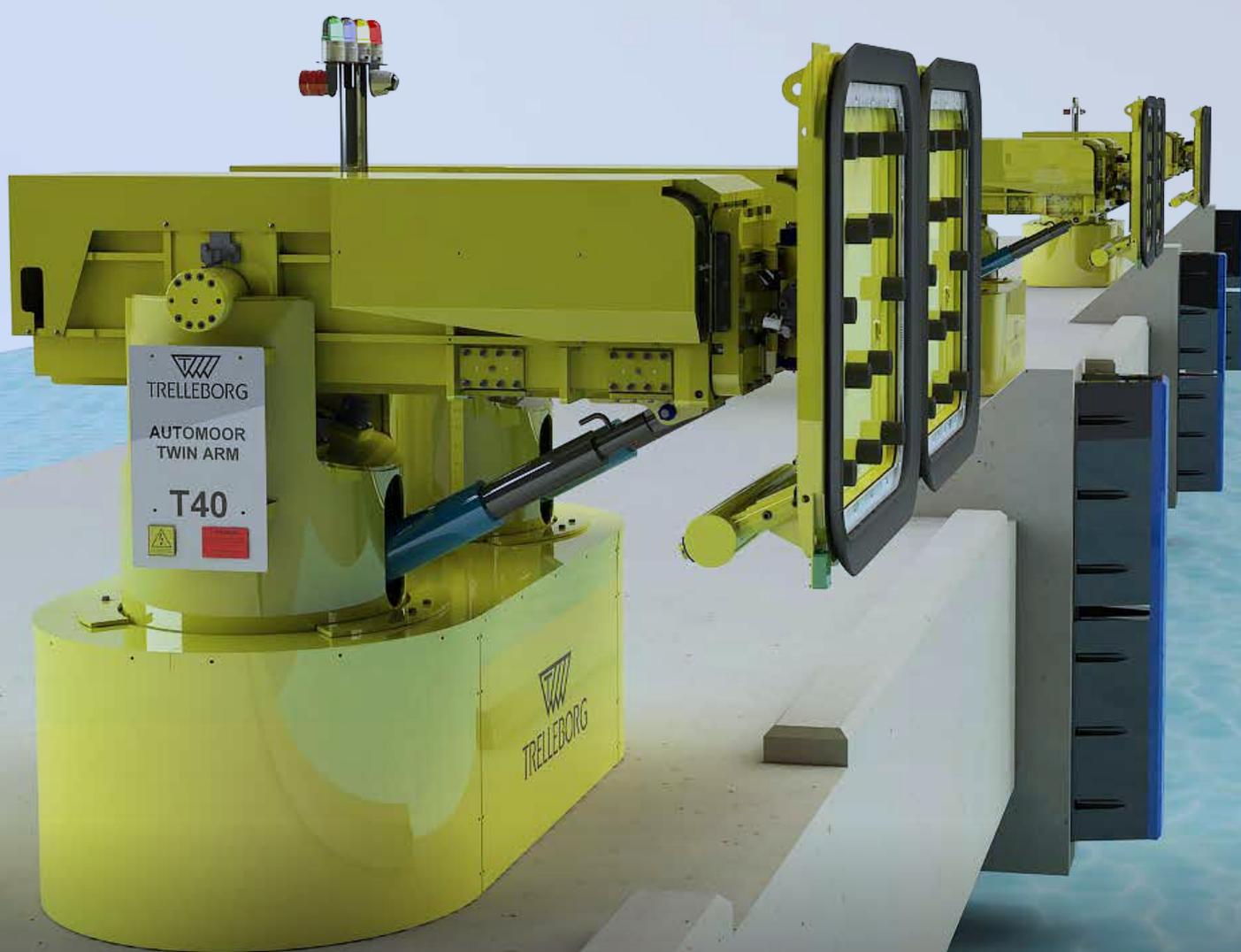


# AutoMoor

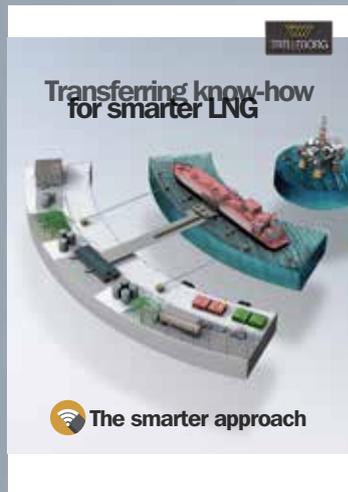
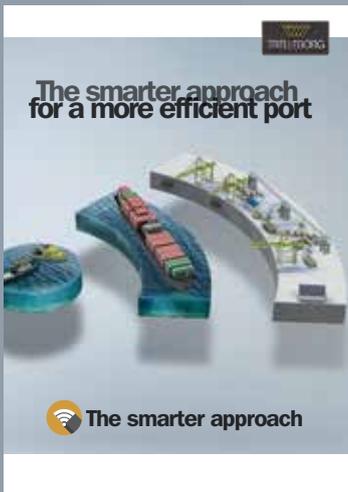
SMART EFFICIENT AUTOMATED MOORING SOLUTIONS



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**SmartPort**



# The Smarter Approach



## Connect with 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 and Infrastructure.

# 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 operations, 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.



### CONCEPTS

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 Centers of Excellence in India where our team generates 3D CAD designs, application engineering drawings, a bill of materials, finite engineering analyses 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 on-site 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.



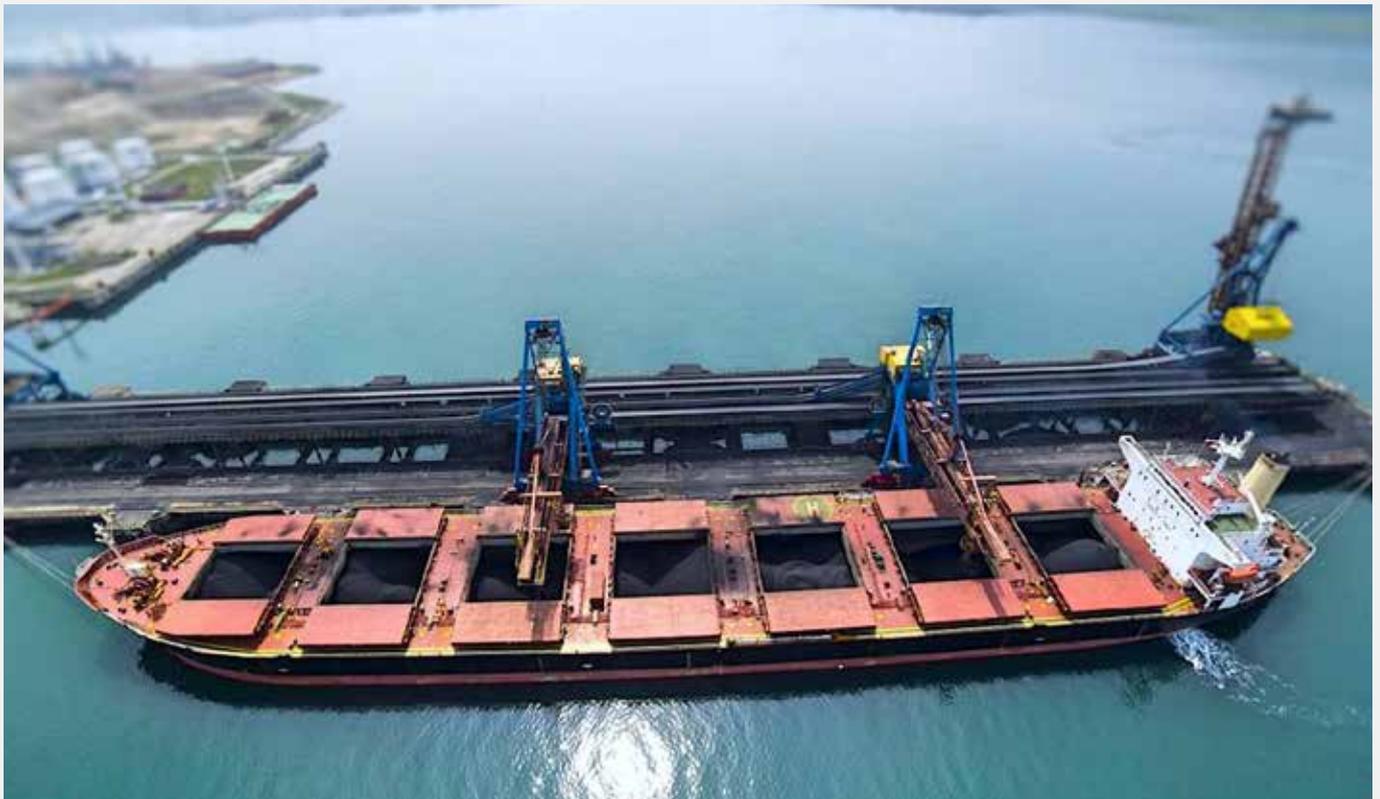
### THE FUTURE

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**

**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 20 and 40 Tonne mooring capacity automated mooring units, with Single or Double Pad and Single or Twin Arm configurations to suit different application requirements. These 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.



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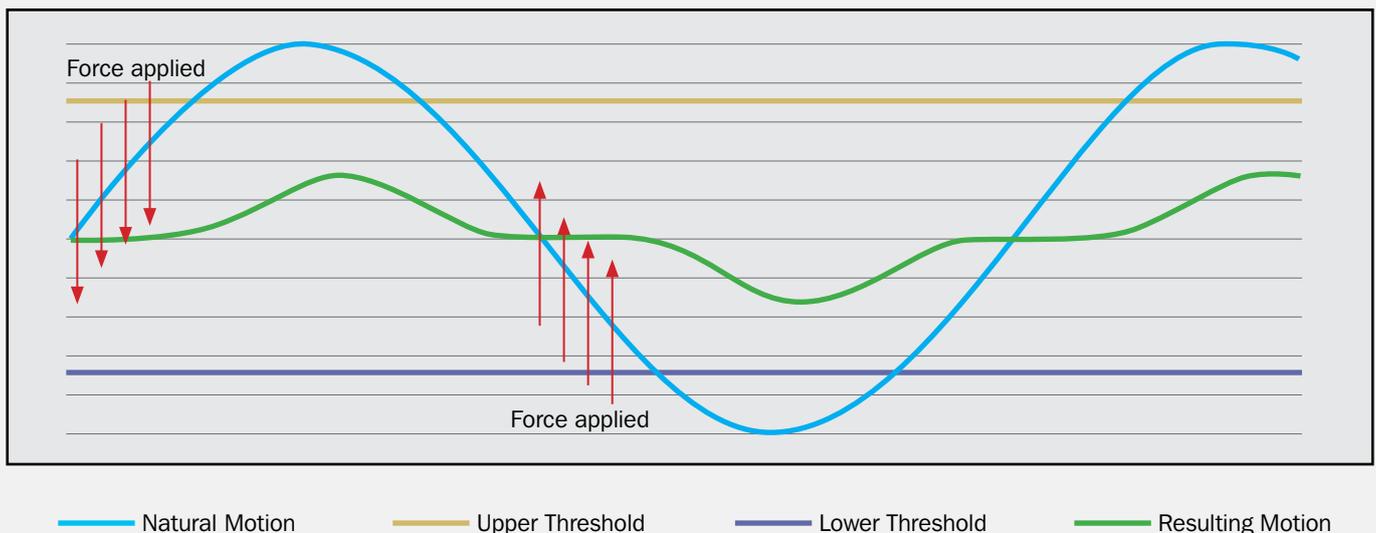
# Key objectives of AutoMoor

## 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.
- **Reduces vessel motions** whilst at berth by limiting peak mooring loads caused by natural sway and surge forces.
- **Less 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.
- **Breakwater infrastructure minimized**, increasing construction savings.
- **Limits peak mooring loads** resulting in reduced civil requirements.



Note: Mooring forces applied by AutoMoor reduce the peak mooring loads resulting in a flatter vessel motion curve.

# Benefits across all port industry sectors



## **Ferry terminals: speed up turnaround to increase profitability**

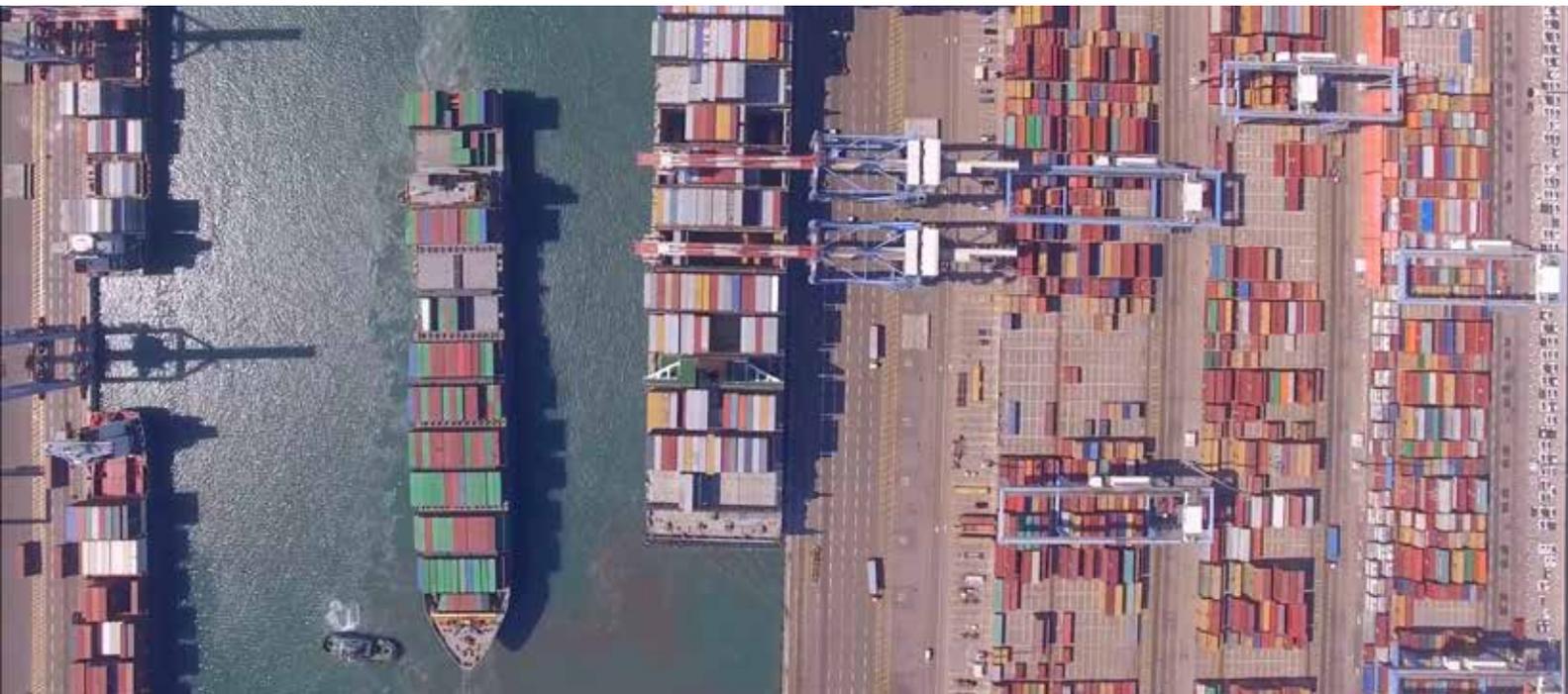
Margins are tight: it's all about efficient turnaround. The faster a vessel is secured at berth, the better. Being judged on emissions means the pressure is on to reduce carbon footprints and comply with IMO rules by 2020.

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.

## **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.



### **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.

### **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.

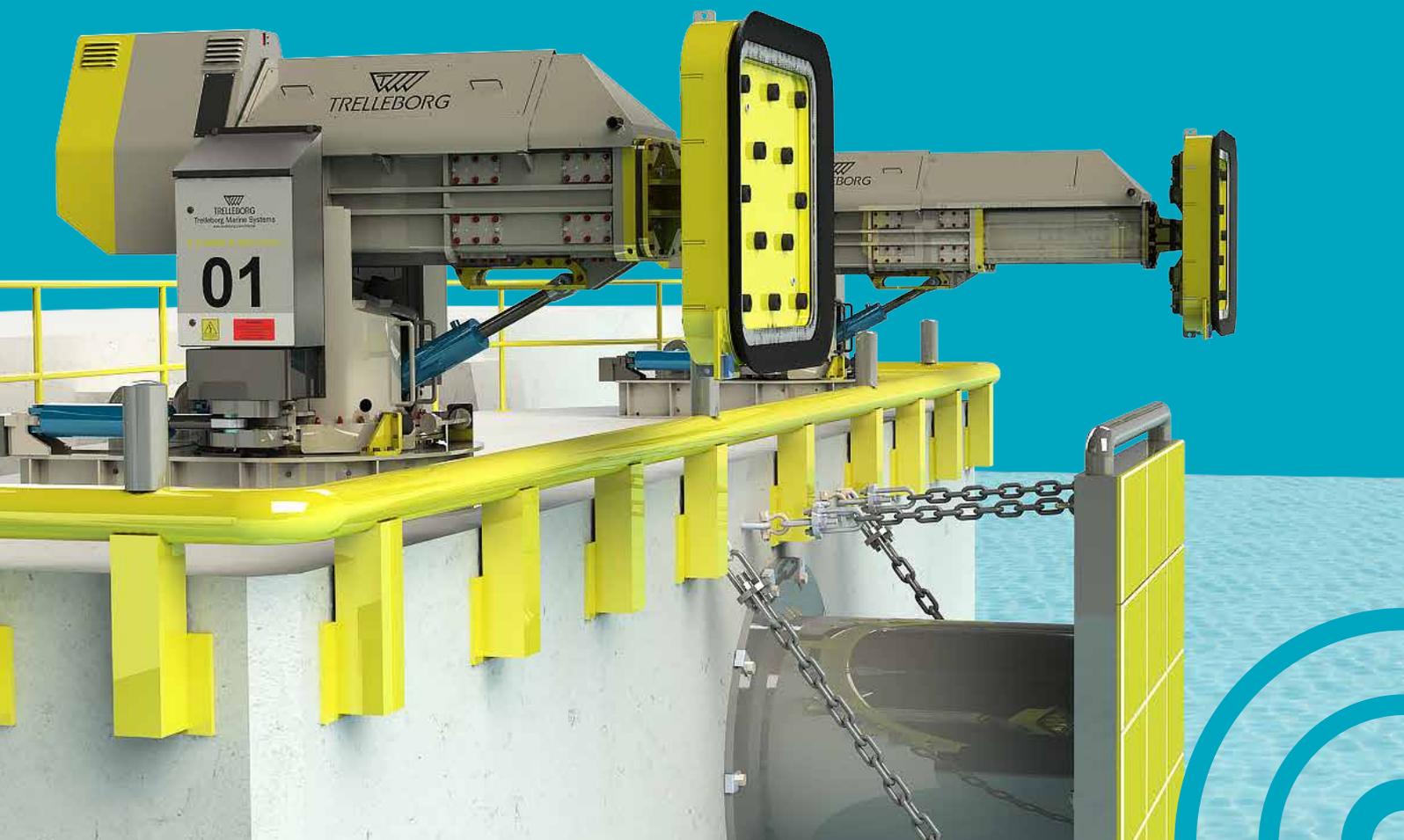
# Reducing Total Cost of Ownership

## 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.**

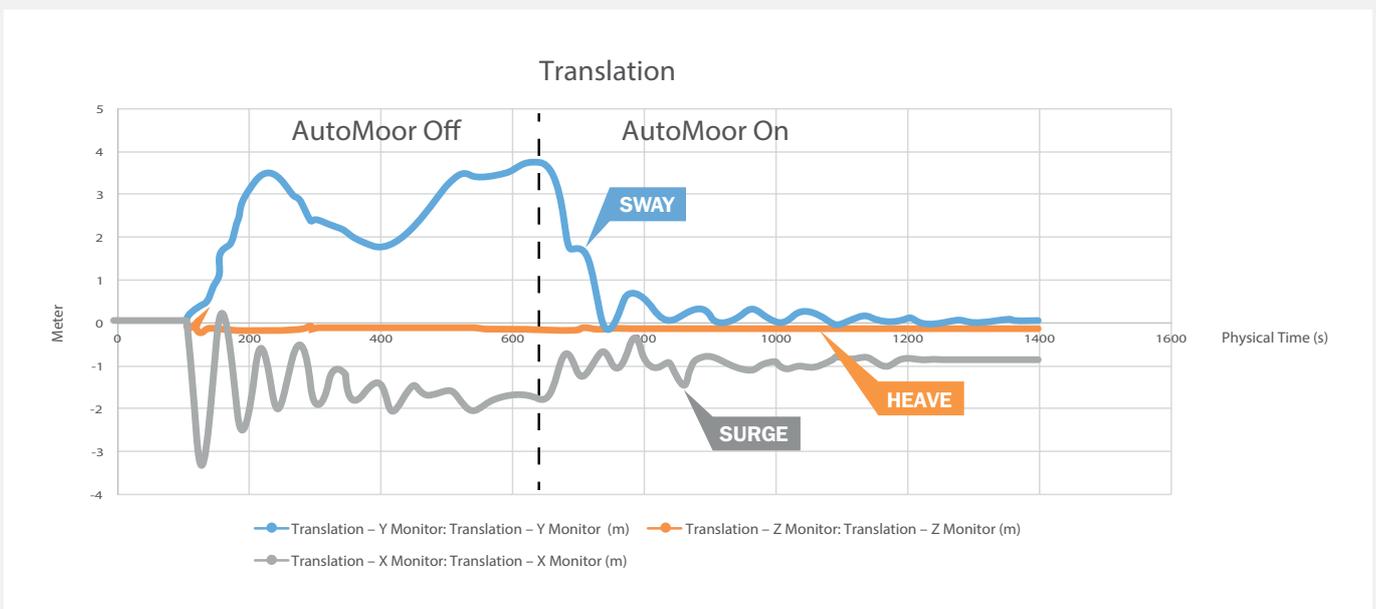
## AutoMoor:

- 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.

- Uses a passive damping system to dampen vessel motions
- Provides self-centering facility for pad positioning
- Features an electro-mechanical or hydraulic 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.

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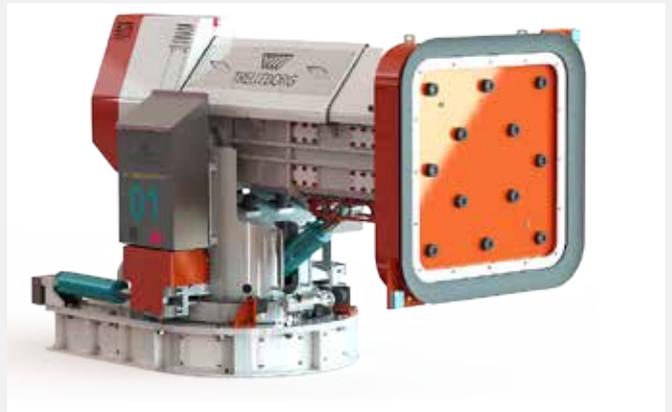
Refer to page 19 for more details on SmartPort.

# AutoMoor T-Series

## T20 SINGLE ARM 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 SINGLE ARM 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.

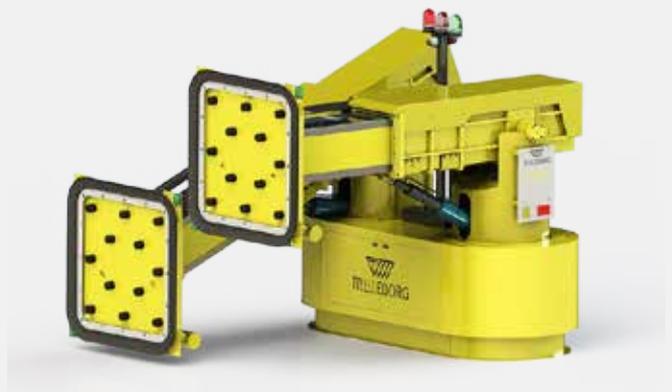
This unit also has a greater range of outreach to suit berths with large fender systems or for different significant wave heights.



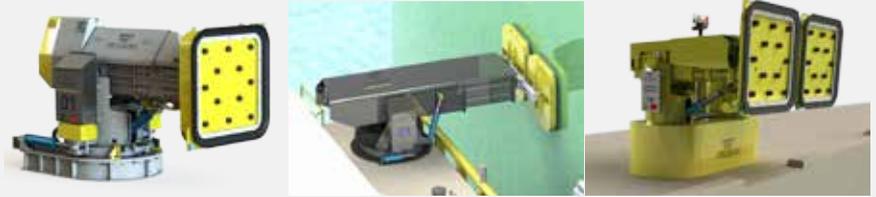
## T40 TWIN ARM UNIT

Trelleborg's Twin Arm AutoMoor unit has a front-to-back dimension of less than two meters, developed to cater for applications where there is limited mounting area, such as between cargo crane or passenger gantry rails and the wharf edge.

The twin arms offer flexible, safe mooring options ensuring each AutoMoor unit has at least one pad attached at all times during tidal and loading draft adjustments, and also if there are hull protrusions on certain vessels to allow for.



# AutoMoor – Details and Specifications



DESCRIPTION	T20 SINGLE ARM	T40 SINGLE ARM	T40 TWIN ARM
<b>1 GENERAL SPECIFICATIONS</b>			
<b>1.1</b> Area Footprint	4.0m <sup>2</sup> deck footprint*	8.1m <sup>2</sup> deck footprint*	6.6m <sup>2</sup> deck footprint*
<b>1.2</b> Length (base only)	2205mm	2355mm	1850mm
Length Retracted	3845mm	4060mm	2880mm*
Length Extended	5130mm	5835mm	4300mm*
<b>1.3</b> Max. Driven Distance of Vacuum Pad	1285mm	1775mm	1420mm
<b>1.4</b> Width Neutral Position	1775mm	3430mm	3525mm*
Width Horizontally Rotated	2400mm	3485mm	3740mm*
<b>1.5</b> Height Neutral Position	2400mm	2470mm	2825mm*
Height Extended and Vertically Rotated	3645mm	3500mm	4235mm*
<b>1.6</b> Range of Movement Horizontal (Surge)	+/-500mm	+/-500mm	+/-760mm
<b>1.7</b> Range of Movement Vertical (Heave)	+/-1000mm	+/-1000mm	+/-1000mm
<b>1.8</b> Passive Adjustment Range (max. on springs)	+/-450mm	+/-450mm	+/-450mm
<b>1.9</b> Shipping Mass	7,800kg	11,000kg	14,000kg**
<b>1.10</b> Vacuum Holding Capacity			
Rated per mooring unit	1 x 20T	2 x 20T = 40T	2 x 20T = 40T
<b>1.11</b> Mooring Operation Speed - Moor/Attach	<60secs***	<60secs***	<60secs***
Mooring Operation Speed - De-Moor/Detach	<30secs***	<30secs***	<30secs***
<b>1.12</b> Warping Operation Speed	–	–	300mm per 70secs****
<b>1.13</b> Primary Fabrication Material	Low Alloy Steel Grade S355J2 to EN 10025-2:2004		
<b>1.14</b> Temperature Range	Operating: -25°C to +50°C Storage: -40°C to +70°C		
<b>1.15</b> Foundation Design Requirements	Designed in accordance with AS4100 Suitable for surface mount concrete or steel foundations		
<b>1.16</b> Hold Down Bolts (Anchors)	M30	M39	M39
	Material Property Class: Grade 8.8, ISO898-1:1999 (E) Finish: Hot-dip galvanizing to ISO10684: 2004 (E)		
<b>1.17</b> Anchor Template	Mild steel template supplied per AutoMoor unit		
<b>1.18</b> 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 a solid-film coating of Molybdenum Disulphide for long-term corrosion protection and to provide anti-seizing properties or galvanized.		
<b>1.19</b> Remote Release	Remote release from port control room, handheld wireless control device and control pedestal adjacent to mooring unit.		

# AutoMoor – Details and Specifications

DESCRIPTION	T20 SINGLE ARM	T40 SINGLE ARM	T40 TWIN ARM
<b>1 GENERAL SPECIFICATIONS</b>			
<b>1.20</b> Peak Power Consumption	AutoMoor units run with <1kW power in passive mode		
Hydraulic Power Unit Motor	–	–	2 x 7.5kW
Electromechanical Drive Motor	5.5kW	7.5kW	–
Vacuum Motor	1.5kW	2.7kW	3.5kW
Heater Motor (optional)	1.5kW	2.2kW	2.2kW
<b>1.21</b> Power Supply (recommended)	Grid Power Supply Type 3-Phase, 400VAC 50Hz		
	UPS Power Supply Type 3-Phase, 400VAC 50Hz		
<b>1.22</b> Control Systems and Reporting			
Operating System:	PLC-Based Control		
User Interface:	Handheld Devices		
Remote Control:	Included		
Alarms:	Audible & Visual Signals, UI Alarm Reporting		
<b>1.23</b> SmartPort Enabled Data Logging and Reporting	Supplied as part of Master Service Agreement		
<b>2 OPTIONAL SYSTEM UPGRADES (ADDITIONAL COST)</b>			
<b>2.1</b> Vessel Warping System	Motor and system programming upgrade to allow AutoMoor units to warp (reposition) a vessel along a berth		
<b>2.2</b> Hazardous Area Operation Capability	Electrical control system and motor upgrades to suit hazardous area operation		
<b>2.3</b> Class Design Approval	Independent 3rd party inspection & certification		
<b>3 QUALITY AND TESTING</b>			
<b>3.1</b> Non-Destructive Testing Standard	ASTM E1444-05 or equivalent		
<b>3.2</b> Welding Standard	AWS D1.1 or AS1554 or equivalent		
<b>3.3</b> Mechanical and Control System Testing	Each mooring unit is individually proof load tested using a specially designed test rig. Proof load testing equipment is calibrated by a 3rd party certifying body such as Lloyds Register. Each unit's functional control system is tested in factory and series tested for multiple unit orders. AutoMoor units are commissioned once installed onsite to verify factory testing and optimize system performance requirements.		
<b>4 PROTECTIVE COATING</b>			
<b>4.1</b> Surface Preparation and Treatment	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		
<b>4.2</b> Colour	As required to suit customer protective coating specifications		
<b>4.3</b> Inspection and Testing Standard	AUS/NZ Standard AS1627.4 or National Association Corrosion Engineers, NACE or Society for Protective Coatings, SSPC-SP10 Sweden, Sa 2.5		

Trelleborg reserve the right to modify designs and specifications without notice.

\* Not including optional mounting plinth

\*\* Not including power-pack and vacuum/control systems

\*\*\* Dependent on distance to travel over fender outstand to vessel hull

\*\*\*\* Can be adjusted to suit requirements

# 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.

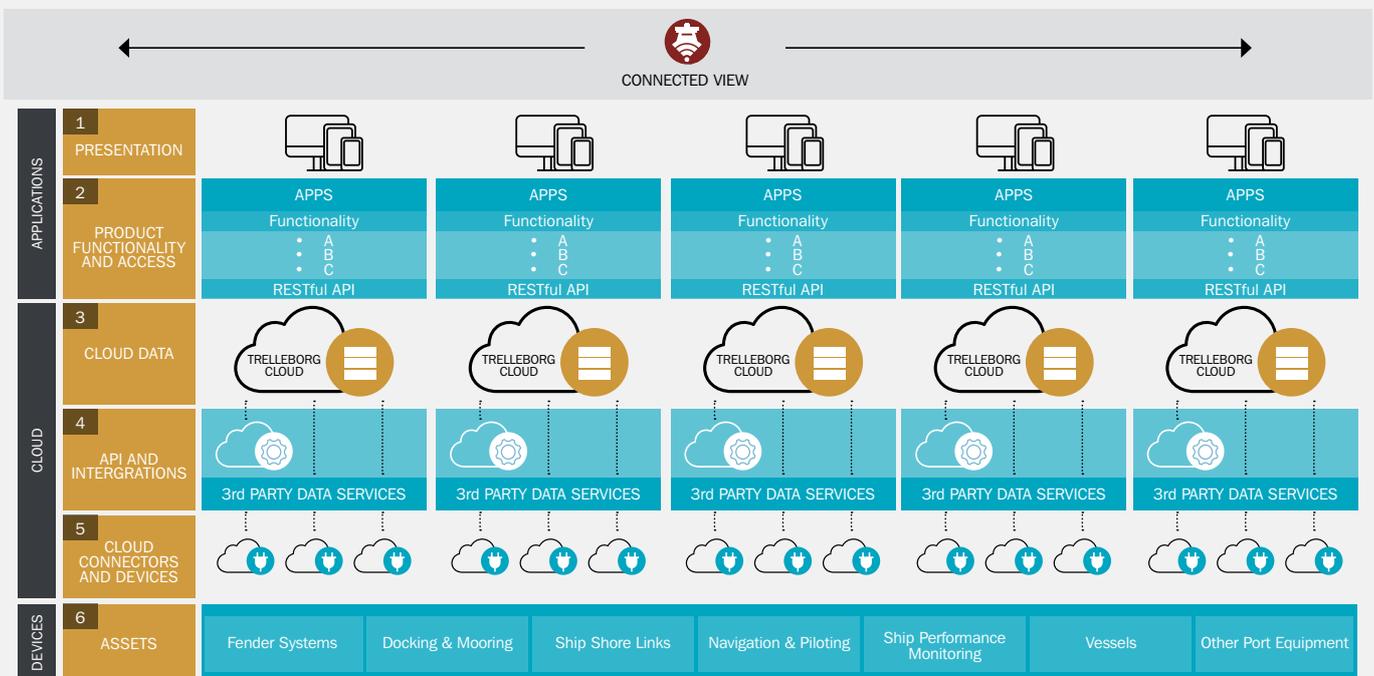
Historically, we have supplied many products for the port environment, from fenders to mooring equipment to ship performance monitoring to navigation and piloting systems: each of which have their own sensors fitted. By adopting SmartPort architecture, all of these systems can be brought under one cloud 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 and Infrastructure 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: [marine\\_infra@trelleborg.com](mailto:marine_infra@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 and Infrastructure.

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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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