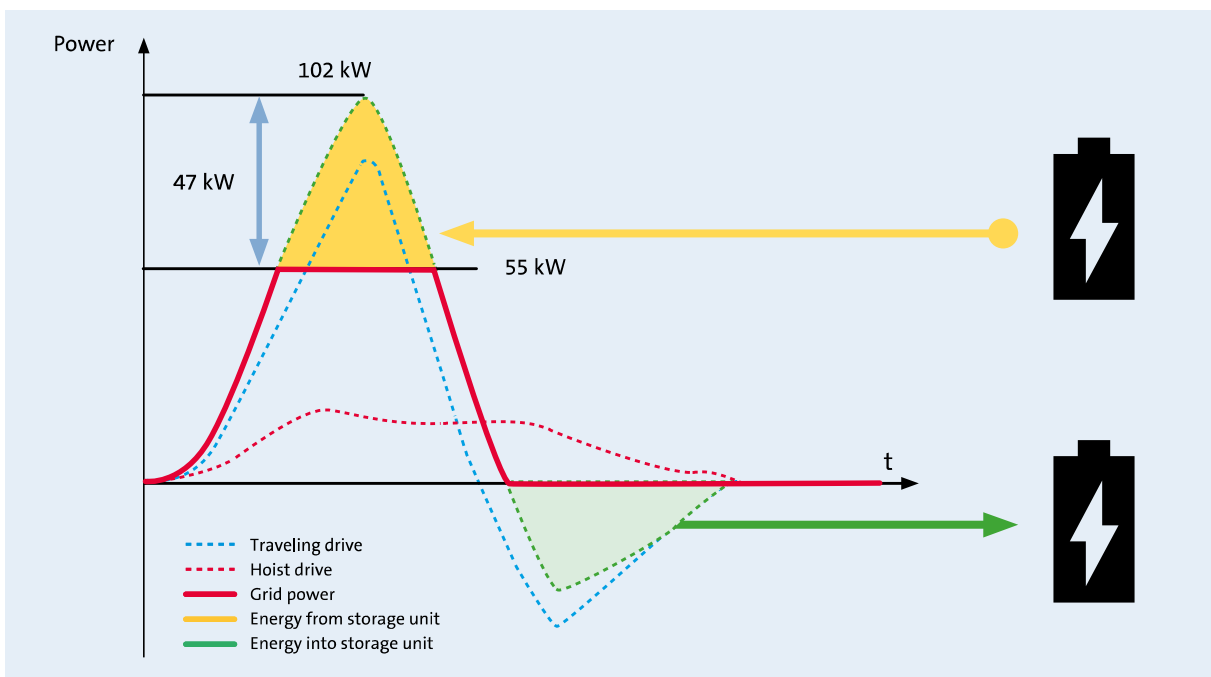




## Reasonable reduction of power peaks by means of energy storage

One goal for increasing economic efficiency is reducing load peaks during the simultaneous acceleration of traveling and hoist drive. The energy storage unit stores the regenerated energy during braking of the traveling drive and lowering of the hoist drive and makes it available for the subsequent acceleration and lifting process.

- This allows power peaks to be reduced for greater economic efficiency
- The achievable power peak reduction and the size of the storage unit necessary for this purpose are determined individually for each SRU design and for specified motion profiles
- Various cost savings can be made in the periphery of the supply cable, e.g.:
  - Smaller fuses
  - Smaller transformer
  - Smaller cable cross-sections





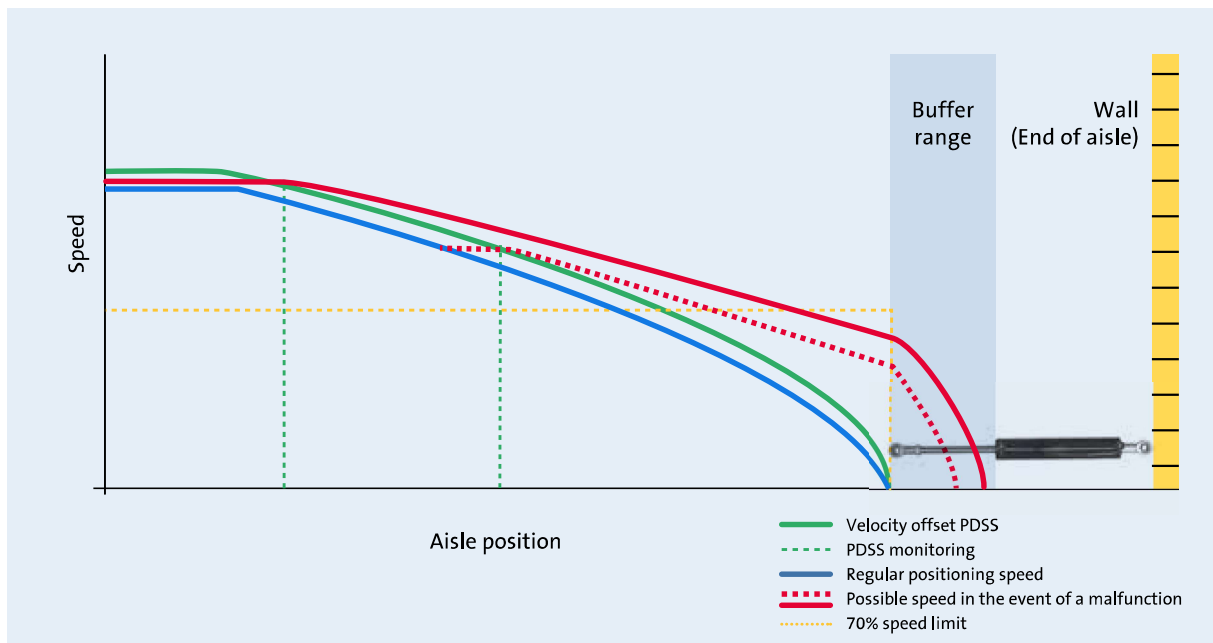
# Innovative safety features reduce costs

## 70% collision buffer

Approaching the buffer at a maximum of 70% of the maximum speed allows a 50% reduction in the buffer length. This is made possible using PDSS (Position-Dependent Safe Speed): safe, constant monitoring of the permissible speed at each position. Excessive speed is detected as soon as it occurs and mechanical braking is triggered. A safe “70% sensor” in the aisle is not required.

Another advantage compared to a conventional solution with monitoring at only one position is the lower deceleration requirement of the mechanical brake. Thus, more non-critical decelerations lead to less mechanical stress in the event of an error.

This safety technology also includes SBC (Safe Brake Control).



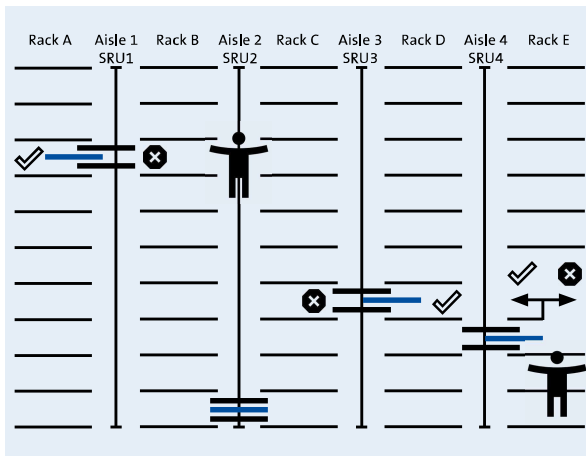
## 0% collision buffer

The PDSS function also makes it possible to eliminate collision buffers. This allows for better utilization of storage space and cost savings. The prerequisite for this is a safe, mechanical braking system in the storage and retrieval unit.



## Safe operation of the load handling device

SLP (Safely-Limited Position) is used, such as when persons are working in aisles during troubleshooting or maintenance work and adjacent aisles are not shut down. SLP prevents the telescope of the load handling device (LHD) from operating in the direction of the blocked aisle. This significantly increases system availability.

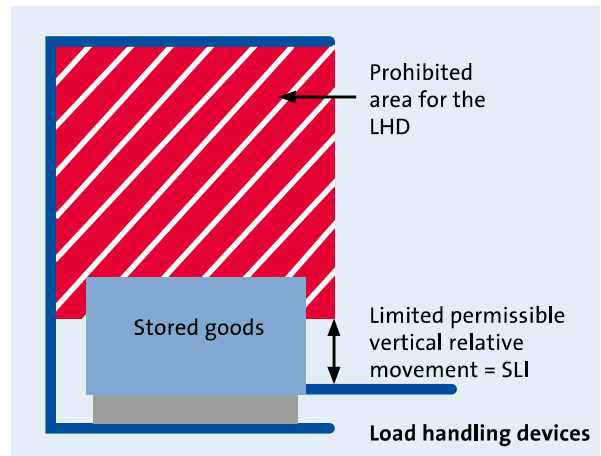


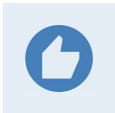
**Use case 1:** Maintenance is taking place in an aisle. The neighboring SRUs are to continue picking but are only permitted to reach into the other side. **Example:** Aisle 2 and/or SRU 2 is being serviced. SRU 1 is only permitted to reach to the left into rack A, but not into rack B. SRU 3 is only permitted to reach to the right into rack D, but not into rack C.

**Use case 2:** There are rack areas into which the machines are not permitted to reach fully. Employees may stand behind the retrieval zone (double-depth retrieval). **Example:** Aisle 4 and/or SRU 4 is permitted to reach fully into rack D on the left, but only to half the depth into rack E.

## Safe limitation of the lifting distance when the telescope is extended

This is also referred to as an extended safety feature – SLI (Safety-Limited Increment), which protects the load, the storage and retrieval unit, and the racking.





# Digitalization augments added value

The digital transformation is often seen as a far-reaching challenge. That is why we focus on interdependent modules. Working together with you, we create the foundation for data collection and evaluation, based on which we design future-proof technology in subsequent steps.

### Remote access

Remote access to your storage and retrieval units as well as components installed in the vicinity and periphery of the overall system.

### Reduced service costs

System access by centralized qualified personnel allows you to pool expertise while also reducing potentially time-consuming and cost-intensive service deployments.

### Reduced downtime

System access via various access points, including mobile devices. Your service personnel can access all notifications and logbooks for the entire system directly at the system or via remote access. This allows for rapid diagnostics and troubleshooting. Furthermore, you also receive breakdowns and overviews of unplanned system downtimes – across multiple machines and systems.

### Condition monitoring

Customized display interfaces (dashboards) for the needs-based visualization of component states (operating times, temperatures, current consumption).

### Improved availability and value creation

Transparency for the Overall Equipment Effectiveness (OEE) of individual or networked equipment. Compare performance features at the press of a button – not just on a per-aisle basis, but also overall across distribution centers.

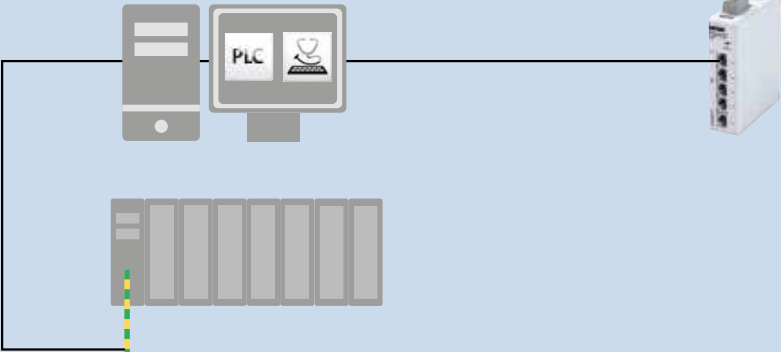






Controller level

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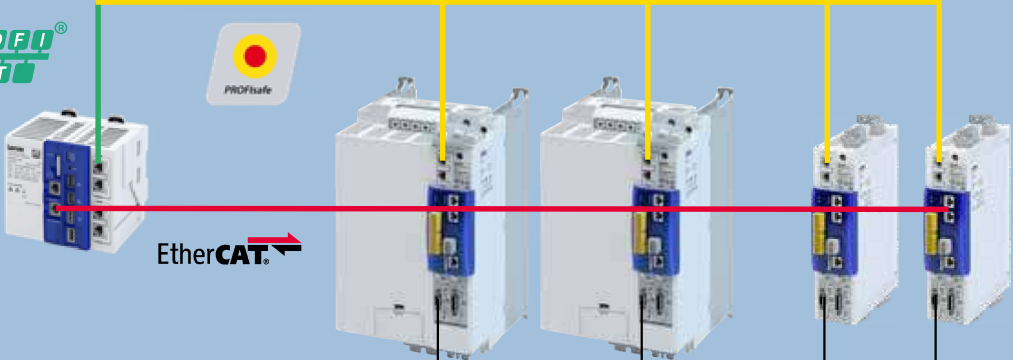


Field level

PROFI<sup>®</sup>  
NET



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Actuator/sensor level,  
Electromechanics

