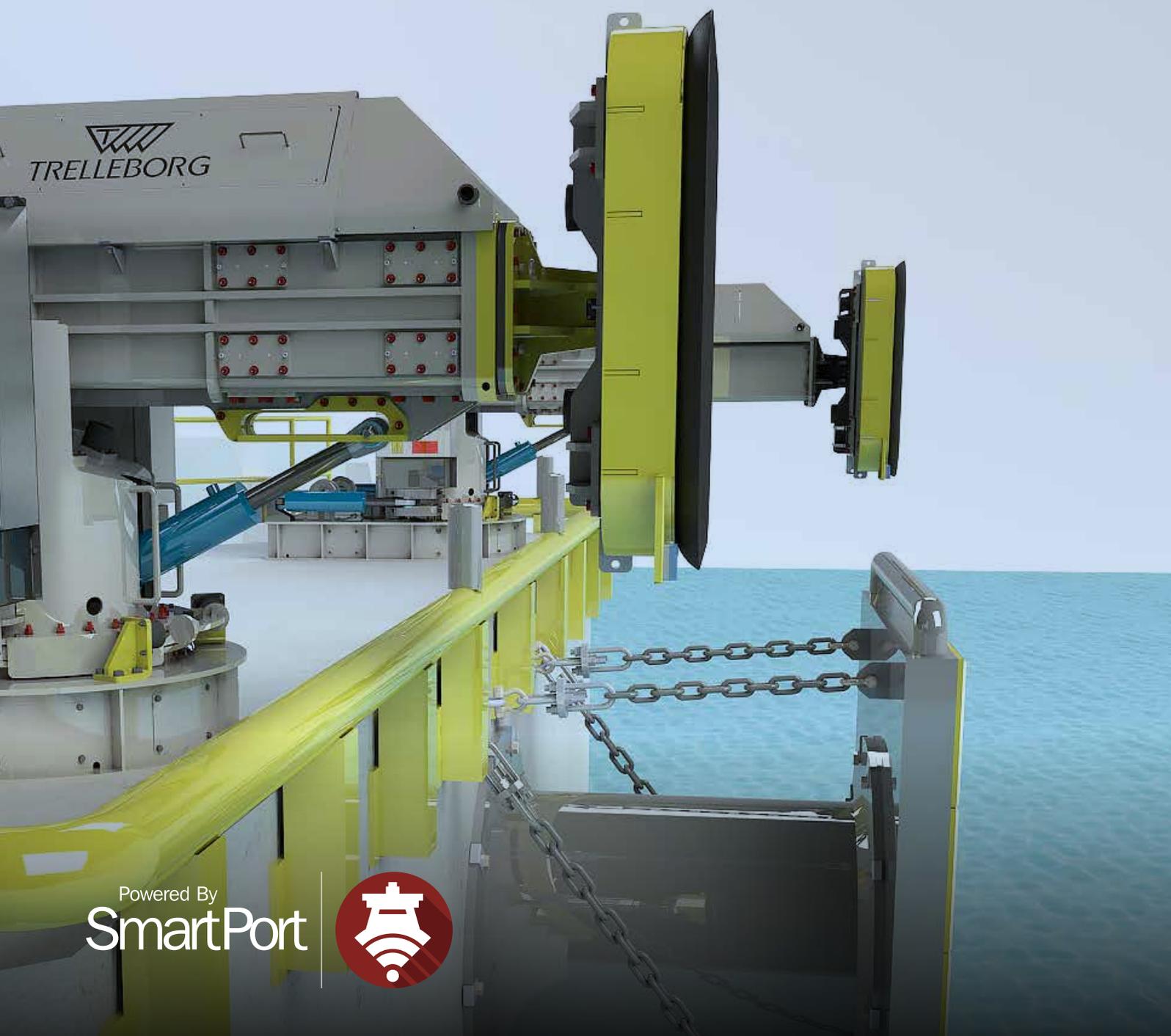


AutoMoor

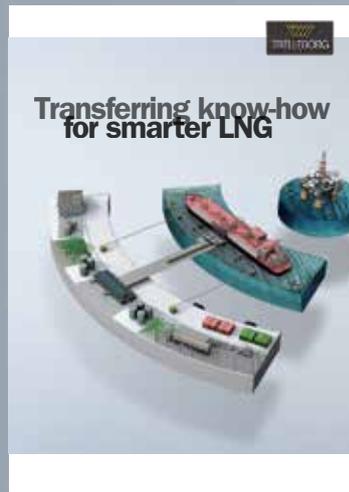
A LEAN REVOLUTION IN DOCKING AND MOORING



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SmartPort



The Smarter Approach



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The demanding nature of commercial ports and terminals means you need partnership that provides much more than technically superior products and technologies. You need to work with a partner that combines best practice expertise gained through worldwide experience with a deep understanding of local requirements and regulations. At Trelleborg, we call this the Smarter Approach.

Our Smarter Approach combines global reach with feet-on-the-ground local presence, delivering solutions that continually enhance your operations.

Smart technologies are at the forefront of improving operational efficiencies. Trelleborg's innovative SmartPort offering deploys the latest in marine technology applications to help ports and terminals optimize their operations.

Connect with a partner that combines smart solutions, proven product capability and industry expertise to maintain and enhance port and vessel performance.

Take a Smarter Approach, with Trelleborg Marine Systems.

Docking and Mooring Systems

When installing or upgrading Docking & Mooring Systems, you need to ensure you choose the right partner. Ensure your provider can deliver the solution for you, on time and on budget, wherever you are in the world.

Ensure your solution is designed around the needs of you and your customers, with a dedicated team that has the experience to understand them.

Ensure your Docking & Mooring Systems feature technically superior products to maximize durability and reliability, whilst minimizing downtime and whole life costs.

Ensure your partner can offer you the maintenance and aftersales service you need.

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A Smarter Approach at every stage

A smarter approach to...

CONSULTATION

Consultation from the earliest project phase to ensure the optimum fender systems and marine technology solutions are specified, with full technical support from our global offices.

CONCEPT

Conceptual design in your local office – with full knowledge of local standards and regulations, delivered in your language – for optimized port and vessel solutions.

DESIGN

Concepts are taken to our Engineering Center of Excellence in India where our team generates 3D CAD designs, application-engineering drawings, a bill of materials, finite engineering analysis and calculations for both our fender systems and marine technology solutions.

MANUFACTURE

Our entire product range is manufactured in-house, meaning we have full control over the design and quality of everything we produce. Our strategically located, state-of-the-art facilities ensure our global, industry leading manufacturing capability.



TESTING

Across our entire product range, stringent testing comes as standard at every step in our in-house manufacturing process. We ensure that lifecycle and performance of our entire product range meets your specifications, and more.



INSTALLATION

Dedicated project management, from solution design right the way through to onsite installation support. We design products and solutions that always consider ease of installation and future maintenance requirements.



SUPPORT

Local support on a truly global scale, with customer support teams all over the world. And this service doesn't stop after a product is installed. You have our full support throughout the entire lifetime of your project, including customized training programs, maintenance and onsite service and support.



THE FUTURE

Deploying the latest in smart technologies to enable fully-automated, data-driven decision making that optimizes port and terminal efficiency. At Trelleborg, we're constantly evolving to provide the digital infrastructure our industry increasingly needs.



When you choose Trelleborg you ensure your expectations will be met, because we deliver a truly end-to-end service – retaining vigilance and full control at every stage.

A Smarter Approach to docking & mooring



The marine industry is in a time of transition and change. We must constantly adapt and innovate to ensure efficient, safe solutions in an increasingly demanding environment.

Docking and mooring has a critical role to play in optimizing the efficiency of both the berth and the overall port facility. Process refinement is key. That's why, at Trelleborg, we have rethought our approach,

introducing a new concept we call lean mooring. The lean mooring philosophy aims to transform berthing strategies and deliver superior efficiency in operations.

A lean mooring approach enables greater control of the operational window, optimizes berth utilization, lowers resource and space requirements and demands less time and infrastructure investment to increase berthing capacity.

Get the advantage of automated mooring

Many ports and terminals are looking towards automated technologies to cope with increased demand and compete effectively in today's complex, global landscape.

The benefits of terminal automation lie in increased reliability, safety and efficiency both in scheduling and throughput. With 45% of all container vessels currently delayed by over eight hours upon arrival, there is an immediate need to raise port efficiency.

Reducing human error is another significant benefit. Data-driven technologies provide robust, accurate information that removes the element of 'best guessing' and replaces it with accurate, real-time decision making.

Safety is one of the key principles that define port operations across the world. Implementing technological advances, such as automated mooring, can enhance the safety of port procedures by minimizing personnel involvement during berthing operations and eliminating snapback.

Automated mooring technologies also minimize downtime by reducing the issue of passing ship movements. When using mooring lines, operators may need to interrupt operations, costing time and money in delayed transfer. Using an automated mooring system to dampen vessel motions and extend the range of conditions in which efficient transfer can take place can have huge implications for efficiency: in some cases, berths experience 15 – 20% downtime due to MetOcean conditions, if this can be reduced down to 10% that means a potential revenue increase of the same.

Not only is mooring time reduced, the window of operation at the berth is increased, meaning more vessel throughput, less time required to transfer the product and, ultimately, an optimized facility.

In summary, automating the mooring process has an important role to play in optimizing the vessel turnaround process and improving port safety and efficiency.





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**Trelleborg's AutoMoor
is suitable for use in
different sectors of
the port industry.**



Introducing AutoMoor

AutoMoor is Trelleborg's rope-free, automated mooring system designed to make your berthing operations smarter, safer and more competitive.

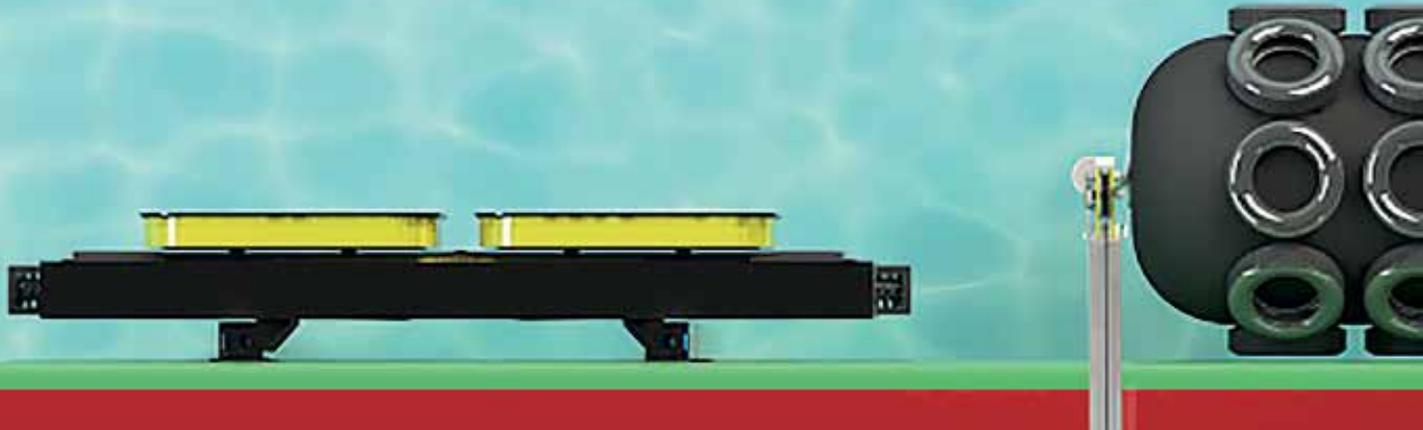
AutoMoor units eliminate mooring lines and are specifically designed to improve operational efficiency and enhance safety levels. Combining new vacuum pad and passive damping technology to rapidly attach to and secure a vessel at berth, the units are suitable for a range of environmental and berthing conditions.

AutoMoor uses SmartPort technology to connect assets and to continuously monitor all mooring loads acting on the vessel at berth, it also provides live data to the operator to optimize day-to-day port and terminal operations.

The AutoMoor T-series consists of the T20 Single Pad Unit and the T40 Double Pad Unit (for larger vessels). Both are designed to secure vessels quickly and efficiently and are available in Hazardous and non-Hazardous specification.

Quality by design

AutoMoor is an engineered mooring solution, adopting the latest computer-aided design, finite element and hydrodynamic analysis technologies. It complies with numerous international engineering standards while production is carried out by qualified technicians using components supplied by Trelleborg-owned factories or Trelleborg-approved supply chain partners.



The benefits of AutoMoor

IMPROVES EFFICIENCY

- Reduces turnaround time for vessels to berth and depart, increasing port throughput. Vessels can be securely moored in under a minute, and released upon departure in less than 30 seconds.
- Dampens vessel motions by reducing peak mooring loads due to surge and sway movements. Port operations can continue safely in a greater range of environmental conditions.
- Decreased reliance on tug boats for berthing and de-berthing reduces waiting and scheduling delays.
- Decreases port emissions thanks to the reduced time taken to moor the vessel, as ship engine idling is diminished and tug vessel time at berth reduced.

MINIMIZES INFRASTRUCTURE COSTS

- Minimizes infrastructure upgrades while increasing berth capacity, by eliminating the need for wharf extensions or mooring dolphin investments for port terminal upgrades.
- Reduces the effects of passing ships in narrow waterways and the long period wave motions experienced in some ports and harbors, by damping motions of the affected vessel.
- Removes the need for breakwater infrastructure lowering port and terminal investment requirements.
- Reduces peak loads resulting in reduced civil requirements.



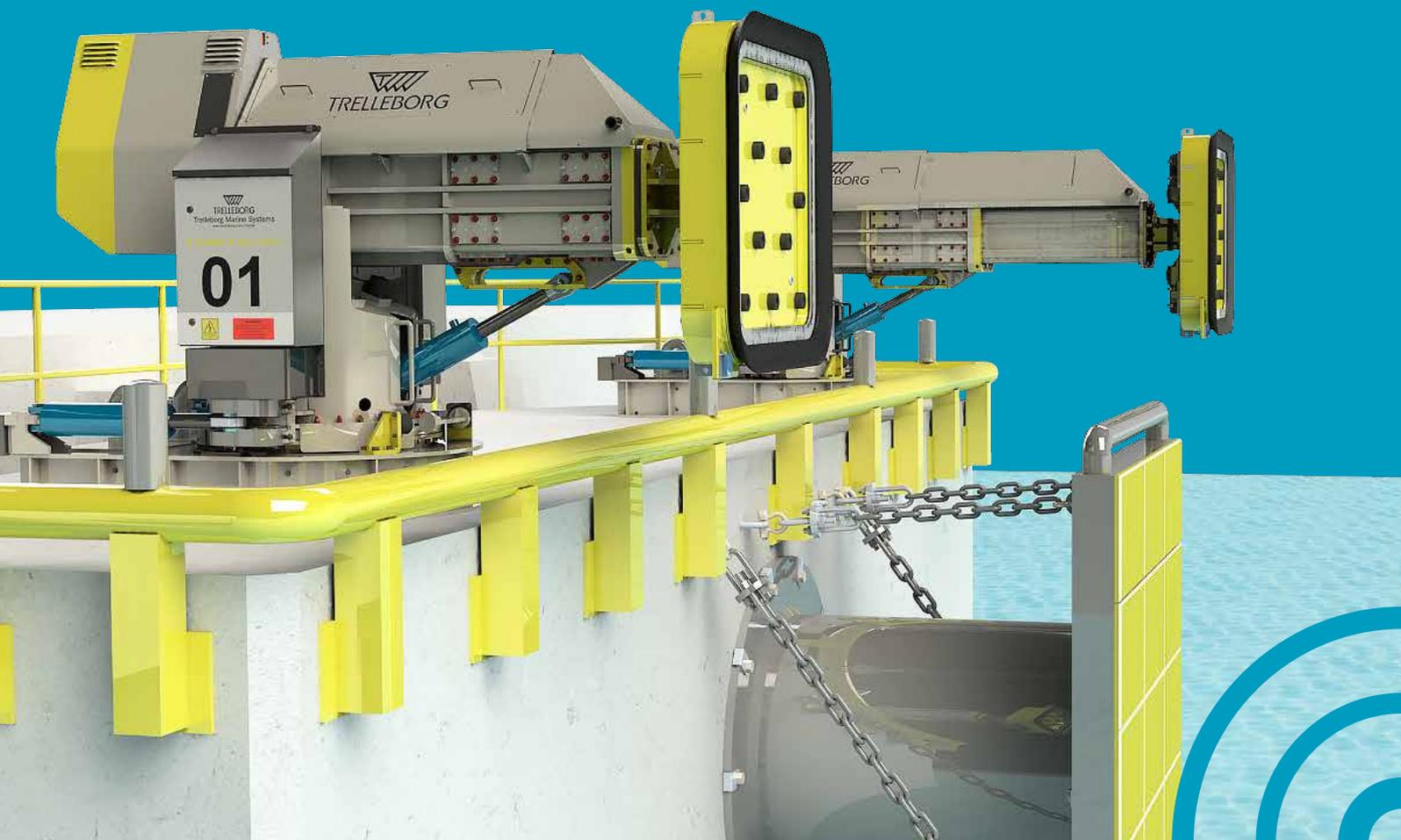
Reducing Total Cost of Ownership

AUTOMOOR REDUCES TOTAL COST OF OWNERSHIP BY:

- ▮ Improving efficiency
- ▮ Minimizing infrastructure costs
- ▮ Enhancing safety

ENHANCES SAFETY

- ▮ Snapback is eliminated and port safety improved as mooring ropes are not required.
- ▮ Operational labor costs are reduced as fewer mooring gang personnel are required during berthing operations.
- ▮ Human error is minimized by automating mooring procedures and reducing the involvement of mooring gang personnel.



Why use AutoMoor?

AutoMoor is a high-quality automated mooring solution that uses real-time information monitoring software to continuously track all mooring loads acting on the vessel at berth and provide live data to the operator to improve port operational performance.

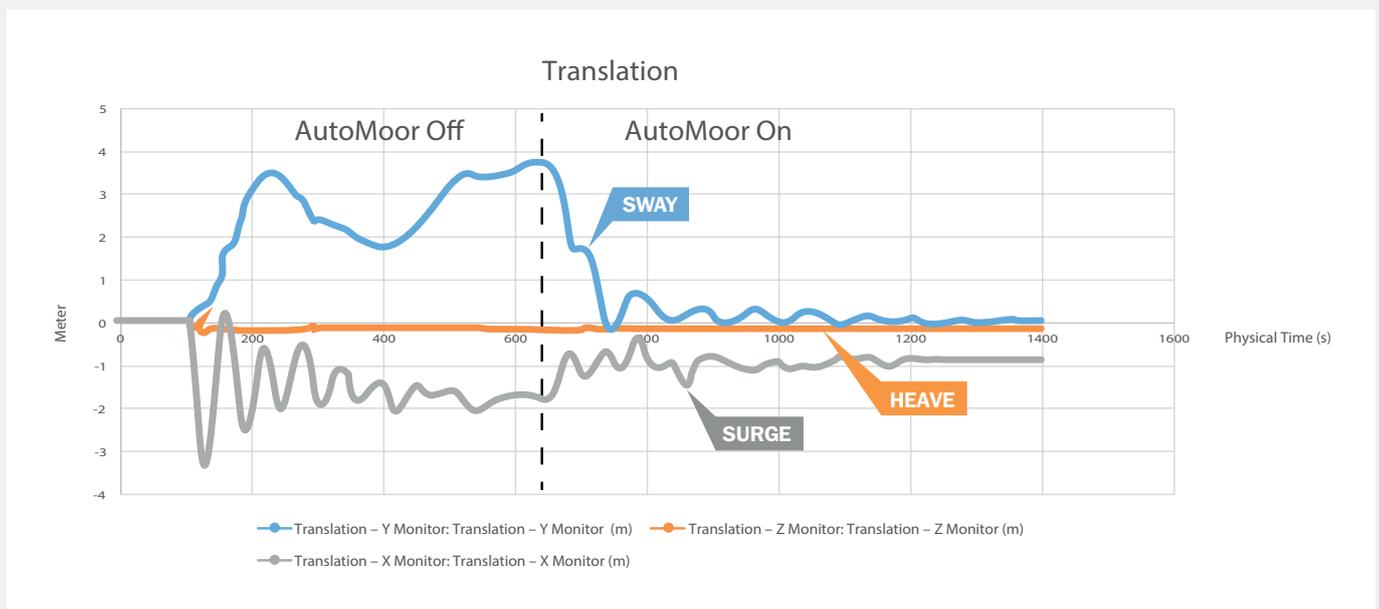
AutoMoor:

- Delivers greater control by showing mooring loads and unit operating conditions continuously
- Clearly indicates the operational status of the mooring unit
- Eliminates the requirement for active damping control

AutoMoor at a glance

Trelleborg's AutoMoor is a safe, efficient and cost-effective automated mooring solution able to securely moor vessels in under a minute and release for departure in 30 seconds. AutoMoor increases port throughput by reducing turnaround time for vessels to berth and depart, while improving port safety and reducing operational costs.

- Requires no active hydraulics
- Uses a patented(pending), passive damping system to dampen vessel motions
- Provides self-centering facility for pad positioning
- Features a patented(pending) electro-mechanical drive system for pad extension and retraction
- Operates using simple electronics with low power consumption
- Allows all maintenance to be undertaken onshore



AutoMoor Integrated Control Systems

The control system is a crucial piece of equipment built into every AutoMoor machine. Combining software and hardware with everything from machine programming and real-time reporting, to sensors, lasers and load cell, the Integrated Control System moves and operates AutoMoor, restraining the moored vessel in a limit-controlled manner.

Real-time information monitoring software shows vessel mooring loads and unit operating conditions, so operators have a comprehensive oversight of how events are occurring, where and when. Step-by-step mooring system sequencing clearly highlights the operational status of the mooring unit.

Designed for maximum ease of use, interface information is presented in three formats:

1. Display mounted on each AutoMoor mooring unit.
2. The entire berth mooring system is displayed on a port operations control room monitor that can focus on a single mooring unit for more control detail as required.
3. A wireless handheld device provides system operation controls from the wharf or from the deck of the vessel.

Back-2-Base communication support is provided by Trelleborg's docking and mooring center of excellence.



AutoMoor is SmartPort enabled, with data logging and reporting available on multiple levels. SmartPort by Trelleborg is a technology platform that connects port operation systems, allowing users to analyze the performance of assets and apply data insights to identify optimization and efficiency gains.

Its integrated features include monitoring of MetOcean conditions with mooring loads acting on the vessel, overlay of vessel motions, overlay of vessel positioning GPS and overlay of passing vessel and port traffic. With information presented in real-time, better day-to-day decisions and long-term operational improvements can be made.

Powered By
SmartPort



Refer to page 19 for more details on SmartPort.

AutoMoor T-Series

T20 SINGLE PAD UNIT

The AutoMoor T-series is a top-mounted mooring unit designed to secure a vessel as quickly and efficiently as possible, while taking up minimal wharf loading area.

Available in mooring capacity modules of 20T, Trelleborg also offers customized extension arms to extend reach envelopes to suit individual applications.



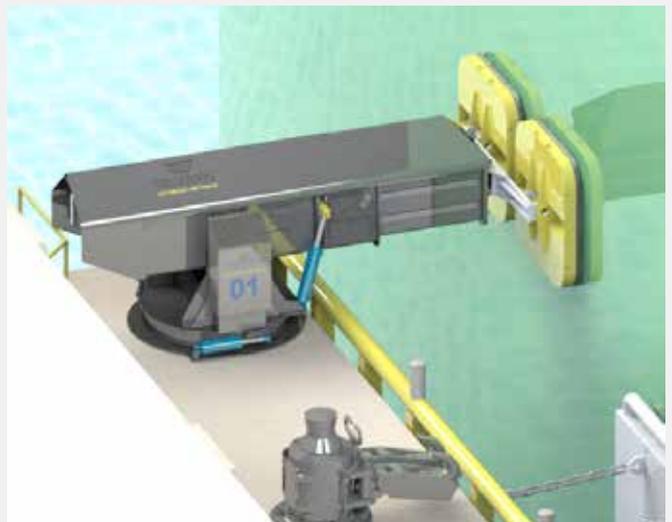
T40 DOUBLE PAD UNIT

For mooring larger vessels, the top-mounted series unit is available as a double vacuum pad 40T model, providing additional holding capacity.

Like its smaller counterpart, the mooring arm can be rotated onshore for ease of maintenance, avoiding the need for scaffolding on the wharf face and improving safety for those undertaking maintenance.

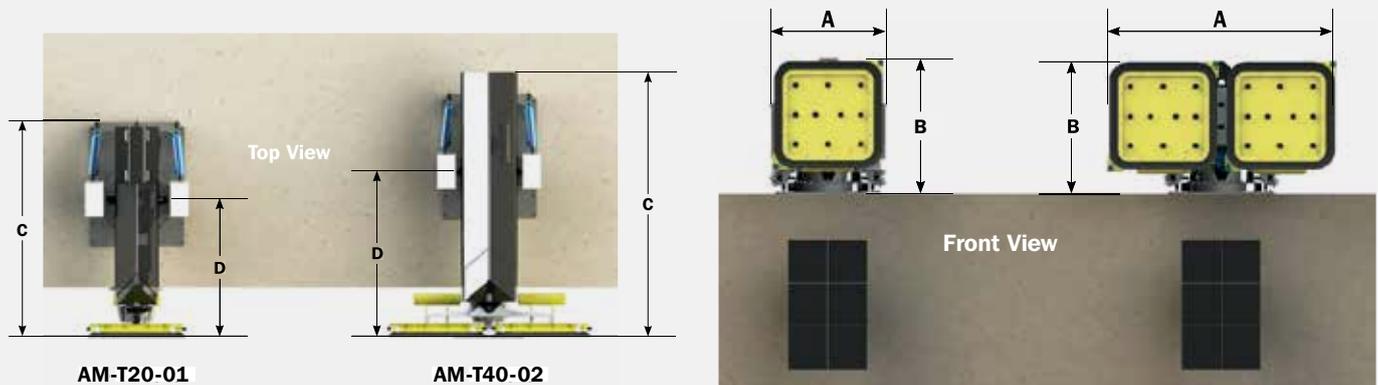
This unit also has a greater range of outreach to suit berths with large fender systems or for different significant wave heights.

AutoMoor models are available in Hazardous and non-Hazardous specification.



AutoMoor – Details and Specifications

MODEL	QTY. PADS	A	B	C	D	ANCHOR BOLT SIZE (mm)	ANCHOR BOLT (QTY)	SHIPPING MASS (kg)
AM-T20-01	1	1780	2400	3845	2450	M30 x 500	14	7800
AM-T40-02	2	3430	2470	4065	2465	M30 x 500	18	11000



DESCRIPTION	T20	T40
1 GENERAL SPECIFICATIONS		
Max Outreach (from wharf edge)	Approx. 2100mm (to suit typical SCN700 fender system outstand and smaller)	Approx. 2600mm (to suit typical SCN800 fender system outstand and larger)
1.1 Horizontal Range of Movement (Surge)	+/-15° or +/-500mm	
Vertical Range of Movement (Heave)	+/-22° or +/-1000mm	
1.2 Vacuum Holding Capacity	1 Vacuum Pad = 20T	2 Vacuum Pads = 40T
1.3 Primary Fabrication Material	Low Alloy Steel Grade Q345B to GB/T1591-2008 equivalent to ASTM A572 Grade 50.	
1.4 Temperature Range	Operating: -15°C to +50°C Storage: -40°C to +70°C	
1.5 Foundation Design Requirements	Designed in accordance with AS4100. Suitable for surface mount concrete or steel foundations.	
1.6 Hold Down Bolts (Anchors)	Supplied with unit as standard. Hold down bolts: M30 x 500mm, ISO898-1:1999 (E) Property Class 8.8 Finish: Hot-dip galvanizing to ISO10684: 2004 (E)	
1.7 Anchor Template	One mild steel template supplied per AutoMoor unit.	
1.8 Fasteners	Where possible all fasteners used in the assembly of AutoMoor units are 316 stainless steel. Non-stainless steel fasteners are high strength Property Class 8.8 alloy steel, treated with solid-film coating of Molybdenum Disulphide for long-term corrosion protection and to provide anti-seizing properties.	

DESCRIPTION	T20	T40
1 GENERAL SPECIFICATIONS		
1.9 Remote Release	Remote release from port control room, handheld wireless control device and control pedestal adjacent to mooring unit.	
1.10 Area Footprint	5.4m ² deck footprint	7.5m ² deck footprint
1.11 Peak Power Consumption		
Driveline Motor	5.5kW	7.5kW
Vacuum Motor	1.5kW	2.7kW
1.12 Power Supply Type	3-Phase, 440-480VAC 60Hz recommended	
1.13 Control System & Reporting	Operating System: PLC based. User Interface: Remote operator workstation. Remote Control: Included. Alarms: Audible & Visual.	
1.14 SmartPort Enabled	Data Logging & Reporting: Multiple reporting levels available.	
2 QUALITY AND TESTING		
2.1 NDT	ASTEM E1444-05	
2.2 Welding	AWS D1.1 or AS1554	
2.3 Testing	Each unit is individually proof load tested using a specially designed test rig. Proof load testing equipment is calibrated by a certified body such as Lloyds Register. Each unit is functional control system tested in factory and series tested for multiple unit orders. AutoMoor units are commissioned once installed onsite to verify factory testing and system performance requirements.	
3 PROTECTIVE COATING		
3.1 Surface Treatment	Surface Preparation – Class 2.5 Blast (1). 1st Coat: Nominal 75µm DFT epoxy zinc-rich primer. 2nd Coat: Nominal 125µm DFT two-part epoxy, containing MIO. 3rd Coat: Nominal 75µm re-coatable two-part polyurethane. Color: As required to suit customer protective coating specifications. AS1627.4, USA, National Association Corrosion Engineers, NACE or society for Protective Coatings, SSPC-SP10 Sweden, Sa 2.5).	
4 OPTIONAL SYSTEM UPGRADES (AVAILABLE AT ADDITIONAL COST)		
4.1 Vessel Warping System	Motor and system programming upgrade to allow AutoMoor units to warp a vessel along a berth.	
4.2 Extended Temperature Range	Below -15°C and above +15°C	
4.3 Hazardous Version	Electrical control system and motor upgrades to suit hazardous area operation.	
4.4 Class Design Approval	Independent 3rd party inspection & certification.	

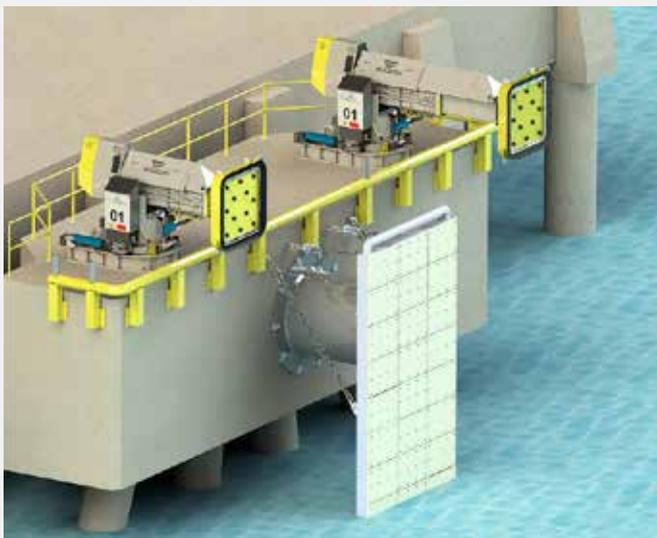
Benefits across port industry sectors

Trelleborg's AutoMoor is suitable for use in different sectors of the port industry.

Container terminals: increase throughput for competitive advantage

Pressure to increase throughput while dealing with increasing vessel sizes make operations a constant battle for efficiency gain and cost reduction. Maximizing operational windows without holding the vessel at berth any longer is a clear route to improving operational efficiency.

AutoMoor substitutes mooring lines with units specifically designed to dampen vessel motions and provide real-time data to monitor mooring loads. AutoMoor gives operators control and eliminates disputes in cases of mooring line failure. By reducing the time taken to moor vessels, AutoMoor increases operational windows without vessels having to remain at berth any longer.



Bulk liquid facilities: a simpler, safer way to operate and to grow

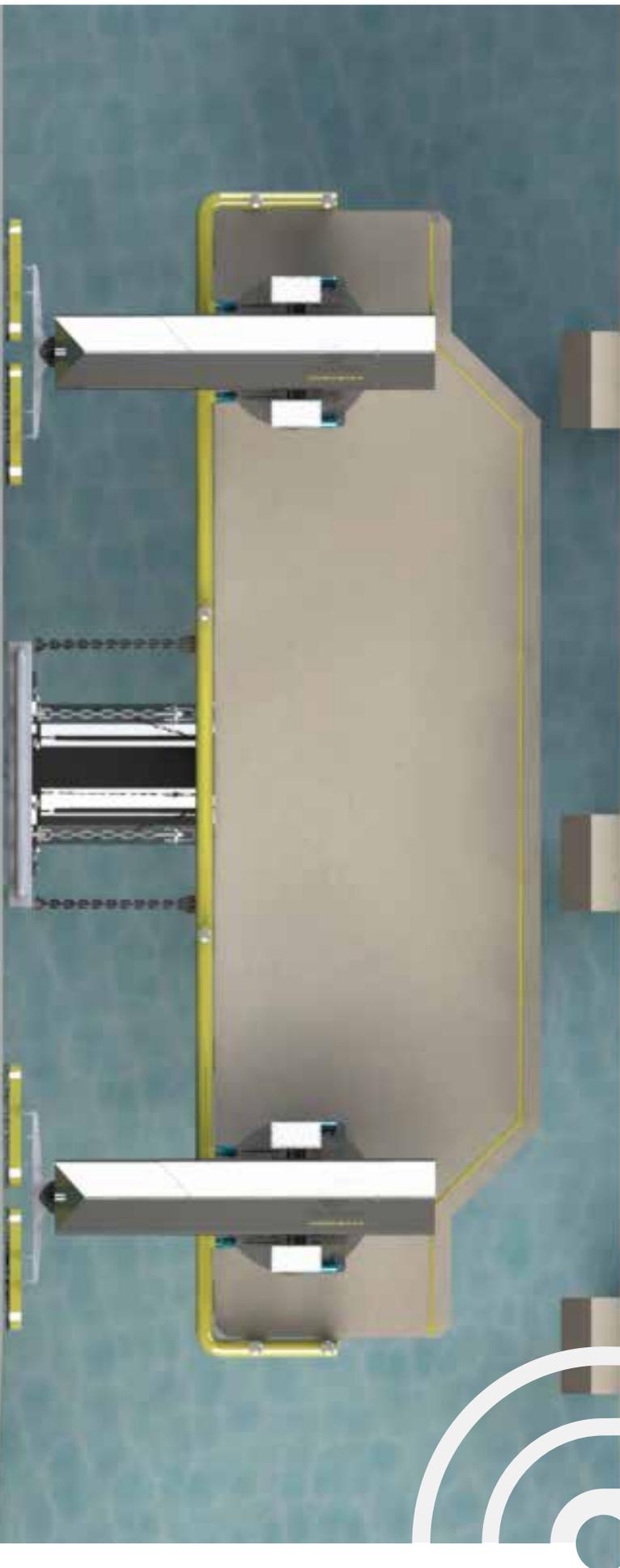
Running a liquid bulk terminal means dealing with multiple environmental and safety concerns and regulatory guidelines. When nearby vessels pass or maneuver, operators may need to interrupt operations: each interruption costs time and money. AutoMoor from Trelleborg equips berths for efficiency, dampening vessel motion and providing real-time data to monitor mooring loads.

Expansion is an option, but any improvements must put safety first, and gaining relevant permits from multiple administrative bodies and authorities is not an easy task. Trelleborg understands the permitting journey, helping customers meet regulatory standards wherever a project is developed.

Ferry terminals: speed up turnaround to increase profitability

Margins are tight: it's all about efficient turnaround. The faster a vessel is secured at berth, the better. Being judged on emissions means the pressure is on to reduce carbon footprints and comply with IMO rules by 2020.

It is a constant battle for safe and efficient berthing. AutoMoor from Trelleborg gives control back to terminal owners and operators, improving speed of berthing and unberthing with fewer people at berth, lowering the risk of injury or accident and reducing vessel idling times to lower carbon emissions.



Dry bulk terminals: a simpler, safer way to operate and grow

Dry bulk terminals are under constant pressure to increase throughput. Extending operational windows without holding the vessel longer at berth is a clear route to improving operational efficiency and financial returns.

Interruptions must be kept to a minimum: troubles during berthing can be critical, given the extreme operating conditions, especially when a shipping crew is not familiar with the terminal.

In such a context, simplifying berthing operations can reduce costs and improve efficiency and safety. Expanding capacity is another way to compete, but gaining project approvals is not an easy task. Trelleborg is an experienced partner with superior understanding of the permitting journey, helping customers meet regulatory standards whatever the project requirements.

Cruise terminals: take advantage of the growing cruise market

The booking industry is demanding new routes, new locations and new vessels, while infrastructure must be improved to deliver a better passenger experience. Cruise lines are selective over their ports of call, and terminals are increasingly judged on carbon emissions, an issue compounded by growing vessel sizes.

It is a constant battle for attractiveness and capacity, but improvements must, above all, be safe. AutoMoor gives operators more choice and control, enabling berth capacity expansion to accommodate larger vessels, without the need for huge capital investment.

SmartPort introduction

SMARTPORT

SmartPort is Trelleborg's answer to the need for a standardized way to collect and store data. It's a technology platform that connects port operations, allowing users to analyze asset performance and apply data insights, to improve day-to-day decision making and long-term operational improvements.

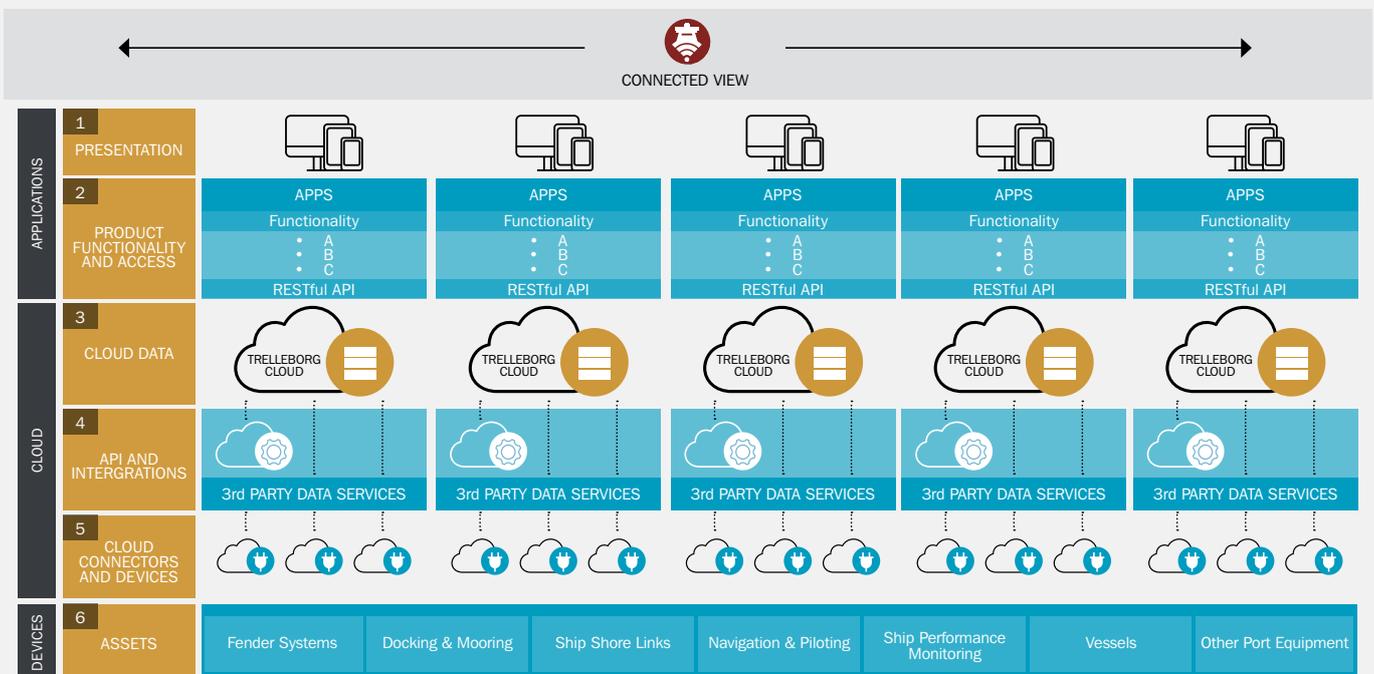
Historically, we have supplied many products for the port environment, from fenders to mooring equipment to ship performance monitoring to navigation and piloting systems: each of which have their own sensors fitted. By adopting SmartPort architecture, all of these systems can be brought under one cloud based system.

SmartPort



Why choose SmartPort by Trelleborg

- The SmartPort technology platform is powering the marine industry to a new level of efficiency and asset optimization.
- SmartPort uses the latest smart technology to manage intelligent data collection, transfer and storage and combines this with access to unique product functionality and data insights.
- SmartPort products collect and transmit data, distributing it to the right people at the right time – whether they are on board the vessel, in the control room or on the jetty – to deliver improved operational efficiencies.
- SmartPort allows the performance of assets to be analyzed quickly and effectively to identify optimization and efficiency gains.
- SmartPort is built on an open API structure to enable collaboration with third party systems and third party assets.



Service and support

Trelleborg Marine Systems offers exceptional service and support across its entire product range.

Our lean mooring solutions are supported by best practice aftersales services including operational training, comprehensive product warranties and simple, cost effective, predictive maintenance packages, giving you peace of mind from conception to completion and beyond.

Trelleborg will also offer data storage and analysis for customers using AutoMoor offering customers unique insight into their facility, into performance over time or individual events.

Our lean mooring solutions can be customized to meet your needs and reduce the Total Cost of Operation (TCO), they include:

- | Global support, local presence, local spares holding
- | Cost effective remote diagnostics and support
- | Tailored maintenance and ongoing support packages
- | In-built system diagnostics
- | Run-time monitoring to optimize predictive maintenance requirements
- | Comprehensive product warranties

Get in touch to see how we can customize a program to meet your needs.

TAKE A SMARTER APPROACH

Speak to the experts at Trelleborg to learn more about our approach to lean mooring and to discuss how AutoMoor could empower efficiency at your facility.

Email: MarineSystems@trelleborg.com



SERVICE AGREEMENTS

Leading companies recognize that it's the total cost of ownership which really matters in the purchase of capital equipment.

Without doubt regular preventative maintenance reduces downtime, improves productivity and manages risk.

A Tailored Service Program gives you inside access to Trelleborg's product experts and allows you to leverage our experience and product knowledge for your benefit. A Trelleborg Aftersales representative will work with you to tailor a service solution including some or all of the following:

- Programmed maintenance and inspection
- Callout service with defined response times
- Refresher training
- Audit of spare parts holdings
- Remote technical support and diagnostics
- Comprehensive reporting and recommendations

Whether you need us onsite every year or every month, we can work with you to help you get the best out of your Trelleborg equipment.

DISCLAIMER

Trelleborg AB has made every effort to ensure that the technical specifications and product descriptions in this brochure are correct.

The responsibility or liability for errors and omissions cannot be accepted for any reason whatsoever. Customers are advised to request a detailed specification and certified drawing prior to construction and manufacture. In the interests of improving the quality and performance of our products and systems, we reserve the right to make specification changes without prior notice. All dimensions, material properties and performance values quoted are subject to normal production and testing tolerances. This brochure supersedes the information provided in all previous editions. If in doubt, please check with Trelleborg Marine Systems.

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Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

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