

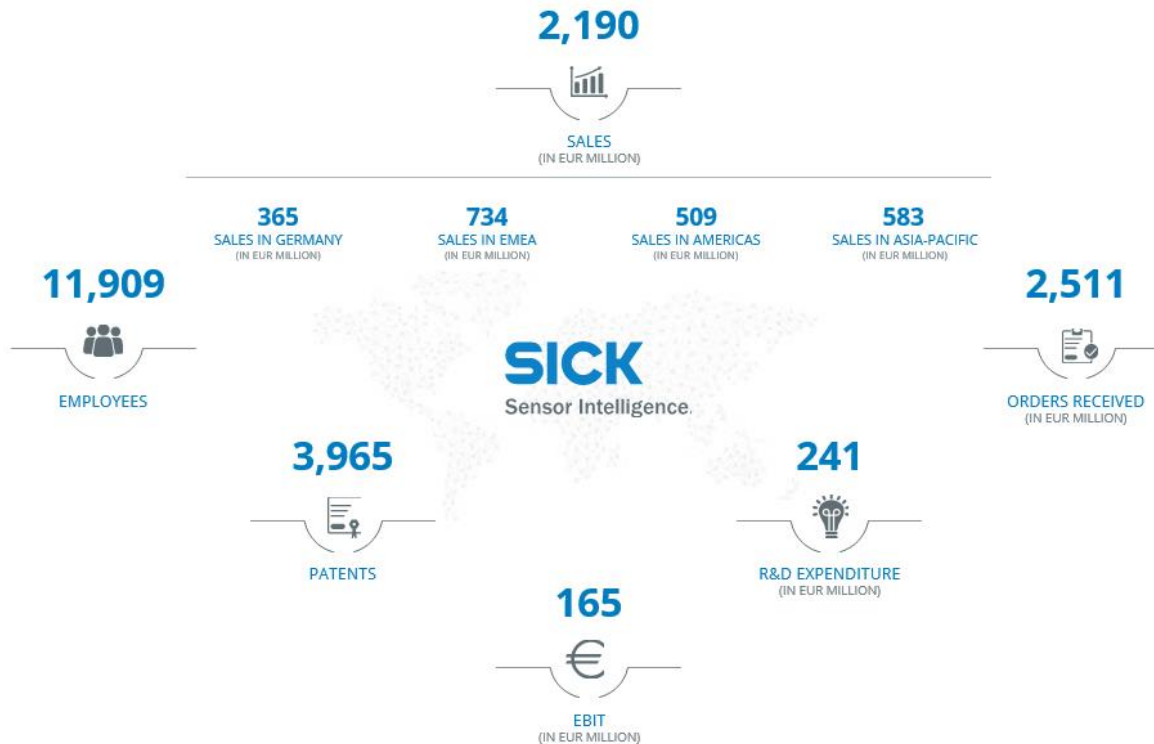


Digital Solutions for Maritime Exhaust Gas Monitoring

Heikki Kangas / Hinrich Brumm / Christian Lohner

SICK at a glance

Key figures (fiscal year 2022)



WE ARE ONE OF THE WORLD'S LEADING COMPANIES

WE DEVELOP SENSOR SOLUTIONS FOR CUSTOMERS AROUND THE GLOBE



SICK MARITIME OFFERING

Benefit from the experience of a leading manufacturer in maritime emission monitoring

Installed Fleet



Global Service Network



- Running fleet of more than 2,000 vessels with MARSIC
- Type Approved solution
- Leading market position for Maritime Emission Monitoring
- New alternative fuels like ammonia or methanol will have new requirements
→ SICK can be a partner for this journey

SICK Maritime Suite Digital Solution



- Training
- Spare parts and modules
- Module exchange
- Trained service technician
- Global service port infrastructure

SICK MARITIME SUITE

Emission compliance assurance

MARdiagnostics

Condition Monitoring for increased CEMS availability



MARlogger

On premises GHG emission monitoring



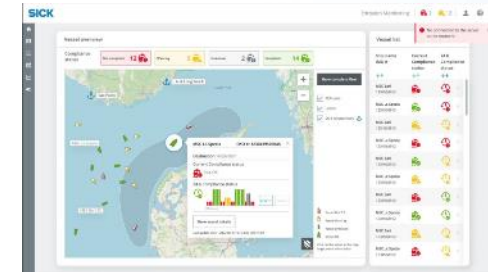
Asset Management

All details always @ hands



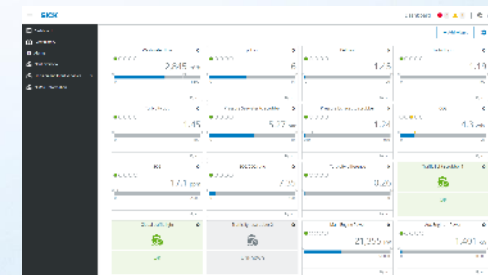
New optional services

Based on "SICK Maritime Suite"



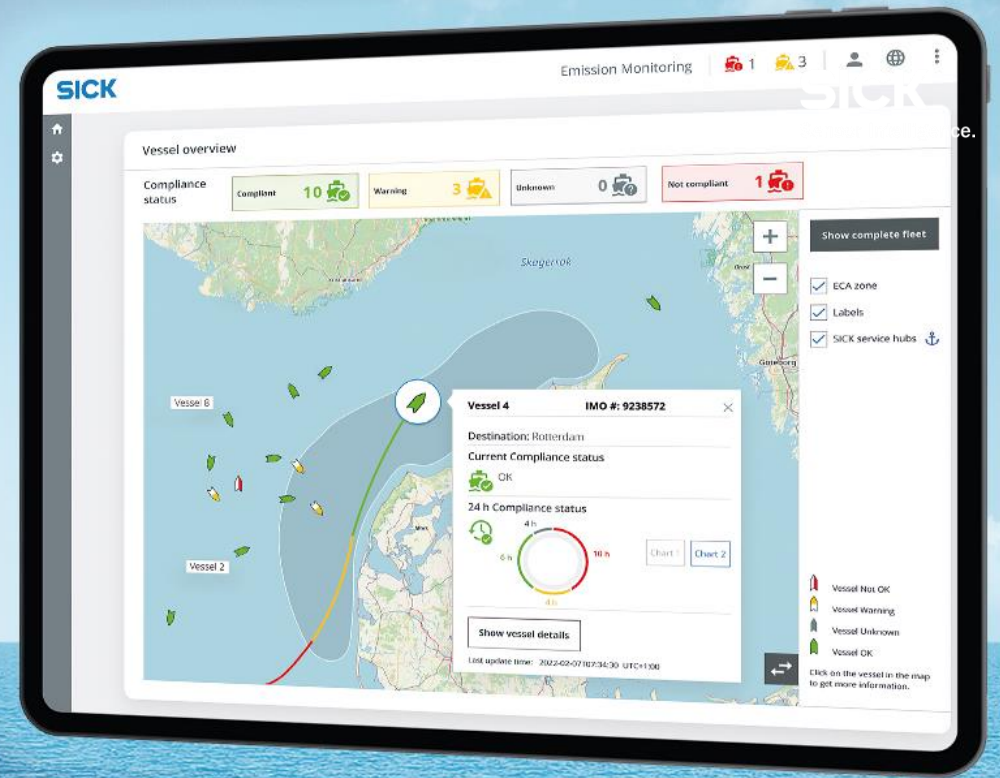
MARtracker

Transparency of emission data



MARpems

Increased Scrubber availability and Emission Compliance

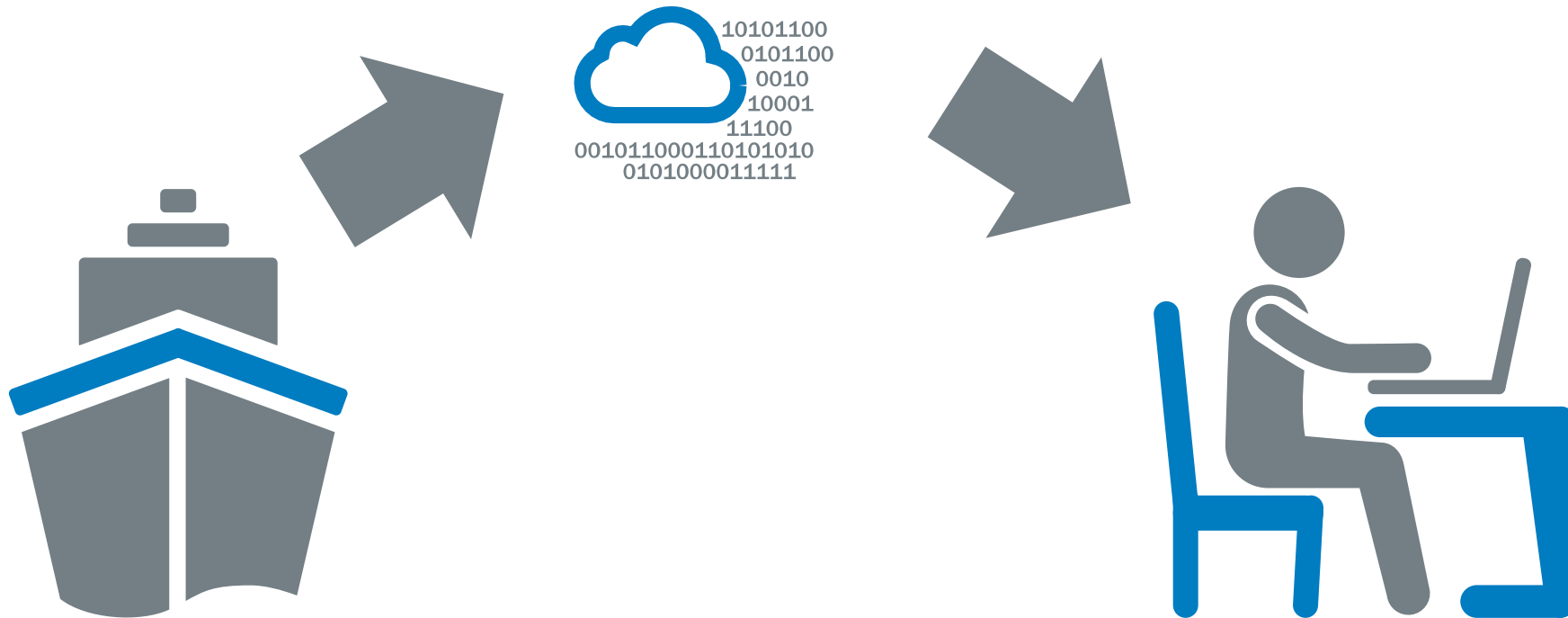


MARtracker

Monitor adherence to emission limit values in real time

SICK Maritime Suite

MARtracker – Online Compliance Monitoring Principle



SICK Maritime Suite

MARtracker – Online Fleet Overview independent from scrubber manufacturer

The screenshot displays the SICK Maritime Suite MARtracker interface. At the top left, the SICK logo is visible. The main area is titled "Fleet overview" and features a world map with vessel icons. A compliance status summary bar at the top of the map shows: Not OK (2), Warning (0), OK (6), and Offline (0). A detailed vessel information popup is open over a vessel on the map, showing its IMO number, current compliance status (Compliant), and 24-hour compliance status (Compliant). A "Show vessel details" button is present in the popup. To the right of the map, there are checkboxes for "Show complete fleet", "ECA zones", "Labels", and "SICK service hubs". A legend at the bottom right of the map identifies vessel status icons: Vessel Not OK (red), Vessel Warning (yellow), Vessel OK (green), and Vessel Offline (grey). On the right side of the interface, a "Vessel list" table shows 8 vessels in total. The table has columns for Ship name, IMO #, Current Compliance status, and 24 h Compliance status. The first two vessels are marked as "Not OK" (red icons), and the remaining six are marked as "OK" (green icons). A "Show vessel details" button is located below the vessel list.

Ship name	IMO #	Current Compliance status	24 h Compliance status
		Not OK	Not OK
		Not OK	Not OK
		OK	OK
		OK	OK
		OK	OK
		OK	OK
		OK	OK
		OK	OK

- Fleet overview incl. compliance status
- Different access levels and vessel visualization dependent on user right, e.g. Superintendent vs Fleet Manager
- Detailed vessel view incl. position on map

SICK Maritime Suite

MARtracker – Detail Vessel View

SICK

Vessel details | 2 | 0 |

Compliance status
OK

24 h Compliance status: Compliant
Speed over ground (SoG): 18.8 kn
Course over ground (CoG): 265.7°
Position: 16°47'46"N 119°43'34"W
Data received: 7 minutes ago

Current ECA: None

EGCS 1 | **EGCS 2**

Main Scrubber ✓

State of operation: on
ECA mode: off
USVGP mode: off
Water quality mode: on
Manoeuvre mode: off
Current SO₂/CO₂ ratio limit: 13.6

Last update time: 2/29/2024 16:34 GMT+1

Map showing vessel route and ECA zones. Legend: Vessel Not OK, Vessel Warning, Vessel OK, Vessel Outline.

- Detailed Vessel view
- Route information
- Compliance Status
- Emission values

SICK Maritime Suite

MARtracker – Process Parameter

SICK

Vessel details | 0 | :

The screenshot displays the 'EGCS details' page for a vessel with IMO 9. It features two columns of data for 'Details EGCS 1' and 'Details EGCS 2'. Each column includes operational status, power consumption, and various sensor readings for exhaust gas, sea water, and wash water. Emission sources for the main and auxiliary engines are also listed.

Details EGCS 1		Details EGCS 2	
State of operation:	on	State of operation:	on
Operating mode:	open loop	Operating mode:	open loop
ECA mode:	off	ECA mode:	off
USVGP mode:	off	USVGP mode:	off
Water quality mode:	on	Water quality mode:	on
Manoeuvre mode:	off	Manoeuvre mode:	off
Total power:	36.5 MW	Total power:	2.0 MW
Exhaust gas		Exhaust gas	
Temperature inlet:	203.0 °C	Temperature inlet:	399.0 °C
Temperature outlet:	29.0 °C	Temperature outlet:	29.0 °C
Differential pressure tower:	6.9 mbar	Differential pressure tower:	0.9 mbar
SO2:	62.9 ppm	SO2:	51.0 ppm
CO2:	4.6 vol%	CO2:	6.7 vol%
SO2/CO2 ratio:	13.6	SO2/CO2 ratio:	7.6
Sea water		Sea water	
Pressure:	5.5 bar	Pressure:	5.0 bar
Temperature inlet:	0.0 °C	Temperature inlet:	0.0 °C
pH inlet:	0.0	pH inlet:	0.0
Wash water		Wash water	
Flow rate:	2479.0 m³/h	Flow rate:	290.2 m³/h
Temperature discharge:	32.7 °C	Temperature discharge:	32.7 °C
pH discharge:	4.7	pH discharge:	4.7
Turbidity difference:	0.3 NTU	Turbidity difference:	0.3 NTU
PAH difference:	18.4 µg/l	PAH difference:	18.6 µg/l
Emission sources		Emission sources	
Main Engine:	on	Aux Engine 1:	off
Aux Engine 3:	off	Aux Engine 2:	on
Aux Engine 4:	on	Aux Boiler:	off

Last update time: 2/29/2024 16:34 GMT+1

- Detailed scrubber values
- Option to identify potential cost saving
- Emission values
- Further sensor data feasible
- Option for vessel comparison

SICK Maritime Suite

MARtracker – Events

SICK

Vessel details | 2 0 |

Overview EGCS details **Events** Charts Reports

IMO 93 - Event history

Filter by compliance status

Not compliant Warning Compliant Info

Events: All Time range: 02/22/2024 - 02/29/2024 Clear all filters

Compliance status	Description	start	stop	ID
	EGCS 1: Scrubber operation started	2/29/2024 09:40 GMT+1	2/29/2024 09:40 GMT+1	01HQT0BC1FWZWP4Z6BVVF239...
	EGCS 2: Open Loop activated	2/29/2024 09:40 GMT+1	2/29/2024 09:40 GMT+1	01HQT0BC1FV8HKTAN07798BVKW
	EGCS 1: Compliance Status changed to Compliant	2/29/2024 09:40 GMT+1	-	01HQT0BC1FMHFA4TRNCZXF...
	EGCS 1: Open Loop activated	2/29/2024 09:40 GMT+1	2/29/2024 09:40 GMT+1	01HQT0BC1F9NKTTR8TRXCVT...
	EGCS 2: Scrubber operation started	2/29/2024 09:40 GMT+1	2/29/2024 09:40 GMT+1	01HQT0BC1F7NZW6PSYD84QT...
	EGCS 2: Compliance Status changed to Compliant	2/29/2024 09:40 GMT+1	-	01HQT0BC1F23JG6R1DDJDK3M...
	Overall Compliance Status changed to Compliant	2/29/2024 09:40 GMT+1	-	01HQT0BC1F0A94P8YJ635P0A6H
	EGCS 2: PAH limit not compliant < 1 h	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4ZRSQG13NGGCCNX...
	EGCS 1: SO2/CO2 ratio limit not compliant < 1 h	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4ZRM4V1VEWCHRQY...
	EGCS 1: Turbidity limit not compliant < 1 h	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4ZH7DGC4A65GZ387JQV
	Overall Compliance Status changed to Warning	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4ZBQ8283BE8A56QZ8D
	EGCS 1: Compliance Status changed to Warning	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4ZB4QH386TMXE6...
	EGCS 1: PAH limit not compliant < 1 h	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4ZADWWQ14CQV0YD...
	EGCS 2: Turbidity limit not compliant < 1 h	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4Z78CBG7X8T51QJPG6
	EGCS 2: SO2/CO2 ratio limit not compliant < 1 h	2/29/2024 09:38 GMT+1	2/29/2024 09:40 GMT+1	01HQT08M4Z5JGV59DWHDMP...

Load more

Event details

Compliance status: The ship is compliant, no action necessary.

Description: EGCS 1: Compliance Status changed to Compliant

Start: 2/29/2024 09:40 GMT+1

Stop: -

ID: 01HQT0BC1FMHFA4TRNCZXFBBT6

- Event overview
- Option for notification
- Historical data available

SICK Maritime Suite

MARtracker – Charts

SICK

Vessel details | 2 | 0 | |



- Historical data in chart view
- Measurements as well as status information
- Customized selection of data

Overview EGCS details Events Charts **Reports**

IMO 9[redacted] - Report PDF Generation

Select time range for the generated report and optionally add more information.

Time range: 02/22/2024 - 02/29/2024

Supplied to: [input]

Comment: [input]

Generate Report

EGCS compliance report

IMO: 9[redacted]
Report generated: Thu, 29 Feb 2024 15:48:46 GMT

Timestamp from: Thu, 22 Feb 2024 15:45:46 GMT
Timestamp to: Thu, 29 Feb 2024 15:45:46 GMT
Generated by: Vasco da Gama
Supplied to:
Comment:

Trinity IMO: 9348947
generated: Thu, 29 Feb 2024 15:48:58 GMT
generated by SICK MARtracker

Map view

From: 19°4'17N 104°17'31"W
To: 19°47'37N 119°45'44"W

Trinity IMO: 9348947
generated: Thu, 29 Feb 2024 15:48:58 GMT
generated by SICK MARtracker

SO2/CO2 ratio

EGCS 1
Main Scubber

Trinity IMO: 9348947
generated: Thu, 29 Feb 2024 15:48:58 GMT
generated by SICK MARtracker



Adobe Acrobat
Document

- Reporting Function
- Time frame selection
- Reporting according current regulatory requirements
- Can be used for port state control

SICK MARITIME SUITE

Emission compliance assurance

Asset Management
All details always @ hands



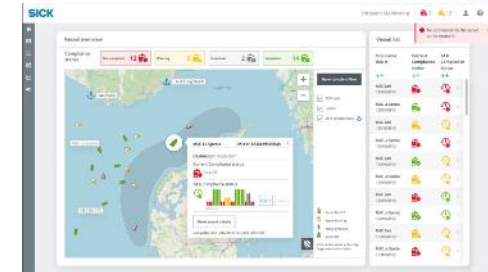
MARdiagnostics
Condition Monitoring for increased CEMS availability



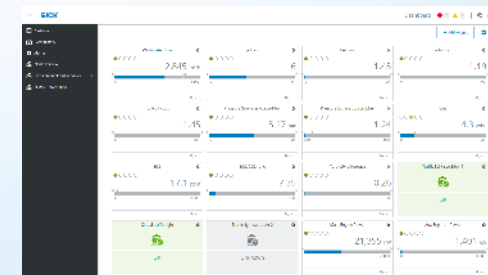
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Based on "SICK Maritime Suite"



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Transparency of emission data



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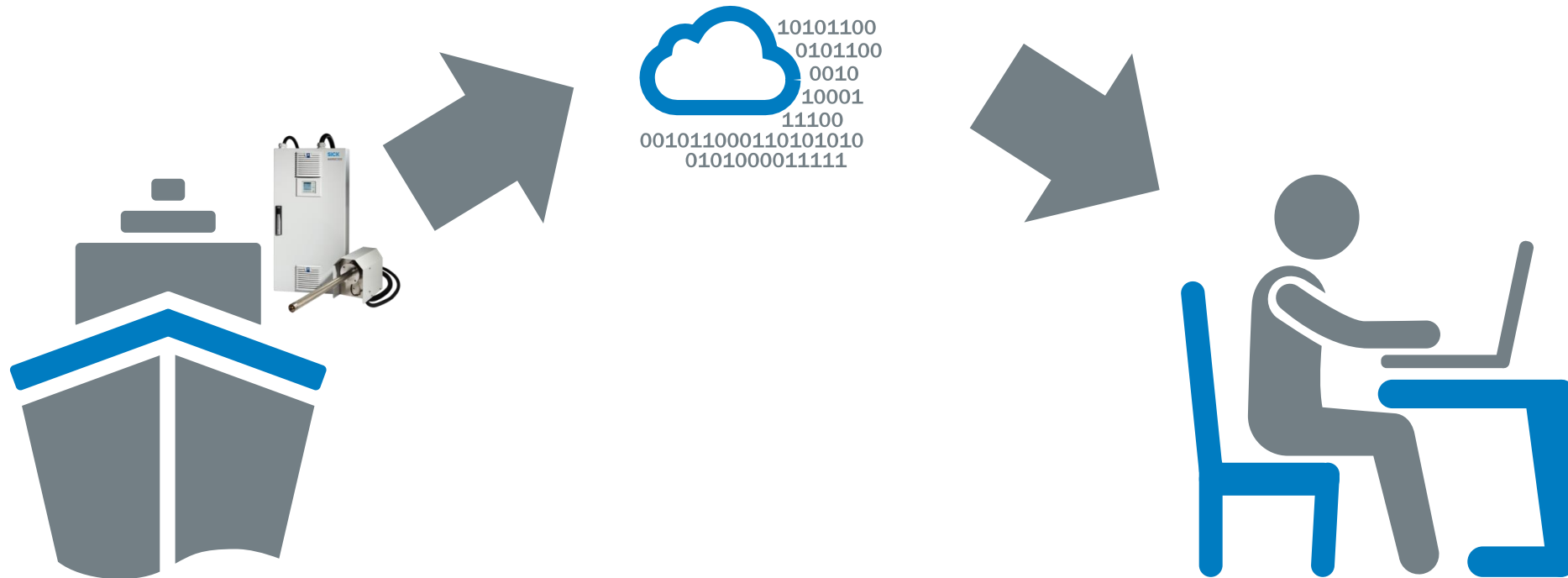


MARdiagnostics

Condition Monitoring for a more efficient service planning

SICK Maritime Suite

MARdiagnostics – Online Condition Monitoring for MARSIC300











SICK Maritime Suite

MARdiagnostics - Online Condition Monitoring for MARSIC300












Dashboard

4 Geräte

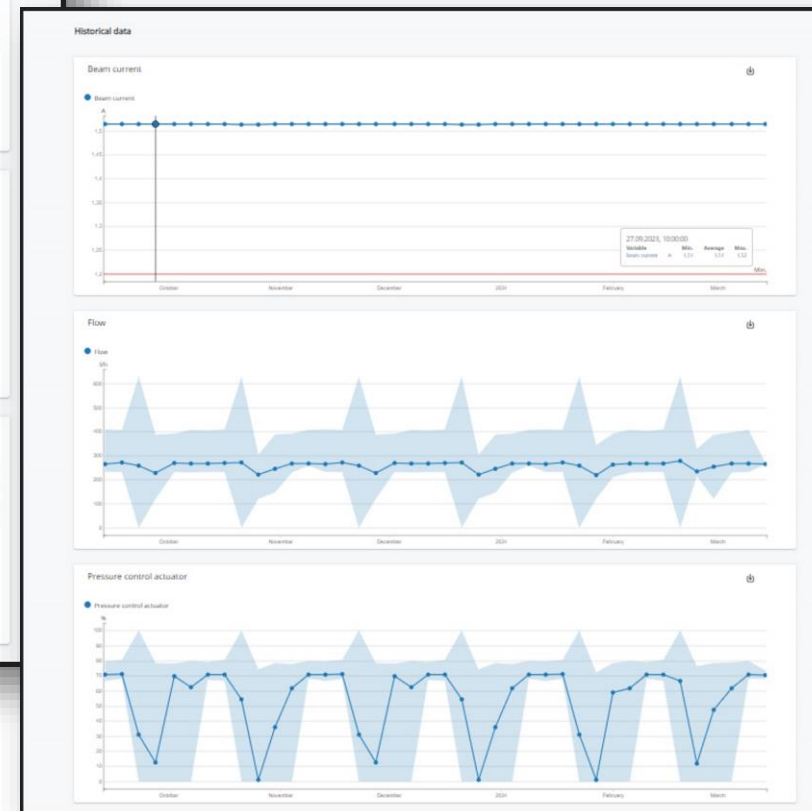
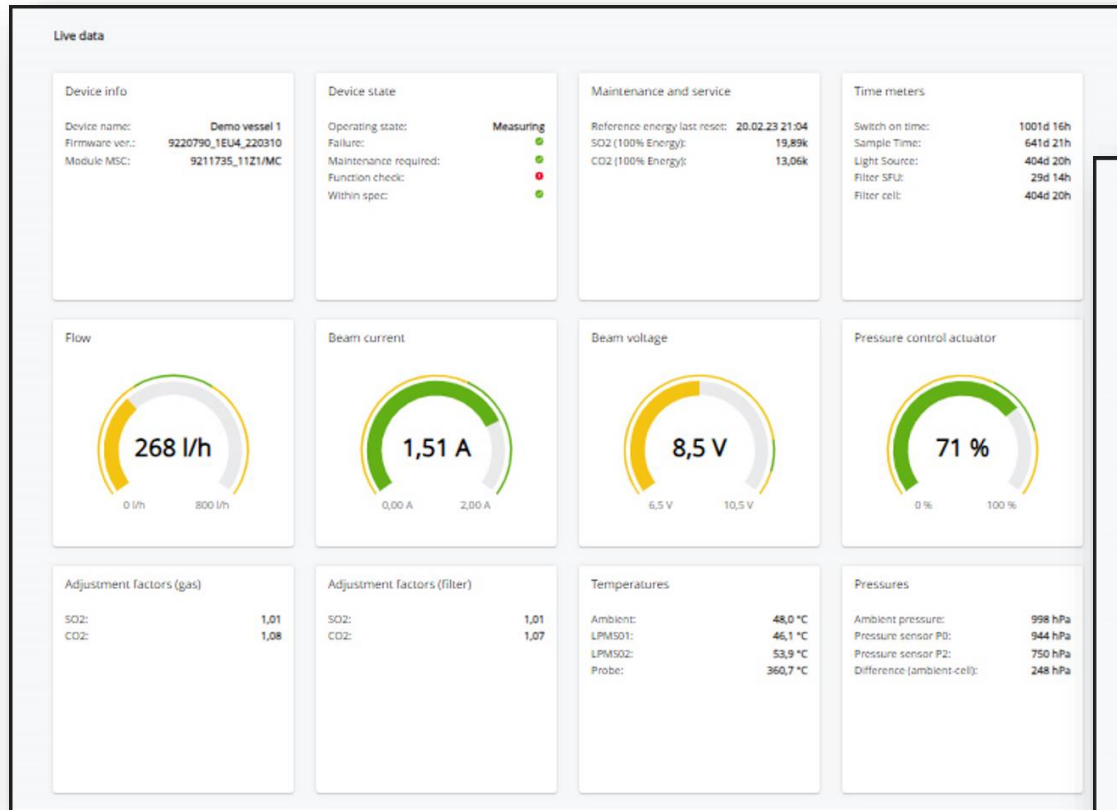
Fehler 	Warnung 	Unbekannt 	Ok 
 0 Geräte	 0 Geräte	 1 Gerät	 3 Geräte

Geräte im Normalbetrieb (3)

 MARSIC300 1 MARSIC300 	 0 Ereignisse
 MARSIC300 2 MARSIC300 	 0 Ereignisse
 TDC-E 	 0 Ereignisse

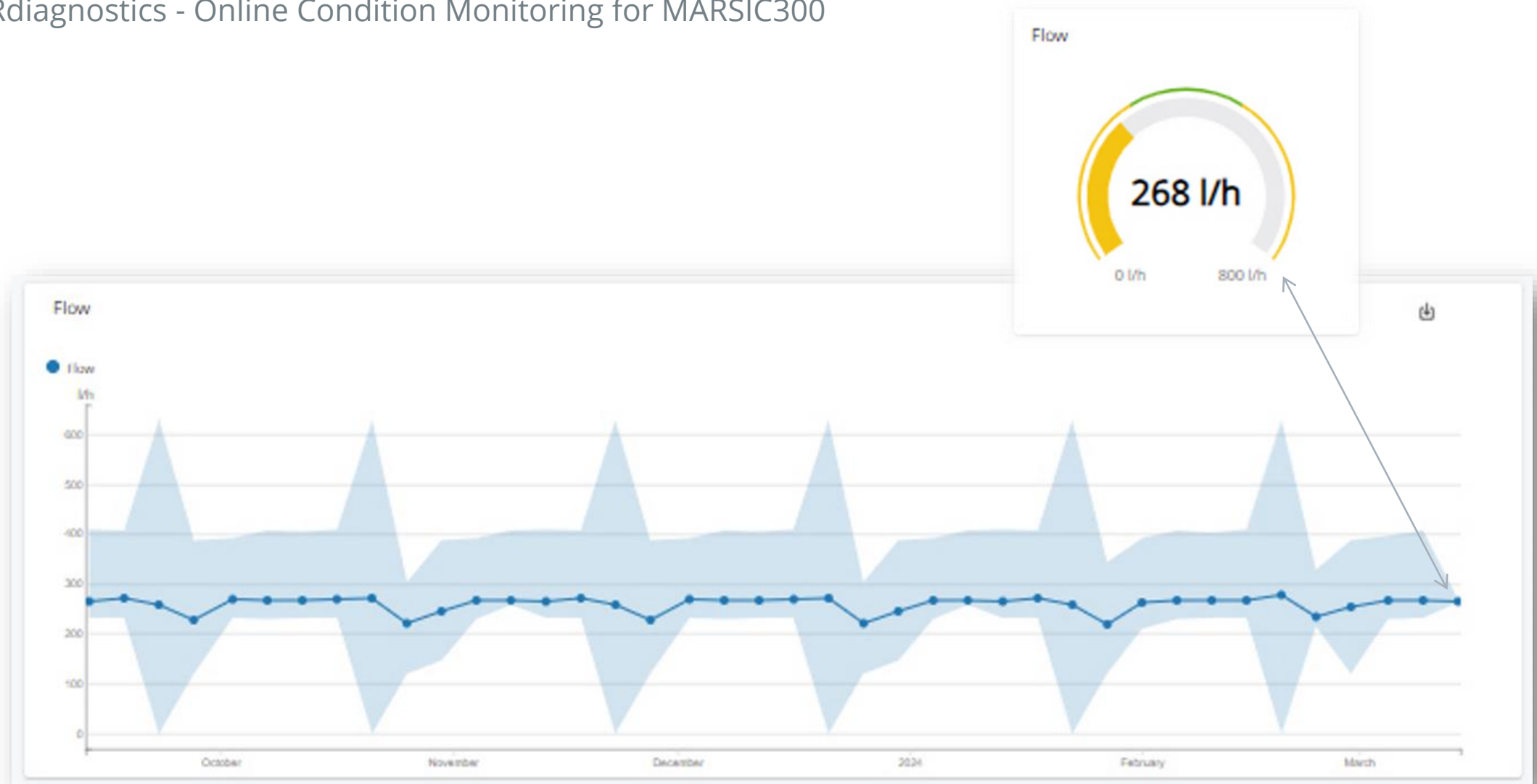
SICK Maritime Suite

MARdiagnostics - Online Condition Monitoring for MARSIC300



SICK Maritime Suite

MARdiagnostics - Online Condition Monitoring for MARSIC300



SICK MARITIME SUITE

Emission compliance assurance

MARdiagnostics

Condition Monitoring for increased CEMS availability



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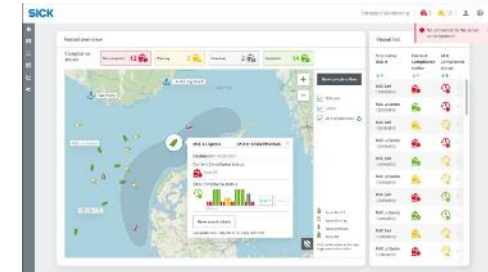
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All details always @ hands



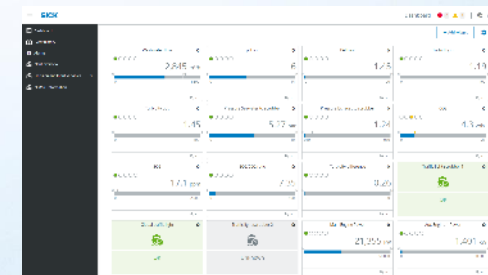
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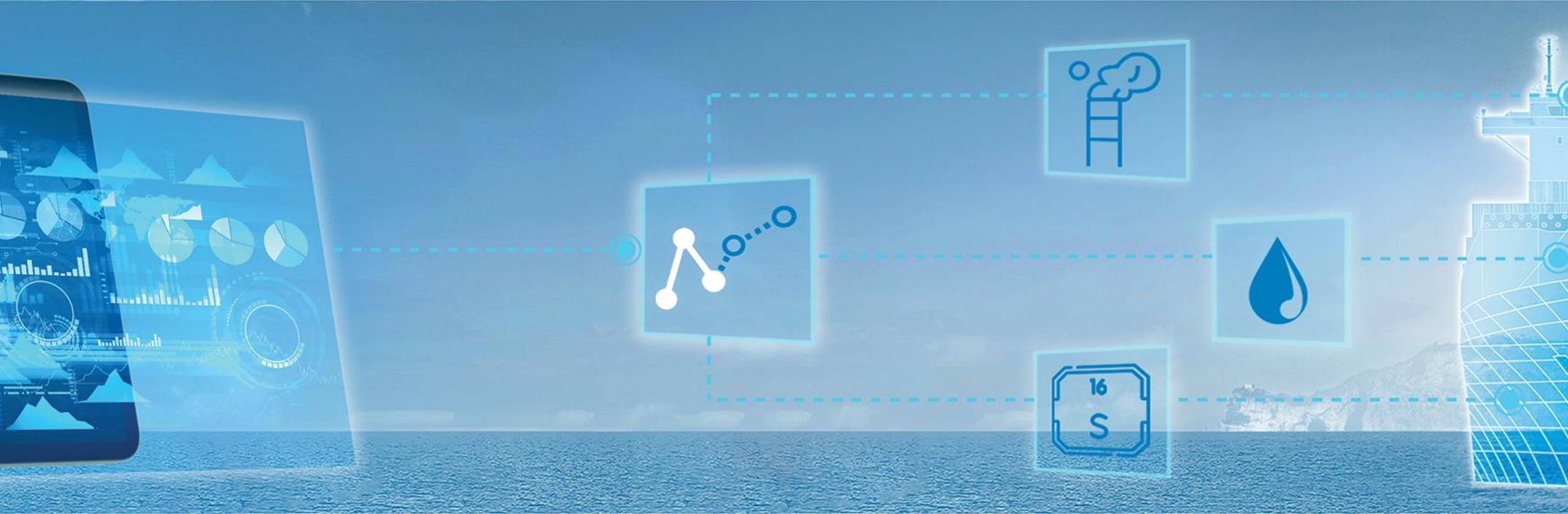
MARtracker

Transparency of emission data



MARpems

Increased Scrubber availability and Emission Compliance

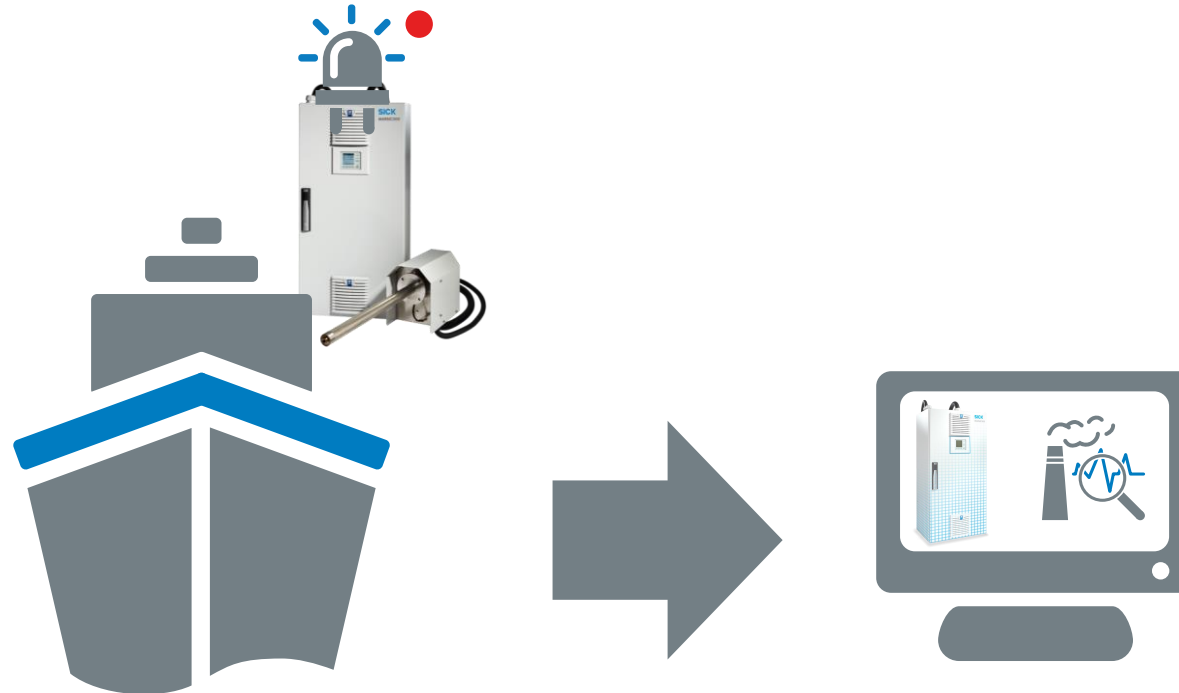


MARpems: the digital twin

Enables compliance with emission regulations, even in the event of failure of CEMS

SICK Maritime Suite

MARpems – Intermediate Solution for Single Sensor Failure



SICK Maritime Suite

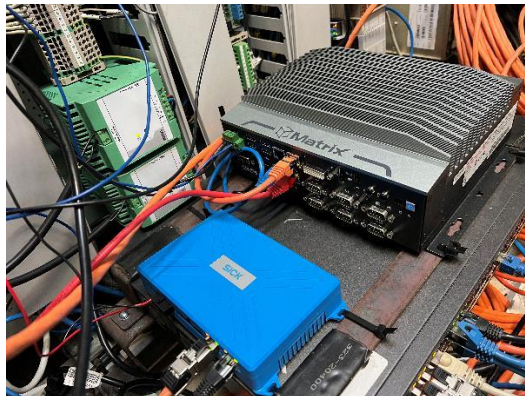
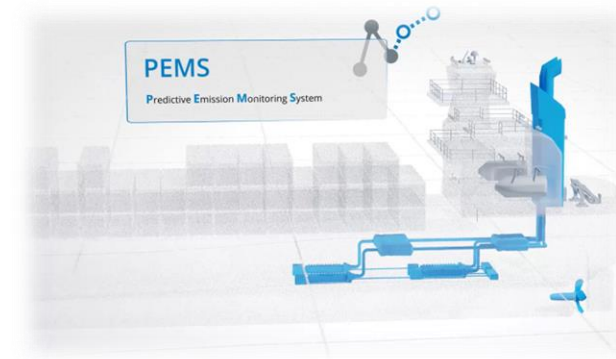
MARpems Mission: 100% availability of emission values

What is PEMS?

- › **Predictive Emission Monitoring System**
- › Software product to calculate emissions based on existing customers' process data

SICK Offering for Scrubbers

A data-driven software solution which checks and verifies process parameters to enable the ship to continue compliant sailing using the scrubber during CEMS (sensor) malfunction.



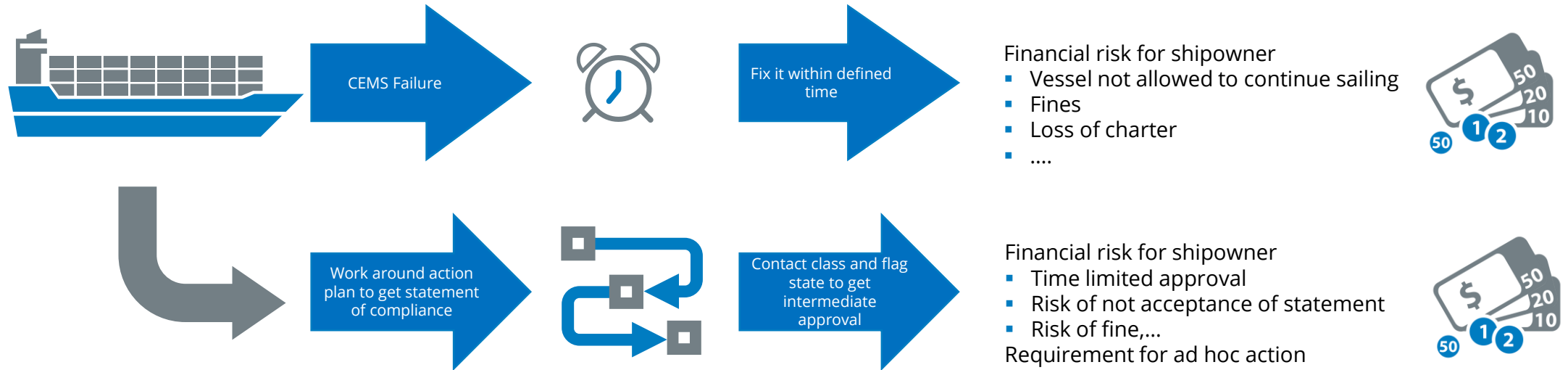
↔ **Digital Twin**



SICK Maritime Suite

MARpems Customer Pain: Gas Analyzer Failure During Sailing

Current state of the art



SICK Solution - MARpems





Summary

Summary

SICK can offer the complete package

- › Product
- › Global Service Structure
- › Digital Services



SICK Maritime Suite can help to eliminate

- › Transparency issues
- › Documentation weaknesses
- › High operating costs
- › Long downtimes and multiple service visits
- › Waste of resources

Next seminar on May 15th : Green house gas monitoring and reporting





Thank you for your attention!

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