Dr. Födisch
Umweltmesstechnik AG

MCA 10 maritime • APPLICATION BROCHURE

Multi component analyser system maritime

Continuous emission monitoring system on ships

Dr. Födisch Umweltmesstechnik AG is a leading manufacturer of emission monitoring devices for dust concentration, gas concentration and flow velocity. We are located in Markranstädt near Leipzig. Our R&D and production are "made in Germany".

The 30 years' expertise in developing and manufacturing emission and process measurement technology, combined with excellent knowledge in the field of environmental laws and regulations enable us to create optimum customised solutions for clients worldwide. This is supported by our Chinese subsidiary Dr. Foedisch Instruments (Hangzhou) Co., Ltd as well as our numerous distributors and service partners who guarantee short and quick routes to customers.

All dust measuring devices are developed, tested and calibrated in the dust channel of Dr. Födisch Umweltmesstechnik AG in Germany. As well, the gas analytics laboratory is equipped with comprehensive measurement techniques in order to determine the properties of substances, to calibrate measuring systems and to investigate basics in IR photometry and UV spectroscopy.

The gas analysers of Dr. Födisch Umweltmesstechnik AG comply with the most stringent European emission monitoring regulations. They own QAL1 approval according to EN 14181:2014 certified by TÜV from Germany and by CSA Group (MCERTS) from UK.

Our portfolio of certified gas analysers comprises hot-wet and cold-dry gas measurement technology based on IR and UV measuring methods as well as analysers for stationary and mobile use.

Apart from the emission measuring devices we offer complete solutions for industries, which means our engineers do planning, installation and maintenance services as well as support with approval procedures. Our clientele are operators of combustion plants, e.g. power plants, incineration plants, cement plants, crematories as well as systems in the chemical/petrochemical and metallurgical industry. A special strength of our company is the development of non-standard solutions for challenging measuring tasks – this is the guiding principle of Dr. Födisch Umweltmesstechnik AG.

Headquarters of Dr. Födisch Umweltmesstechnik AG, Germany

International shipping is a reliable, cost-effective means of global trade for many goods. It transports more than 90 % of world trade. This does not remain without consequences for the world's oceans. The task of the International Maritime Organisation (IMO), as a special UN agency, is therefore to define standards for safety, security and the environment.

With the help of the "International Convention for the Prevention of Pollution from Ships (MARPOL)", it has been possible to create internationally recognised, uniform standards.

Annex VI of the MARPOL Convention explicitly addresses the issue of air pollution. It does not only set global emission limits, but also defines so-called "emission control areas" (ECAs) in which stricter requirements apply. These regulated areas include the North Sea and Baltic Sea coasts in Europe as well as the North American coasts and Caribbean coast. Other regions will follow in the future.

NOx

Regulation 13 of Annex VI contains the control of nitrogen oxide emissions from marine diesel engines. NOx emission limits apply to marine diesel engines > 130 kW depending on the rated speed of the engine.

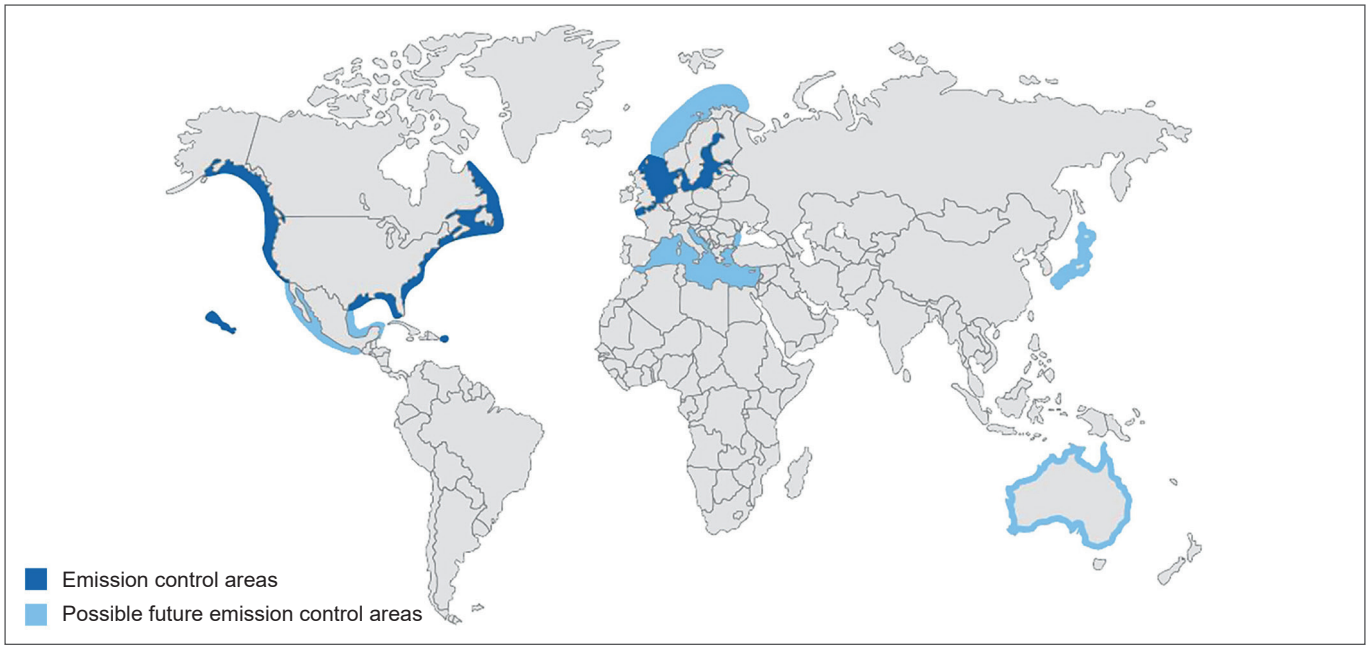
The verification is carried out according to the technical NOx regulation 2008 [Decision MEPC.177(58) and MEPC.251.66 of the Marine Environment Protection Committee] in compliance with the TIER I/II/III standards.

The valid NOx emission value for marine diesel engines is determined via test cycles and documented in an engine certification (EIAPP certificate). However, the technical NOx regulation does not require continuous NOx emission measurement on board, as is the case for combustion plants on shore.

SOx

Regulation 14 of Annex VI defines maximum permissible sulphur contents for heavy fuel oil both for the open oceans and for the ECAs of the coastal regions.

In conjunction with the Marine Environment Protection Committee's decision (MEPC.259(68)), guidelines are defined for the use of exhaust gas cleaning systems and their monitoring. Corresponding SO_2 / CO_2 ratios are defined for different sulphur contents in the oil and operators have to provide proof of compliance based on the ratio of SO_2 (ppm) / CO_2 (% v/v) in the exhaust gas. This results in the requirement for continuous measurement of SO_2 / CO_2 on board. The values are to be recorded and submitted to the official authorities if required.



Emission Control Areas (ECAs) *(Source: IFPEN)*

TECHNICAL ADVANTAGES

For the monitoring of ship emissions, i.e. the continuous measurement of sulphur dioxide (SO_2) and carbon dioxide (CO_2), the MCA 10 maritime has been developed and approved by DNV.

In addition to SO_2 and CO_2, other components such as NO, NO_2 and NH_3 can be measured.

DNV
- certified in compliance with MEPC.259(68), Doc. no.: 27975892/DNVGL
- tested according to DNV GL CG-0339, Cert. no.: TAA00002ZV

The MCA 10 maritime is based on the well-proven QAL1-certified multi component analyser MCA 10 HWIR.

TÜV SÜD
- EN 15267, QAL1, Cert.-No.: 1729865-ts
- TUV-approved CEMS for combustion and incineration plants (as system part)

mCERTS
- certified in compliance with MCERTS Performance Standards
- certificate no.: Sira MC140256/01

- certified in compliance with GOST
- certificate no.: МП-242-1852-2015

Exterior design

Steel sheet cabinet (IP54) for weather-protected location

Low-maintenance fan instead of air conditioner

Control unit with 15’ touch panel mounted in the cabinet door allows parameter setting, measuring value display, measuring system data storage and remote control possibility

Installation conditions
(according to DNVGL-CG-0339):
- ambient temperature in operation: 5...45 °C (class A)
- relative humidity: max. 95% (non-condensing) (class B)
- vibration: class A
- electromagnetic compatibility: class A
- enclosure: class B

Special design as a compact and robust system with vibration dampers make it suitable for permanent installation on board

The analysis system delivers continuously precise measurement data and is predestined for reliable emission measurement even under the challenging operating conditions on ships. It fulfils all the necessary measurement and safety requirements. Digital remote access (optional) via Ethernet or UMTS router enables worldwide support.

In particular, the compact device design and the internal modular construction make the MCA 10 extremely operator-friendly. Its core piece is a hot-wet photometer that does not require any maintenance-intensive gas conditioning, which usually consists of a sample gas cooler, sample gas/condensate pumps and filters. The need to replace wearing parts is therefore quite low and maintenance activities are reduced to a minimum.

The analyser calculates internally all concentrations required according to the specification with all necessary compensations and standardisations. Visualisation and operation with the analyser's own operating software is carried out via a connected PC. The user interface is designed for one-click operation via touch function.

Interior design

PLC Interfaces:

- inputs for analogue and digital signals
- analogue outputs 4...20 mA
- digital outputs (e.g. failure, maintenance, maintenance requirement, measuring range switch over)
- Modbus RTU, Modbus TCP/IP, Profibus DP, Profinet

Direct connection for heated line (no gas cooler, no external pumps), therefore low maintenance requirement

Multi component analyser module MCA 10 HWIR:

- measurement of up to 8 IR components and oxygen
- Correction of cross-sensitivity and air pressure
- Long-term stability by automatic zero point calibration; sets its zero point automatically every 12 hours to minimise the zero drift
- Automatic reference point – calibration by adjusting filter (optional)

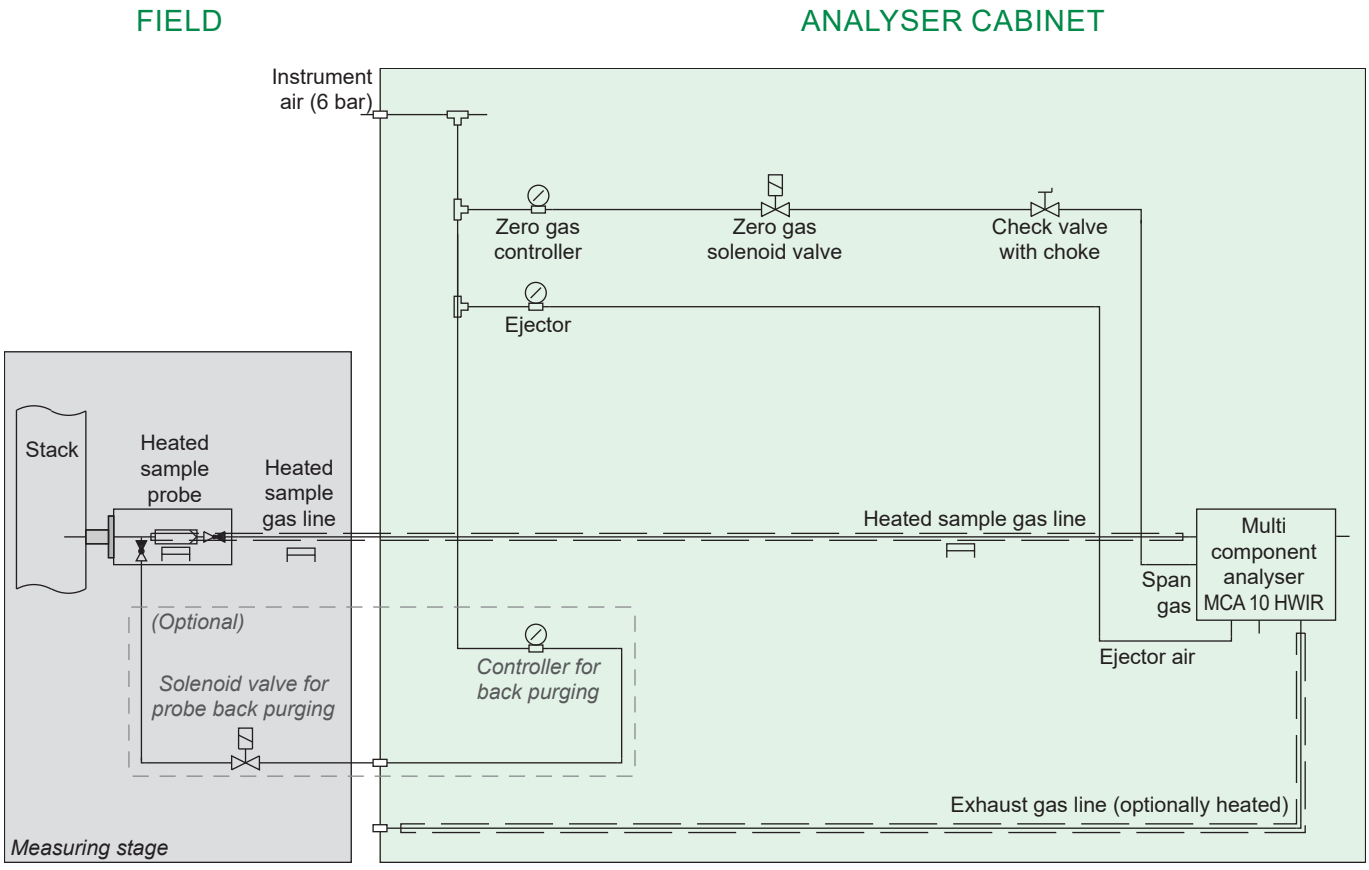
The MCA 10 maritime is an extractive hot-wet gas analyser system. The gas path from sampling probe, via sampling line to the measuring cell inside the analyser is completely heated in a regulated way (185 °C). The sample gas is conveyed via the ejector integrated in the gas distribution block at the gas analyser. This means that the system requires neither an external sample gas pump nor a sample gas cooler for conditioning the sample gas. Nor is there any condensate.

The moisture contained in the exhaust gas is also measured for cross-sensitivity correction of the IR components and can be output if required. Even high concentrations do not cause a measurement problem. This makes the system extremely simple in design and robust in application.

After the measurement, the sample gas is led out of the system again (via PTFE or heated exhaust gas line, depending on the application) and can be fed back into the process if necessary.

The MCA 10 maritime measures directly SO_2 and CO_2, but can be equipped additionally with CO, NO_2 or NH_3 amongst others.

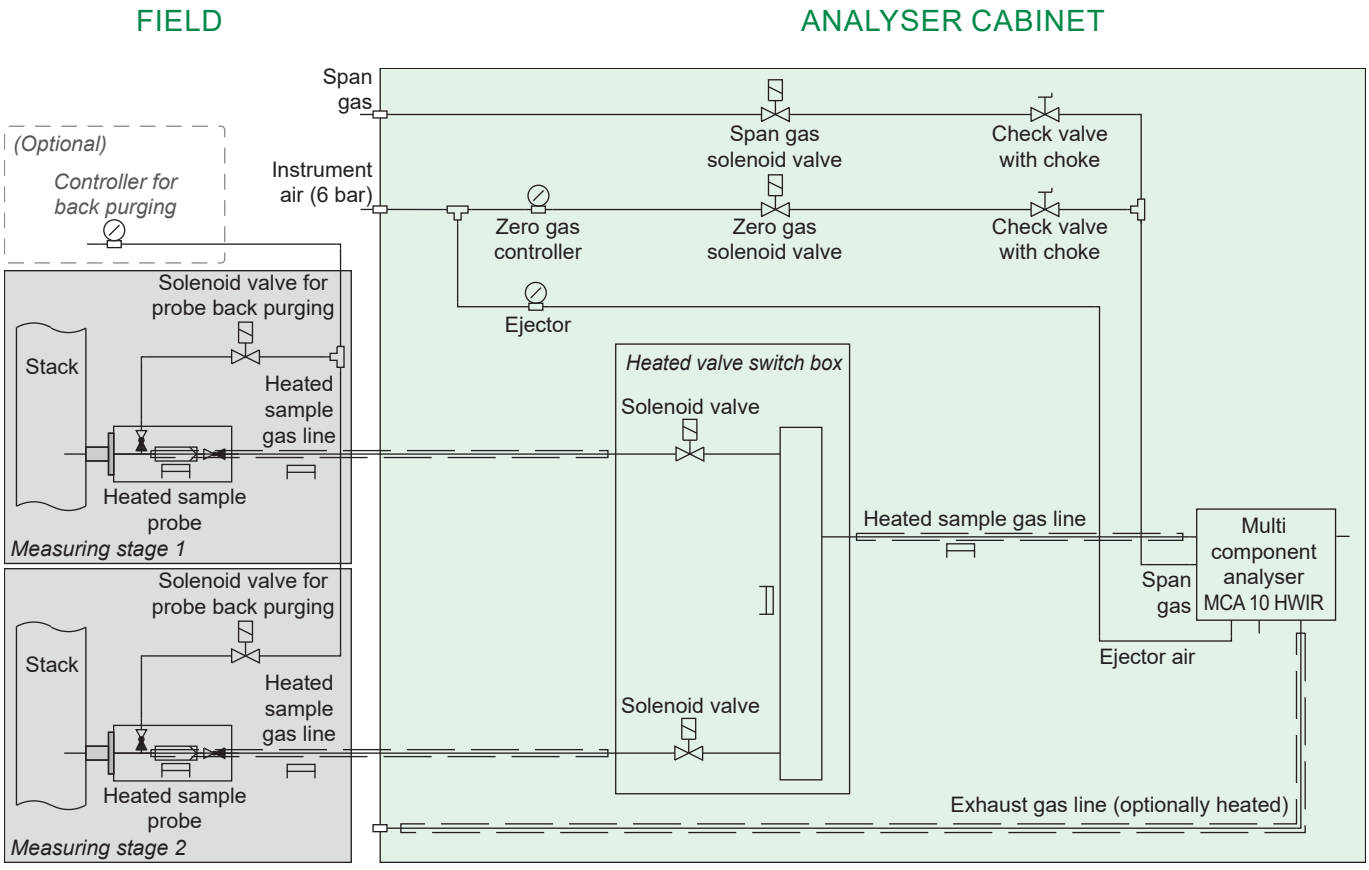
Gas flow sheet of system for one measuring point (standard, application example)



The MCA 10 maritime can not only be used for measurement at one sampling point, but also offers further application possibilities due to the option of a heated valve switch box. These include, for example, line switching between several measuring points in the clean gas or switching between measuring points at different flue gas cleaning stages (e.g. before and after scrubber).

The heated valve switch box is mounted above the MCA 10 maritime cabinet. The standard version is configured for connecting 2 heated sampling lines. An internal sample gas line leads from the heated valve switch box to the gas distribution block of the analyser. The switching is controlled via the analyser's PLC. The heated valve switch box is part of the DNV approval of the MCA 10 maritime.

Gas flow sheet of system with line switching for two measuring points (optional, application example)



Analyser cabinet

The dimensions of the MCA 10 maritime analyser cabinet including the heated valve switch box for line switching are as follows:

Sampling equipment

The *heated sampling probe* requires own type approval *.

Requirements on sampling probe:

- Self-regulated heated up to 180 °C
- 115/230 V 50/60 Hz, 400 W supply voltage
- Signal for temperature alarm, Signal for back purging
- Ambient temperature: -20...60 °C
- Protection degree: IP66
- Connection for calibration gas

The *heated sampling line* is not subject to own approval but becomes an integral part of final acceptance test [tests at DNV were done with Winkler line]

Requirements on sampling line:

- Entry from top
- with exchangeable PTFE core, power 125 W/m
- Temperature control for sample gas line, adjustable from 0...185 °C
- Standard system designed for up to 35 m sample gas line (more on request)

** tests at DNV were done with Bühler version GAS 222.15-MA (4622215MA0990312000)*

MCA 10 maritime

Analyser system:	steel sheet housing (IP54) with additional wall fixation and vibration dampers; 600 mm x 1510 mm x 500 mm (w x h x d), approx. 120 kg
Measuring methods:	• bi-frequency measuring method (NO_2, SO_2 [1], H_2O, CO_2 [1]) • gas filter correlation (CO, NO, NH_3, CH_4) • zirconium dioxide sensor (O_2)
Display / Operating:	15“ touch panel, 1024 x 768 Pixel
Tested interfaces:	• inputs for analogue and digital signals • analogue outputs 4...20 mA • digital outputs (e.g. failure, maintenance, maintenance requirement, measuring range switch-over) • Modbus RTU, Modbus TCP/IP, Profibus DP, Profinet
Compressed-air connection:	pressure: 4...6 bar, consumption: ca. 1 m³/h
Gas conveyance:	via ejector; gas path continuously heated (standard 185 °C, higher temperatures on request)
Standardisation:	dry, wet
Sensitivity correction:	with test gas, once in 12 months (when using automatic calibration)
Calibration:	• zero point: automatically with instrument air; • span point: with test gas, automatically by adjusting filter (optional)
Power supply:	230 V or 400 V / 50 Hz, 4000 W (analyser cabinet, fan, probe) + 125 W/m measuring gas pipe; further options on request
Ambient conditions (acc. to DNVGL-CG-0339):	• ambient temperature in operation: 5...45 °C (class A) • relative humidity: max. 95% (non-condensing) (class B) • vibration: class A • electromagnetic compatibility: class A • enclosure: class B
Available system components (optional):	DNV certified probe, measuring gas pipe, switch-over between two measuring points (certified; response time for each measuring point: T_{90} < 140 s)

Measuring ranges:	Measuring range 1	Measuring range 2	Measuring range 3
CO:	0...60 ppm	0...240 ppm	0...4000 ppm
CO_2:	0...12 vol.-% [1]	0...25 vol.-% [1]	0...50 vol.-%
NO:	0...60 ppm	0...300 ppm	0...2250 ppm
NO_2:	0...25 ppm	0...250 ppm	-
NH_3:	0...15 ppm	0…70 ppm	0…660 ppm
SO_2:	0...30 ppm	0...100 ppm [1] / 0...250 ppm [1]	0...875 ppm
CH_4:	0...70 ppm	0...700 ppm	-
H_2O:	0...40 vol.-%	-	-
O_2:	0...25 vol.-%	-	-

[1] *certified in compliance with MEPC.259(68)*
Special models as well as other components and measuring ranges on request.

NOTES

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