

Next generation Kalmar ASC system

Ready to run.



Kalmar offers the widest range of cargo handling solutions and services to ports, terminals, distribution centres and to heavy industry. Kalmar is the industry forerunner in terminal automation and in energy efficient container handling, with one in four container movements around the globe being handled by a Kalmar solution. Through its extensive product portfolio, global service network and ability to enable a seamless integration of different terminal processes, Kalmar improves the efficiency of every move. www.kalmarglobal.com

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Be prepared, the future is here.

Your challenge can be summed up in a few words: more container traffic, less time, less space. Add the need to handle ever-larger vessels, increase safety, reduce costs and eliminate risks and mistakes, and you will find that automation is the answer. Consultation and planning together with us at Kalmar Terminal Development will prepare you for the future.

With shipping lines expecting faster and more predictable turnover times, the demands on your terminal just keep mounting. We know

that saving your time and resources is extremely valuable. Just a few seconds off every container move means big increases in productivity year on year.

That is why we are integrating ever more automation, using our advanced field-proven solutions to answer your demands. Our global experience is at your service in optimising terminal performance and realising the value of your automation investment faster. With Kalmar, you are ready for tomorrow, today.

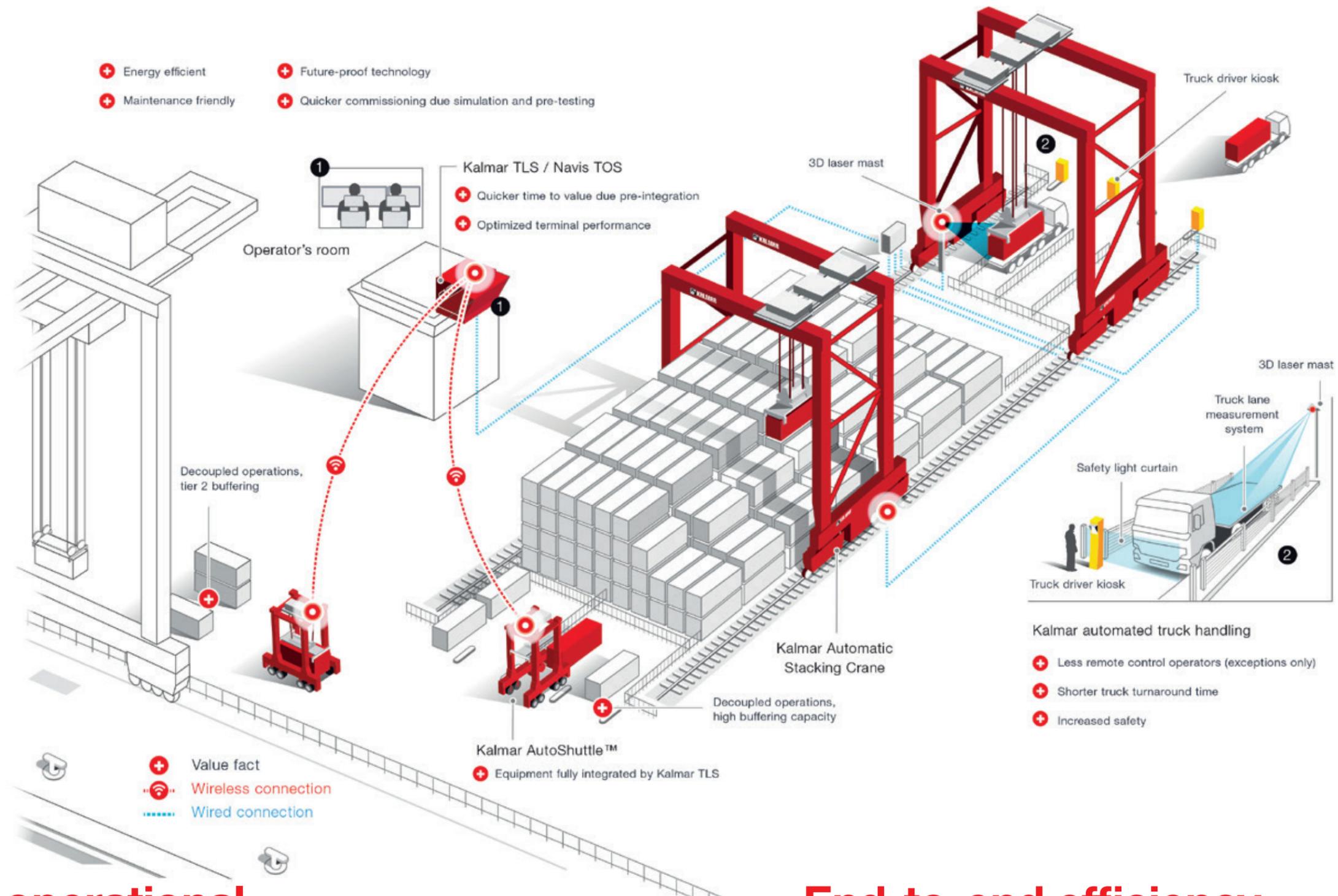
Improve your productivity.

Consistently high throughput, predictable and reliable performance 24/7, less need for personnel, no lost containers, higher stacking density and improved safety – the Kalmar ASC system brings tremendous advantages to your container terminal.

In 1990, Kalmar was the first company to introduce ASCs, at the ECT Delta Terminal in Rotterdam, the Netherlands. Today, our portfolio already includes six ASC terminal projects around the world. We are unique in realising end-to-end efficiency through integrated automation solutions in landside

and waterside operations, complete with automated truck handling and Kalmar Auto Shuttles™. We ensure optimum efficiency for your every move.

Automating a greenfield terminal is what often comes to mind when discussing automated terminals. However, existing terminals can also be automated partially or wholly to achieve the benefits of automation. The transition to automation can be carried out step-by-step to maintain capacity throughout the conversion, or by expanding a terminal into a previously unused area.



Fully operational before even breaking ground.

The next-generation Kalmar ASC system will give your business an outstanding advantage, as we can now fully simulate and optimise your automated operations before actual deployment on site.

From the quay to the stack and beyond, all equipment and solutions are pre-integrated

and tested at Kalmar's Competence Centre in Tampere, Finland, to ensure that they work together seamlessly. Testing and simulation in a highly precise virtual environment enable a significantly shorter time to realising the value of your automation investment, while minimising integration risks.

End-to-end efficiency.

Our unique end-to-end automation system encompasses our latest-generation ASC system as well as automated truck handling and AutoShuttles, all integrated with our in-house terminal logistic system (Kalmar TLS) and the industry-leading Navis TOS. This enables smooth and fast automation deployment and ensures that your terminal delivers high throughput as well as predictable and reliable performance around the clock,

every day of the year. Product innovations and upgrades will continue to improve efficiency for years to come.

Kalmar Care support will ensure that the value of your investment is maintained and equipment performance is optimised throughout the system's lifespan. All because we know that your every move counts!



Kalmar 5th generation ASC

More efficient, easier to maintain.

At the heart of the Kalmar ASC system is our 5th generation automatic stacking crane, the most efficient and productive ever. An optimised lightweight structure decreases energy consumption, brings savings in operational costs, and reduces yard infrastructure costs for crane rails.

The crane features a redesigned machinery trolley with Max Stable type stiff rope reeving. The rope tower is more compact than before, but still maintains optimum stiffness for fast and accurate automated operation with easier rope replacement and adjustment procedures. Maintenance access, ergonomics and usability have been greatly improved with a single-platform machinery trolley, a segregated transformer-house and a more spacious e-house.

Future-proof technology

The new Kalmar ASC is built around PROFINET, the standard for time-critical industrial Ethernet. This reduces the number of components and the amount of cabling required. The greater reliability of latest-generation network technology ultimately boosts the productivity of the entire crane system.

Energy savings and reliability are further enhanced by new AC drives that control IE2 class motors. State-of-the-art drives also ensure spare-part availability throughout the future life cycle of the system.

Kalmar TLS

Intelligent logistics.

The ASC system features a redundant, scalable automation network, built-in remote control operations and Kalmar TLS software. Kalmar TLS is the key to realising the full potential of your automation. It ensures that your automated equipment and terminal operating system work with optimal efficiency, while accommodating the exceptions typical of your operations.

Kalmar TLS handles the planning, routing and execution of automated operations. As the most flexible and widely adopted equipment control system, it interfaces with any type of system, ensuring that your operations are managed with a single platform. Our TLS system is fully pre-integrated off-site with our equipment, which means that much less time is needed for routine tests when deploying the system on-site.



Automated truck handling **Best in class.**

The landside automation module ensures the safe and efficient handling of all transport systems, with continuous high productivity maintained by Kalmar automated truck handling. Our truck handling technology is based on measurements taken by lasers as the crane approaches the truck. This system reduces the need for manual work and shortens truck turnaround times. Operator intervention is only required for exception handling. Safety is also improved, resulting in minimum accidents, fewer damaged containers, and lower insurance costs and workers' compensation.

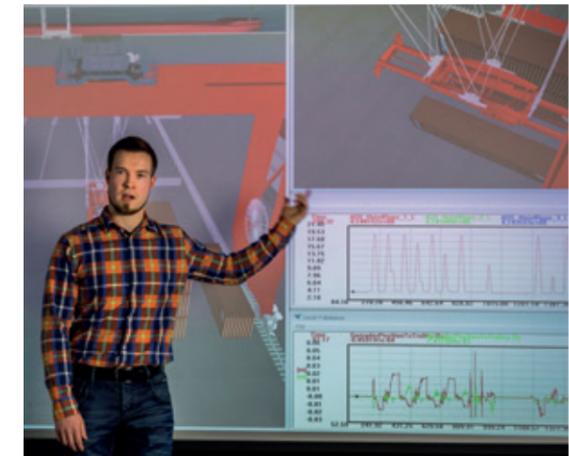


Kalmar AutoShuttle™ **Maximum productivity.**

Fully automated waterside operation can be realised with Kalmar AutoShuttles, allowing several vehicles to operate simultaneously in the interchange area. AutoShuttles can be interfaced safely, reliably and efficiently with other terminal systems using Kalmar TLS control and monitoring functionality. Kalmar AutoShuttle provides the highest

terminal productivity of all automated horizontal transport systems. Furthermore, based on their ability to pick and place containers on the ground, both manned and automated shuttle carriers allow the interchange area to be used for additional storage during operational peaks.





World-leading test facility.

Kalmar has invested in a new port automation testing and development platform at its Technology and Competence Centre in Tampere, Finland. This investment includes the world's largest automation test field, as well as facilities and laboratories for prototyping, simulation, testing, monitoring and optimisation. Software and equipment at customer sites around the world can be monitored or used in pre-integration testing 24/7, via a remote connection.

With the latest investment to be finalised by 2016, Kalmar will have a complete end-to-end automation system in Tampere, including shuttle carriers for horizontal transportation, an ASC system for yard operations, and automated truck handling for landside operations, all integrated with Kalmar TLS and Navis N4 software.

Faster deployment based on simulation and testing

Automation projects have traditionally required extensive and time-consuming testing at the terminal after equipment delivery, which has a major impact on implementation time and cost.

Kalmar is the world leader in advanced simulation and emulation for container terminals. With Kalmar's unique automation test facility, testing can begin well in advance of deployment, and on-site testing can be minimised. This results in faster implementation and the shortest possible time to value.

The automation project begins with a productivity simulation at terminal level to define and optimise end-to-end efficiency from gate functions to the yard, as well as for horizontal transport systems in both land and waterside areas. A more detailed operational analysis comes later, during project execution, in order to define the actual

business scenarios for the terminal. These are then validated thoroughly on a system and integration test platform, using emulated TOS and TLS control software.

Fully pre-integrated TLS software can cut the core system integration time by at least 20%. In the final integration phase, interfacing with third-party systems is significantly faster when using the industry-leading Navis TOS.

System simulator engineering

A key component in realising the benefits of off-site testing is Kalmar's ASC system simulator, which includes multibody dynamic simulation software for real-time modelling and 3D visualisation of the ASC and its container block. The system runs actual TLS software configured with real block data, including the parameters of the container stack and interchange area. Because the simulator is driven by the crane control software (PLC code) belonging to the delivery project, it provides a highly accurate model of

the ASC. Deployment risks and time to value are significantly decreased, as any issues involving, say, stack layouts can be spotted well before physical installation work on site.

Simulation and pretesting bring major benefits in every phase of the project. Simulating existing terminal facilities in a detailed virtual environment enables faster and more accurate completion of the building stage. This also shortens commission times by up to 30%.

The ASC system simulator is also used when developing new features, as well as in problem solving and site support for existing deliveries. It improves cooperation between mechanical, electrical, PLC and automation disciplines, enabling a holistic design optimum. This results in a better product, a shorter production ramp-up time, a faster solution of technical issues and smooth product upgrades.

Ready for tomorrow, today.

The latest innovations in terminal design include decoupling container handovers and creating terminal layouts that combine the best of multiple container handling technologies. Such innovations are making the benefits of automation increasingly accessible for terminals of all sizes.

The most recent project is **VICT** (Victoria International Container Terminal) in Melbourne, Australia, which included the widest-ranging

automation ever delivered by Kalmar. The delivery scope of the related phased development will reach a total capacity of 1.4M TEU, with operations beginning by the end of 2016. The deployment includes the Kalmar ASC system, AutoShuttles™, automated truck handling, TLS software and the Navis TOS. In addition, Kalmar is supporting the terminal integration process with professional services.



ASCs and AutoShuttle™.

The automated Kalmar shuttle carrier is the ideal complement to the automatic stacking crane. This combination of ASCs and automated shuttle carriers provides high stacking density, immediate transfers and decoupling of quay and yard crane working cycles.

Two of the most recent automated terminals to come online are based on a combination of ASCs and shuttle carriers. Although the shuttle carriers at both terminals are manually driven, Kalmar shuttle carrier fleets can also be easily prepared for future automation.

DP World London Gateway is a greenfield development featuring 40 Kalmar automatic stacking cranes, 28 Kalmar shuttle carriers, the Kalmar TLS equipment control system and the Navis N4 terminal operating system.

The automated truck handling option for Kalmar ASCs feeds containers onto road trucks and cassettes operated by terminal tractors.

In March 2015, Kalmar announced a major repeat automation contract with DP World London Gateway for the delivery of an additional system of 20 automatic stacking cranes, as the port continues its successful expansion with an investment in a third berth.

As an existing terminal, **DP World Brisbane** converted to ASCs and shuttle carriers from reachstacker operations. Kalmar delivered an integrated solution including 14 ASCs with an automated truck handling option, 14 shuttle carriers, the TLS equipment control system and the Navis N4 terminal operating system.



ASCs and automated straddle carriers.

In addition to its ability to transport and stack containers, the straddle carrier can work in combination with automatic stacking cranes. Kalmar has realised terminals that combine ASCs with both manned and automated straddle carrier operations.

The automated straddle carriers at **TraPac**, Los Angeles, feed ASC stack blocks as well as a dedicated straddle stack. Kalmar equipped the terminal with 27 Kalmar ASCs, 28 Kalmar automated straddle carriers and the Kalmar TLS equipment control system.

All of the ASCs are fitted with automated truck handling for landside operations.

The HHLA Container Terminal Burchardkai (**CTB**) at Hamburg was the first large-scale brownfield conversion to ASCs. This terminal was gradually converted from straddle carriers to automatic stacking cranes, ultimately doubling the terminal's capacity. The project formed the basis for a complete Kalmar ASC system development based on a unique three-crane nested design

Decades of experience.

The most traditional horizontal transportation solution for ASCs is automated guided vehicles. Kalmar's very first automated terminal, **ECT Delta**, is based on this operational concept. Up and running since 1993, the terminal became the blueprint for the industry, with similar systems realised

at several other locations around the world. Kalmar has replaced 11 older 2-high stacking cranes at ECT Delta with 1-over-5 ASCs, ensuring the optimisation of both capacity and performance based on the single-crane block concept.



Kalmar Care for automation.

Kalmar is dedicated to optimise the value of your terminal equipment throughout its lifetime. Maintaining an automated terminal is a whole new game – and we are the most experienced player in the field.

Fast track to commercial operations

Kalmar Care start-up services are designed to streamline the commercial operations start-up phase. Our expertise has been proved in real life cases, helping you to reach the planned throughput even months earlier. In the heart of the service is our core team. Your maintenance management is set up faster, required competencies are at hand from day one, and your maintenance personnel trained by experienced professionals. For example, our experts will plan and implement CMMS,

including asset structures and maintenance programs. They will also help in training and recruiting technicians, and support your operators in their daily work during the early steps of your operations.

Making sure your business never stops

Kalmar Optimal Care contract provides guaranteed availability of your equipment or terminal, as well as financial predictability, over a longer term partnership. If you selected Kalmar start-up services, the same core team will continue to support you 24/7, optimising the value of your terminal. With Kalmar Optimal Care, you can reach even 10% savings in operational costs through for example our spare parts management and other optimisation services.

Kalmar OneTerminal

Optimise your performance every day.

Kalmar OneTerminal provides an integrated automation solution, delivered by a single team, which brings together Kalmar and Navis software systems, equipment and services for seamless deployment.

Whether automating a greenfield or existing site, the Kalmar OneTerminal will help you to realise your investments faster and ensure that your terminal performance is optimised for both today and tomorrow. You can expect dedicated operational support, combined with Kalmar's superior service, throughout the lifespan of your terminal.

Based on a unique integrated combination of the Navis N4 and Kalmar's equipment control system TLS, Kalmar OneTerminal provides a complete automation solution for container terminals, based on three initial concepts for ASC, AutoStrad and AutoRTG terminals. It also ensures that all automation systems combine optimally, giving you the shortest possible time to realisation and providing outstanding efficiency from day one.

With one key contact, one core team, Kalmar OneTerminal makes automation accessible, mitigates the risks involved and enables you to realise the full potential of your terminal operations.