MoorMaster™

Automated Mooring

CAVOTEC
Inspired Engineering

State of the art technology

MoorMaster™ is a vacuum-based automated mooring technology that can safely hold even the largest 450,000 dwt bulk vessels and 18,000 TEU container vessels, and eliminates the need for conventional mooring lines. Remote controlled vacuum pads, recessed in, or mounted on the quayside and attached to hydraulic actuated arms, extend, attach and moor ships in a few seconds.

"Cavotec MoorMaster provided PHPA with a solution to a defined technical problem i.e. fitting a mini cape into a Panamax space. The system has proven to be a great success to date and allowed improved productivity, safety and risk management strategies. Innovative and the leading edge of changing maritime technological solutions"

John Finch
A/GM Operations - Harbour Master, Port Hedland Port Authority

TIME IS MONEY

Save up to 1.5 hours for mooring your vessel as MoorMaster™ normally requires only 30 seconds for mooring, and just 10 seconds to detach (Conventional mooring normally takes between 20 and 90 minutes involving mooring gangs, ships' crews, pilots and tugs).

OPERATION EFFICIENCY & SAFETY

1 man operation with either a single port officer or the captain himself equipped with Cavotec remote control for your modern and safe mooring operation. Automatic adaptation to tidal and draft changes enables the client to better utilise personnel which are no-longer required in high-risk working zones.

INFRASTRUCTURE COST SAVINGS

MoorMaster™ units can be designed to hold the vessel at a preset distance from uncompressed fenders. Furthermore, the units only attach to the parallel body of the ship, giving possibility of berth overhang. The need for berth extensions or mooring dolphins may therefore be eliminated in some cases. Proper hydrodynamic studies may even prove breakwater arrangements might be unnecessary with a MoorMaster™ system in place.

"Cavotec's MoorMaster systems represent a major asset for our port developments by speeding up our operations and turnaround times, which in turn, help us improve the reliability and quality of service for the benefit of our customers. This mooring system is a unique and innovative technology that has been adopted by our company in order to support our strategy of integrating more efficient and reliable systems for our ferry services."

Hans Henrik Simonsen
Fleet Manager, Danske Færger A/S

"Cavotec has demonstrated great versatility, creativity and adaptability in developing and delivering a product tailored to our unique marine environment."

Benoit Nolet
Manager, Transit of the Future St-Lawrence Seaway Management Corporation

A PROVEN REVENUE BOOSTER

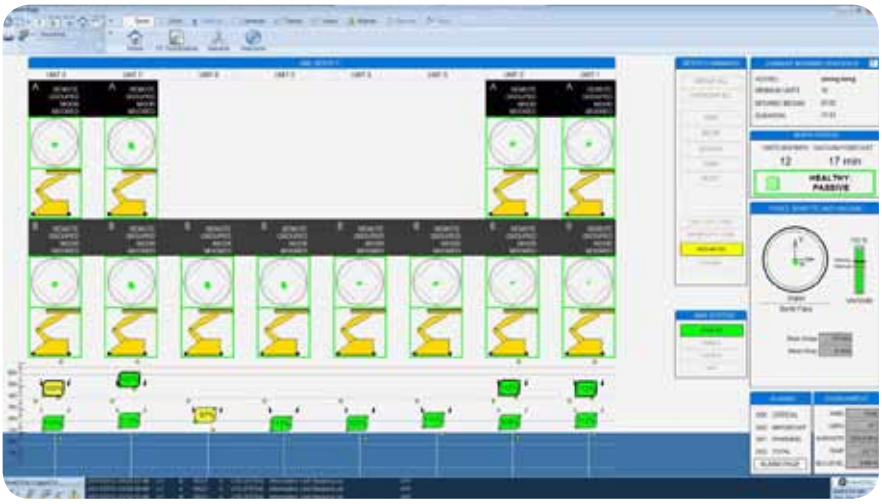
MoorMaster™ improves operational efficiency and reduces environmental impact. Sophisticated electronic hydraulic controls minimise vessel movement (surge, sway and yaw) to maintain the vessels position with millimetre accuracy. MoorMaster™ units can also be used to warp the vessel position without the need for ship's own steam or with the help of tugs.

CORE ELEMENT OF ENVIRONMENTAL STRATEGIC PLANS

Vessels using MoorMaster™ are "all secure" far more quickly than those using conventional means, enabling them to shut down their engines sooner and reduce the amount of time tugs are required. MoorMaster™ thus has a positive effect on air quality in ports.

PERMANENT ONLINE MONITORING & VISUALISATION

MoorMaster™ incorporates continuous load monitoring and sophisticated alarm functions relayed in real time to operations personnel onshore, onboard and/or in port control office. Alerts can be sent to pagers, mobile phones and other devices.



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Advantages & Benefits

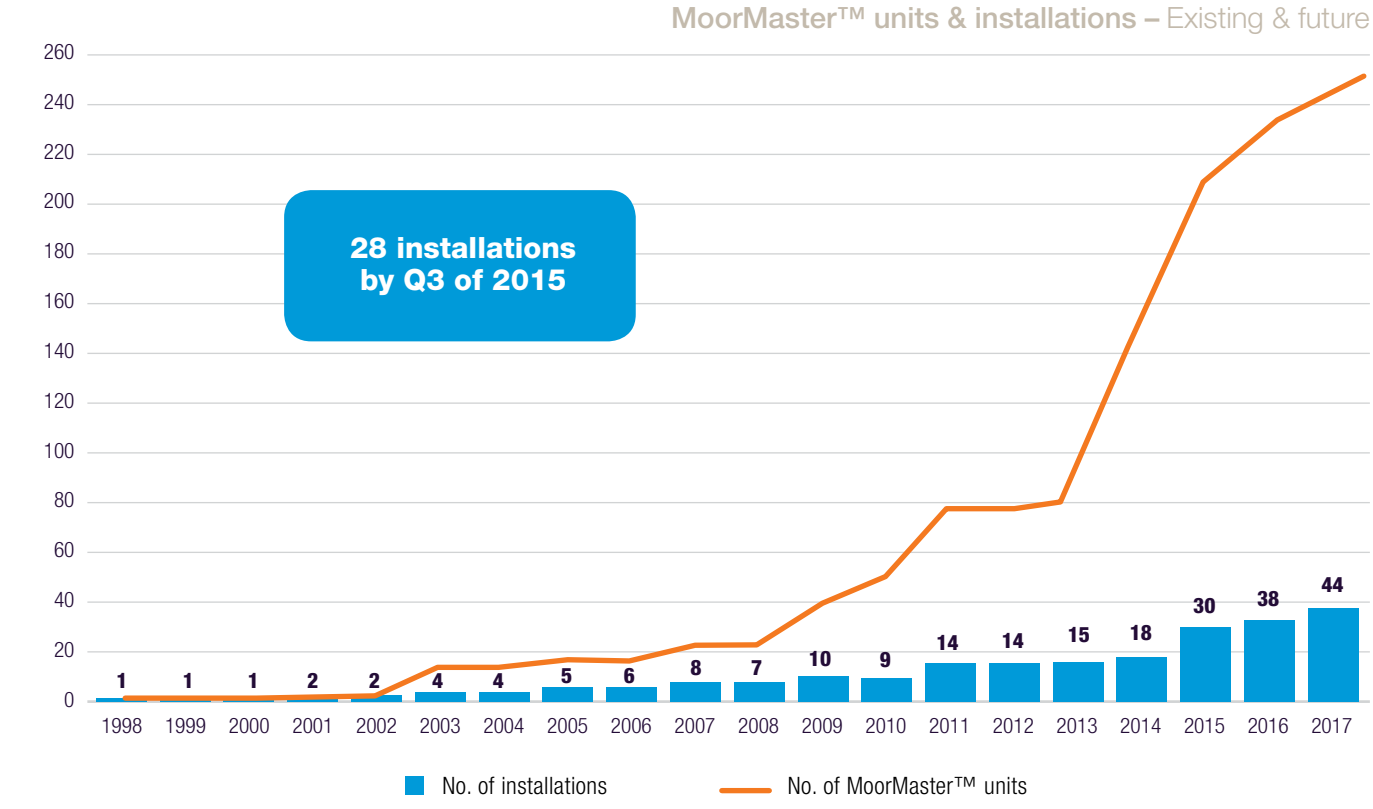
PORT

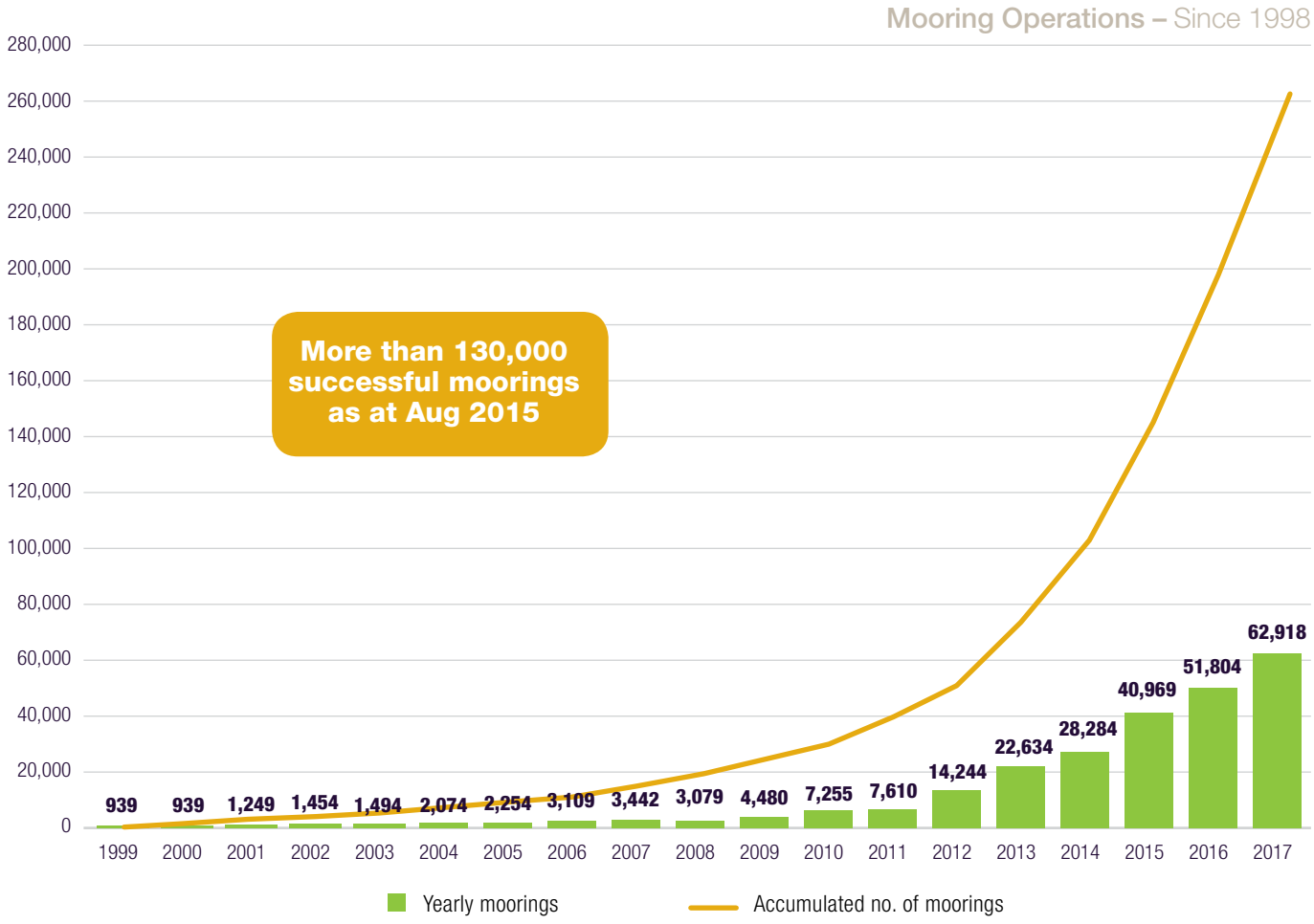
- Faster vessel-turnaround enables larger number of ship calls.
- Cargo and crew transfer can start earlier.
- Increased cargo throughput.
- Improved utilisation of tug fleet: tugs leave ships much earlier and return just prior to departure.
- Mooring gangs not required.
- Improved utilisation of terminal length if berthing distances reduced.
- Vessels longer than berths can be moored with overhang, enabling substantial savings on quay extensions or dolphin investments.
- Restricted waterways not disturbed.
- In some cases, MoorMaster™ may eliminate the need for breakwater construction.
- Personnel safety improved.
- Personal injuries during mooring reduced to a minimum.
- Potential reduction in insurance premiums.
- Mooring load status constantly monitored and event logs can be reviewed.
- Less wear and tear on fenders.
- Cargo operation less dependent on weather conditions.
- Vessel creep during port stay eliminated.
- Improved service for shippers.
- Reduced use of the vessel's propulsion system and of tugs and line boats diminishes fuel consumption and emissions.
- Faster connection to shore power, where available.
- Aid for development of STS Automation.

SHIP

- Potential slower cruise speeds for vessels.
- Cargo and crew transfer can start earlier.
- Improved utilisation of pilots' time: pilots are able to disembark immediately after the fast mooring and return just prior to departure.
- Ship's crew can use their time for more productive jobs and keep uninterrupted rest hours.
- No need for crew to modify rope arrangements due to tidal and draft changes.
- Improved personnel safety.
- Mooring loads and status known at all times.
- Less wear and tear on ropes, winches, ship's hulls and plating.
- Automatic ship repositioning facility results in fuel saving for vessels.
- Reduced use of the vessel's propulsion system and of tugs during berthing diminishes fuel consumption and emission.

Statistics





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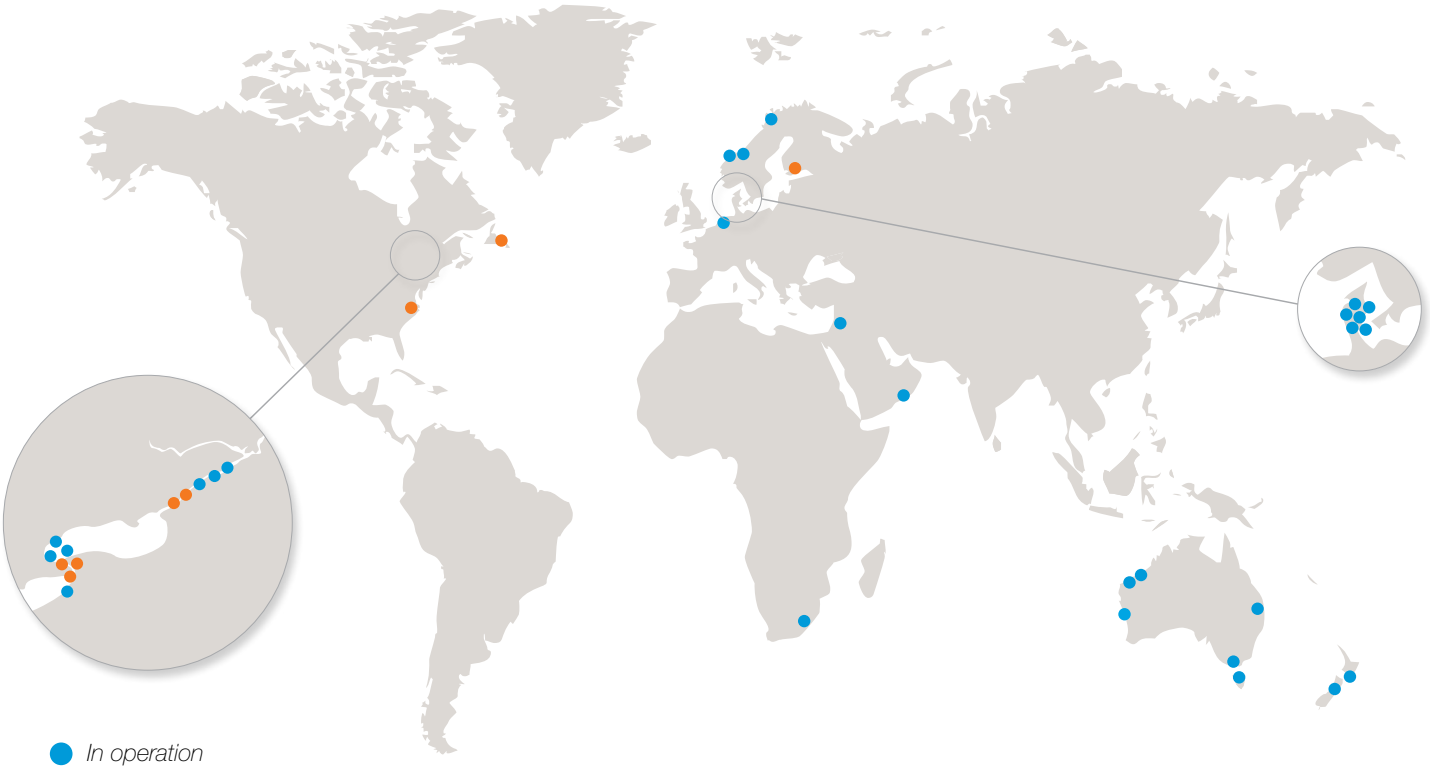
MoorMaster™ references

MoorMaster™ first entered service in 1999 at a ferry application in New Zealand. At this point, MoorMaster™ was a bold challenge to thousands of years of conventional mooring methods.

Today, MoorMaster™ is a widely accepted technology that has performed over 130,000 mooring operations, with a 100 per cent safety record, at ferry, bulk handling, Ro-Ro, container and lock applications all around the world.

Cavotec engineers continue to develop MoorMaster™ and are perfecting new ways the technology can be used to improve safety, operational efficiency and realise infrastructure savings.



- *In operation*
- *Installation pending*

Port of Salalah, Oman (Container ships)	7-9
Port of Beirut, Lebanon (Container ships)	10
Port of Ngqura, South Africa (Container ships)	11
Port Hedland, Australia (Dry bulk carriers)	12
Port of Geraldton, Australia (Dry bulk carriers)	13
Port of Narvik, Norway (Dry bulk carriers)	14
Ports of Hou & Sælvig, Denmark (Ferries)	15
Ports of Spodsbjerg & Taars, Denmark (Ferries)	16
Ports of Ballen & Kalundborg, Denmark (Ferries)	17
Ports of Melbourne & Devonport, Australia (Ferries)	18
Port of Picton, New Zealand (Ferries)	19
Port of Wellington, New Zealand (Ferries)	20
Port of Den Helder, Netherlands (Ferries)	21
Ports of Lavik & Oppedal, Norway (Ferries)	22
Brisbane, Australia (Dredger)	23
Port of Dampier, Australia (Tankers)	24
Great Lakes, Canada (Locks)	25

US Navy, USA (Ship to ship)	*Expected operation Q3-15*
Port of Helsinki, Finland (Ferries)	*Expected operation Q1-16*
Great Lakes Locks, Canada & USA (Locks)	*All locks fully automated by 2017*
Newfoundland Labrador Ferries, Canada (Ferries)	*Expected operation Q2-16*

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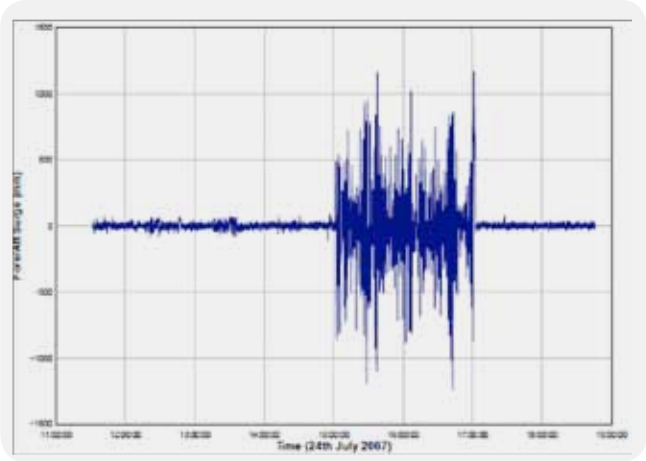
Berth 1, Port of Salalah, Oman

Container ships

Product:	MM200C[17]
Type:	Front mounted
Capacity:	12 x 200kN = 240 tonnes
Moorings:	3-4 times per week
Route:	Global
Vessel names:	Various
LOA:	Container vessels up to 362m
Operator:	APM Terminals
Owner:	Port of Salalah
In operation:	Since 2009



MoorMaster™ automated mooring systems are in use at the Port of Salalah at two of the port's six container berths, where they moor vessels of up to 362m LOA. The most recent installation has a holding force of 2,400 kN, provided by 12 x MM 200 units. The primary reason for the Port of Salalah to use vacuum mooring is to dampen vessel surge motion that occurs during the Khareef season, when surges up to +/- 2.5m occur with rope mooring. Cargo handling efficiency tends to drop dramatically, by between 30 and 40 per cent, during this period. MoorMaster™ holds vessels in a stable position (±50-100mm) and also eliminates vessel creep, thus maintaining operational efficiency. Due to the speed of operation of the MoorMaster™ units - attaching in 30 seconds and detaching in ten - the port is able to optimise the use of pilots and tugs, as both are able to leave vessels earlier and return later. Major shipping lines such as MSC and Maersk use these MoorMaster™ berths.

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Berth 6, Port of Salalah, Oman

Container ships

Product:	MM600
Type:	Shore-based
Capacity:	4 x 600kN = 240 tonnes
Moorings:	3-4 times per week
Route:	Global
Vessel names:	Various
LOA:	Up to 350m
Operator:	APM Terminals
Owner:	Port of Salalah
In operation:	Since 2006

Following the success of trials carried out in 2005, the Port of Salalah installed four MoorMaster™ 600s at a berth servicing container vessels of up to 350 metres LOA and 130,000 tonnes displacement. MoorMaster™ has proven to be an extremely efficient tool for the control and reduction of vessel motion, dramatically improving productivity through time savings during berthing, loading and departure.

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Berth 5, Port of Salalah, Oman

Container ships

Product:	MM400E[15]
Type:	Deck mounted
Capacity:	8 x 400kN = 3,200 tonnes
Moorings:	3-4 times per week
Route:	Global
Vessel names:	Various
LOA:	Up to 350m
Operator:	APM Terminals
Owner:	Port of Salalah
In operation:	Since 2015

Continuing their drive to better serve their customers, Port of Salalah decided in 2014 to install MoorMaster™ on another of their six active container berths. This time berth 5. As with previous installations the objective was to mitigate the surge issues experienced during the Khareef (long wave) Season. On this occasion both Port of Salalah and Cavotec determined that the newest MoorMaster™ model was the best solution and 8 x MM400E[15] units were produced and installed. This installation also represents an increase in holding power from 2,400 tonnes on berths 1 and 6 to 3,200 tonnes. The increase was requested by the port to ensure that more vessels could benefit from the system where vessel geometry prevented all units from being employed.

Port of Beirut, Lebanon

Container ships

Product:	MM200C[17]
Type:	Shore-based
Capacity:	42 x 200kN = 840 tonnes
Moorings:	Expected 5-8 times per week
Route:	Global
LOA:	Container ships up to LOA 350m
Operator:	Port of Beirut
Owner:	Port of Beirut
In operation:	Since Q1 2014

Having determined that it would be economically unviable to extend the existing breakwater to protect a new 500m quay extension, the Port of Beirut needed a solution to mitigate wave induced vessel motions at the unprotected berth. Numerical studies clearly demonstrated MoorMaster's superiority over ropes in this kind of environment, and the port opted to implement this technology after having also considered the added benefits of faster vessel turnaround times, and increased safety levels at the terminal. The MoorMaster™ system covers the entire 500m extension of the 1100m long quay no. 16. A total of 42 MM200C[17] units have been installed, and these were commissioned in early 2014. The units are mounted in pairs with one unit on each side of each fender. Each pair shares a slimline & service friendly hydraulic and vacuum service enclosure that has been designed for temporary immersion during storm conditions when waves can overtop the berth. The MM200C[17] system has all the typical characteristics of the MoorMaster™ product including remote operation, active vessel position control, self-diagnostics and the ability to operate in temperatures up to +50°C.

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Port of Ngqura, South Africa

Container ships

Product:	MM200C[17]
Type:	Front mounted
Capacity:	26 x 200kN = 5,200 tonnes
Moorings:	3-4 times per week
Route:	Global
Vessel names:	Various
LOA:	up to 366m
Operator:	Transnet
Owner:	Transnet
In operation:	Since 2015

Transnet National Ports Authority (TNPA) awarded a contract to Cavotec for automated mooring units at the Port of Ngqura's container terminal. Cavotec designed, manufactured and installed 26 MoorMaster™ MM200C[17] units for a container berth at the port which is located on South Africa's East coast. The system moors container ships from 1,500 TEU up to 13,000 TEU and 366m LoA. In addition to the supply of the MoorMaster™ equipment, Cavotec undertook a hydrodynamic mooring study to verify unit numbers and location, and to supply one year of onsite support and maintenance as well as training local technicians in Cavotec´s Italian manufacturing plant. Additionally Cavotec took full responsibility for the installation work including civil works and electrical distribution. The Port of Ngqura experiences significant long wave effects and high winds, especially during winter, causing excessive movement in the ships along the quay wall which interferes with crane operations. As a result there is a lot of downtime in cargo operations affecting the terminal's efficiency targets.

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Port Hedland, Australia

Dry bulk carriers

Product:	MM200C[23]
Type:	Front mounted
Capacity:	14 x 200kN = 280 tonnes
Moorings:	1 time every second day
Route:	Global
Vessels:	Large bulk carriers
LOA:	up to LOA 295m
Operator:	Port Hedland Port Authority
Owner:	PHPA
In operation:	Since 2010

Fourteen MoorMaster™ MM200 units, with a total capacity of 2,800kN, spaced at 14m intervals, are installed at Port Hedland in Western Australia. The MoorMaster™ units moor dry bulk carriers of up to 135 kdwt, 295m LOA.
The units and vessels at the 270m long berth, located at the harbour mouth, are exposed to strong tidal currents and hydrodynamic effects created by passing ships.
The maximum size of vessels (LOA 295m) is longer than the berth itself that was originally designed for LOA 200m bulk carriers. MoorMaster™ has thus enabled the PHPA to accept larger vessels and thereby increase capacity without the need for costly infrastructure investment.
Furthermore, MoorMaster™ comprehensively addresses critical personnel and vessel safety concerns of the PHPA. These MoorMaster™ units are built to withstand the harsh environmental conditions at the port: up to 2 kn current, 7m tidal variations, vast amounts of fine iron ore dust and extreme heat (+45°C).

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Port of Geraldton, Australia

Dry bulk carriers

Product:	MM200C[23]
Type:	Dolphin mounted
Capacity:	12 x 200kN = 240 tonnes
Moorings:	3-4 times per week
Route:	Global
Vessel names:	Various
LOA:	Panamax bulk vessels
Operator:	Karara Mining
Owner:	Karara Mining
In operation:	Since late 2012

The Port of Geraldton, Western Australia suffers significant downtime as a result of long waves. Similar to the Port of Salalah, vessel motions caused by these waves often require the port to be abandoned.
When Karara Mining began examining the feasibility of building berth 7 in Geraldton to service their new mine, the investigation revealed an unacceptable level of berth inoperability as a result of the long wave, ocean swell and berth location.
After consulting Cavotec and completing further computational studies it was shown that the implementation of MoorMaster™ would result in a very large increase in uptime.
Additionally by utilising MoorMaster™ Karara Mining did not need to build the originally proposed mooring dolphins resulting in a large saving in infrastructure costs.

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Port of Narvik, Norway

Dry bulk carriers

Product:	MM200C^{17}
Type:	Front mounted
Capacity:	18 x 200kN = 360 tonnes
Moorings:	2-4 times per week
Route:	Global
Vessel names:	Various carriers up to 185,000 DWT
LOA:	up to 305 m
Operator:	LKAB
Owner:	LKAB
In operation:	Since 2015

Cavotec supplied 18 MoorMaster™ 200C^{17} units for international minerals group LKAB's new iron ore berth in Narvik, northern Norway, on behalf of the PEAB construction and civil engineering group. The scope of the order included manufacture of the mooring units and comprehensive technical support. The units moor bulk carriers of up to 185,000 DWT and 305m LoA. This is the first MoorMaster™ bulk handling application in Europe, and the first located within the Arctic Circle. The MM200C^{17} units for this project are built to withstand the harsh winters and demanding operational conditions common to its location. The LKAB facility at Narvik ships 15-20 million tonnes of iron ore every year. The MoorMaster™ units ensure vessels are moored quickly, safely and remain in position to ensure fast and efficient loading operations.

Ports of Hou & Sælvig, Denmark

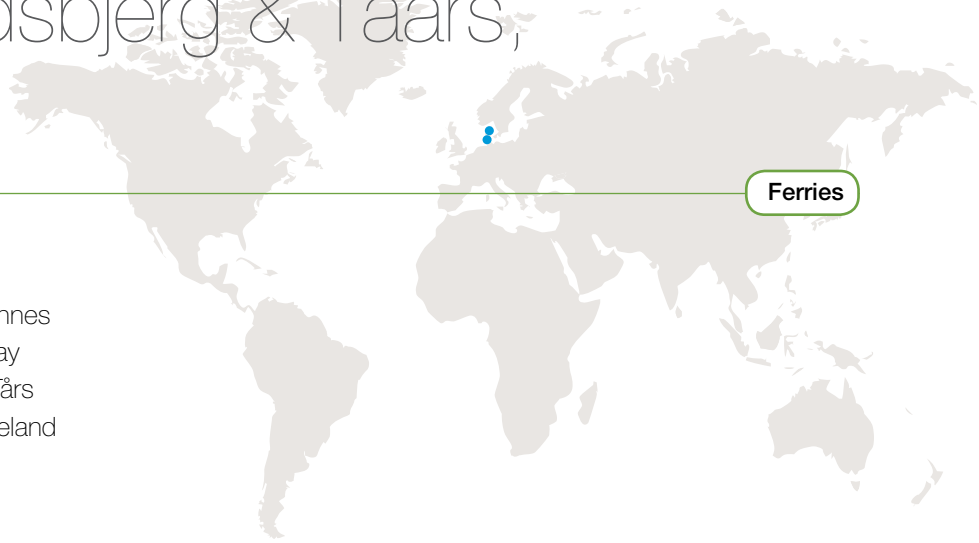
Ferries

Product:	MM400A[10]
Type:	Shore-based
Capacity:	1 x 400kN = 40 tonnes
Moorings:	14 times per day
Route:	Hou – Sælvig (Samsø)
Vessel name:	Prinsesse Isabella
LOA:	99m
Operator:	Samsø Rederi
Owner:	Samsø Rederi
In operation:	Since 2015

Samsø Municipality and their ship operator, Samsø Rederi, won the 10 year concession for the Hou/Sælvig route and decided to order a new-build 99m long LNG powered ferry. In addition to the new vessel Samsø Rederi decided to use a MoorMaster™ system, similar to that of the former operator on the route, Færgen A/S. As the new ferry is using a king-pin system in the linkspan, only one MoorMaster™ 400A[10] unit is required to moor the seaward end of the vessel. The MoorMaster™ system is equipped with an AIS system that detects the proximity of the ship to the berth ensuring optimized use of the system. Cavotec included an additional feature, high water level mode. This enables the quick, one button push, alteration of the attachment position in the event of extreme high water at the berth.

From the wheelhouse, the captain controls the mooring which is completed in less than 40 seconds after the stern end is secured with the ramp king-pin. Automated handling methods are important for the client to enable fast and efficient operation on the frequent route with minimum crew onboard and onshore.

Ports of Spodsbjerg & Taars, Denmark



Ferries

Product:	MM400A[10]
Type:	Shore-based
Capacity:	400kN = 40 tonnes
Moorings:	36 times per day
Route:	Spodsbjerg – Tårs
Vessel names:	Lolland & Langeland
LOA:	99m
Operator:	Færgen A/S
Owner:	Færgen A/S
In operation:	Since 2012

Following the succes of using MoorMaster™ automatic mooring on the Samsø route, Færgen A/S implemented a MoorMaster™ 400 system in the 2 ferry ports, Tårs and Spodsbjerg, connecting the islands of Lolland and Langeland. The fast mooring is secured with the use of a kingpin solution combined with a MM400 unit taking care of the bow mooring. The MoorMaster™ automatically adjusts to tidal conditions ensuring the vessel is constantly in optimal position. The ship's hull is also better protected because MoorMaster™ continuously holds the vessel at a preset distance from the fender line. Operated with wifi and radio communication the mooring is secured from the bridge in short order, allowing the ship crew to concentrate on servicing passengers without having to depend on shore crew.
The 2 double-ended ferries run 36 cruises every day and the demand for short turnaround times and limited crew numbers is vital for the operation.

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Ports of Ballen & Kalundborg, Denmark

Ferries

Product:	MM400A[10]
Type:	Shore-based
Capacity:	2 x 400kN = 40 tonnes
Moorings:	5 times per day
Route:	Kalundborg- Ballen (Samsø)
Vessel name:	Kanhave
LOA:	91m
Operator:	Færgen A/S
Owner:	Færgen A/S
In operation:	Since 2015

Færgen A/S purchased their first MoorMaster™ system in 2008 when they won the operation of the Hou-Samsø route. When they in 2014 lost the renewal of the concession, they decided to remove the MoorMaster™ units, refurbish them and install them on another site nearby, the Ballen-Kalundborg route. The 91m long ferry, Kanhave, serve passengers travelling from Sealand to the island of Samsø. 5 times each day the ferry is quickly moored with Cavotec´s automated mooring system with an advanced, but simple control system from the wheelhouse of the ship. The MoorMaster™ system ensures that the ship is constantly in optimal position and captain can even perform a shifting of the ship with the system without the need of turning on the ship´s engines.

Ports of Melbourne & Devonport, Australia

Ferries

Product:	MM400A[10]
Type:	Shore-based
Capacity:	4 x 400kN = 160 tonnes
Moorings:	1 time per day
Route:	Melbourne – Devonport
Vessel names:	Searoad Tamar, Searoad Mersey
LOA:	118m, 149m
Operator:	Searoad Holdings Pty Ltd
Owner:	Searoad Holdings Pty Ltd
In operation:	Since 2003

MoorMaster™ automated mooring technology first saw service in Australia at the port of Melbourne, on a dedicated berth used by two Ro-Ro vessels; the Searoad Tamar, (149 metres, 13,697 tonnes displacement), and the Searoad Mersey, (118 metres, 7,928 tonnes displacement). The MoorMaster™ system consists of four MM400 units, each rated at 40 tonnes. The units are positioned in pairs, forward and aft of the amidships line. Similar to the MoorMaster™ systems employed at Picton, New Zealand, these MM400s are activated from the bridge wing, extending to attach to the ship's hull. To accommodate displacement caused by local tide variations and draft change, this system employs the patented 'stepping' method. The application also offers the considerable advantage of being able to shift vessels along the berth. The system has been in daily operation since 2003.

Port of Picton, New Zealand

Ferries

Product:	MM400A[10]
Type:	Shore-based
Capacity:	2 x 400kN = 80 tonnes
Moorings:	3 times per day
Route:	Picton – Wellington
Vessel name:	Kaitaki
LOA:	181m
Operator:	KiwiRail Ltd
Owner:	KiwiRail Ltd
In operation:	Since 2005

The introduction of a new and longer vessel for the Picton to Wellington route in 2005 required the extension of the Picton pier – if conventional mooring ropes were used.

Avoiding the cost of extending the pier by at least 60 meters or driving piles for mooring platforms, Toll Shipping opted to install two MoorMaster™ 400 units at the end of the pier. Picton now enjoys the benefits of safe, swift and efficient operations, while having also made considerable capital expenditure savings.

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Port of Wellington, New Zealand

Ferries

Product:	MM400A[10]
Type:	Shore-based
Capacity:	2 x 400kN = 80 tonnes
Moorings:	3 times per day
Route:	Wellington - Picton
Vessel name:	MV Aratere
LOA:	180m
Operator:	KiwiRail Ltd
Owner:	KiwiRail Ltd
In operation:	Since 2011

The MV Aratere underwent a major re-fit that included an additional 30m of length (now LOA 180m). This would require that the existing rail berth in Wellington be lengthened.

By implementing MM400 units for the bow mooring KiwiRail were able to avoid lengthening the pier and thereby save both project cost and time.

2 MM400 units were especially modified to reduce the overall height due to possible interference issues with other vessels using the berth.

Port of Den Helder, Netherlands

Ferries

Product:	MM400A[10]
Type:	Fixed to a Floating terminal
Capacity:	2 x 400kN = 80 tonnes
Moorings:	16 times per day
Route:	Texel - Den Helder
LOA:	LOA 110m & 130m ferries
Operator:	Teso
Owner:	Teso
In operation:	Since Q1 2014

Teso runs a high frequency ferry route between Den Helder and the island of Texel with 2 passenger ferries. Following increased pressure from municipalities to improve air environment in port areas, Teso decided to change the berthing procedures from the ferries running their engines during the entire time at berth, to idling after a few seconds. This was made possible by installing 2 MoorMaster™ units securing safe mooring very shortly after the touch of a button on radio remote control on-board the ferry.
The 2 MM400A[10] units, each being able to perform 400kN holding force, are fixed to a floating steel structure (pontoon) at the terminal. Teso is now benefitting not only from very fast and safe mooring of their ferries, but is also saving a lot of fuel. Furthermore the time saving has enabled the ferry line to better keep the schedule. The MM400A[10] system has all the typical characteristics of the MoorMaster™ product including remote operation, active vessel position control, self-diagnostics and the ability to operate from -25 to +50° C temperature range.

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Ports of Lavik & Oppedal, Norway

Ferries

Product:	MM200E[15]
Type:	Shore based
Capacity:	1 x 200kN = 20 tonnes
Moorings:	16 times per day
Route:	Lavik-Oppedal (crossing the Sognefjord)
Vessel name:	Ampere (Battery driven)
LOA:	86m
Operator:	Norled
Owner:	Norled
In operation:	Since 2015

Cavotec won a unique order to manufacture fully integrated MoorMaster™ automated mooring and Alternative Maritime Power (AMP/APS) electrical supply systems for two Norled frequent-use ferry berths in western Norway, servicing the world's first fully battery powered ferry, Ampere. The first systems in the world that integrate automated mooring & automated shore-to-ship APS! The systems have been installed at the Lavik and Oppedal passenger ferry berths, and are used by the catamaran-hulled ferry, run by Norwegian ferry operator Norled. The 86m long vessel has a capacity for around 120 cars and 360 passengers, and makes 17 crossings of the Sognefjord daily. The MoorMaster™ units are operated by Cavotec hand-held radio remote controls by the ship's captain from the bridge of the vessel, and signals to the APS unit when the ship is secure, whereafter a laser sensor then guides the AMP connector to a hatch in ship hull, connecting to the ship's battery to start charging.
By using MoorMaster™ the ferry's propeller system can be switched off for nine minutes during each 10-minute boarding process, thereby saving power. With around 6,000 port calls made annually, the air quality improvement and fuel cost savings compared to using conventional mooring and power systems is considerable.

Brisbane, Australia

Dredger

Product:	MM200[23]
Type:	Front mounted
Capacity:	8 x 200kN = 1600 tonnes
Moorings:	2 times per day
Route:	Local area
Vessels:	Dredging vessels
LOA:	183m
Operator:	Jan de Nul
Owner:	Jan de Nul
In operation:	Since April 2014

Jan de Nul (JdN) had been contracted to reclaim land for the second runway at Brisbane Airport. This process involved dredging sand from the seabed and discharging at a fixed location on a 12 hour dredge – discharge cycle. During project planning, it was discovered that mooring the Charles Darwin hopper dredge by conventional methods during discharge, as required by the Brisbane Harbour Authority, would make it impossible for Jan del Nul to meet the stipulated project schedule. This challenge was overcome by utilising MoorMaster™. Jan de Nul were able to source eight MoorMaster™ MM200C[23] units from a previous Cavotec customer enabling a very short system delivery. Cavotec were contracted to re-factory test the units, provide engineering details to assist with dolphin construction, support installation and commissioning and re-warrantee the units as new for a period of 12 months.

The reduced mooring times, from 2 hours to approximately 30 seconds ensured the required schedule was not only achieved but the reclamation was completed ahead of schedule. Following the successful completion Jan de Nul removed the MoorMaster™ system which was placed in storage for future use.

Port of Dampier, Australia

Tankers

Product:	MM200C[23]
Type:	Dolphin / Shore-based
Capacity:	8 x 200kN = 160 tonnes
Moorings:	approx. 1 time per week
Route:	Various
Vessels:	Tankers up to 60,000 dwt
LOA:	Various
Operator:	Rio Tinto
Owner:	Rio Tinto
In operation:	Since 2011

Rio Tinto were required to build a fuel loading facility to service their mines and other operations in North West Australia.
Two dolphins were built with 4 x MM200D units on each to negate the need for mooring dolphins.
The MoorMaster™ system is configured to moor tankers up to 60,000 dwt in winds of 45knots and swells of up to 1m.
This system enabled the client to save significantly on capital invested and thus keep the project within the required budget.

CAVOTEC

Great Lakes Locks, Canada

Locks

Product:	MM400L^{22}
Type:	Front mounted in lock wall
Capacity:	3 x 400kN = 120 tonnes per lock
Moorings:	4-5 times per day
Route:	Global
Vessel name:	Various
LOA:	up to 225m
Operator:	SLSMC
Owner:	SLSMC
In operation:	Since 2014

In 2007 Cavotec began working with St Lawrence Seaway Management Corp (SLSMC) to develop the best possible MoorMaster™ system for use in their locks. The initial installations were in the Welland Canal Lock 7 with 2 MoorMaster™ prototypes trailed. Using the information gathered SLSMC and Cavotec worked together to refine the system with improved capacity and performance to meet the demands of the entire SLSMC lock system and their customers. The result was a brand new Generation IV system, known as the MM400L^{22}. The MM400L^{22} system is currently installed at 7 of 12 lock sites where water level change varies from 13-18 m. Approximately 97% of all vessels transiting the seaway can be successfully moored with the MoorMaster™ systems. The installation of the remaining MM400L^{22} systems will continue during 2016 and 2017. By the close of 2017 all ships passing through the seaway to and from the Great Lakes will benefit from automated mooring. MM400L^{22} has all the typical characteristics of the MoorMaster™ product including remote operation, active vessel position control, self-diagnostics and the ability to operate from -25 to +50°C temperature range.

We are present in

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Norway
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For more information please visit our website www.cavotec.com
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