

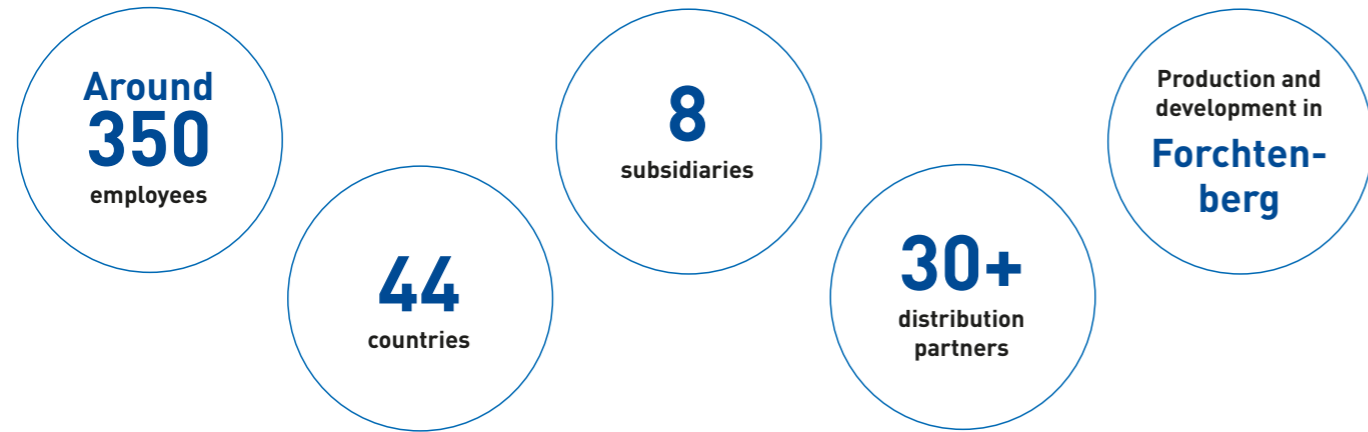
A CLEAR COURSE: RELIABLE VALVE TECHNOLOGY

Valves for the Marine Industry in gas valve units, engines and much more



The müller coax group

Your strong global partner



The müller coax group is the world's leading valve manufacturer in the coaxial valve technology and high pressure valves.

Made in Germany – developed and produced exclusively in Germany at the headquarters in Forchtenberg, our valves impress customers worldwide in a range of industries.

Our mission – we develop customized solutions. With the goal of always achieving top quality for our customers in both existing and newly developed processes, müller coax impresses with proven valve technology and a customer-oriented focus, to guarantee long-term success.

Our experts are always available, right where they are needed. A global sales and service organization stands ready to serve our customers.

“Our customers can count on us. We aren't afraid of handling extremes: from extreme pressure to extreme temperatures or extremely challenging media. We are ready to set out on new paths, and to go the extra mile for our clients. It's all part of our motto: “We start where others stop.”



Friedrich Müller,
Managing Director

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coax® Industries at a Glance

Two things we have perfected over the years, to deliver true added value for you:

Unique valve design

As the inventor of the coaxial valve, we are always working to remain a leader in our industry.

Selection of options and materials

We offer maximum flexibility, thanks to our broad portfolio of accessories. We can quickly and easily make adjustments to valves for specific applications.

In addition to coaxial valves, we offer many other valve types and series. Our flexibility allows us to offer customized solutions for a wide range of customer groups. Just look at the diversity of valves we offer, currently over 60,000 variants.

We continuously expand and optimize our portfolio to fulfill current and future customer and market demands.

Expertise, decades of experience and competent advising make us a strong partner in many different markets:

Marine Industry

Our valve technology for tomorrow's challenges

To better serve our customers, we keep up with the latest trends. After all, your goals are our goals. Because of this, coax® is focusing on: the energy revolution in shipping, and the conversion from heavy crude oil to alternative fuels such as LNG, hydrogen or ammonia to reduce greenhouse gas emissions. Ship propulsion is one of the primary applications for coax® valve technology. Our valve technology offers reliability

at the highest technological standard for diesel, natural gas or other alternative fuels.

Above and under water

Thanks to our broad valve portfolio, coax® valves are used in cruise ships, yachts, LNG tankers, diving bells and civil submarines.

Why coax®?

The best valve technology for challenging industries.

Your requirements: High seas and rough conditions often prevent fast and regular maintenance. Available space can often be limited as well. In situations like this, a system's reliability depends on the components installed.

Our valve technology: coax® offers highly reliable and efficient solutions. The unique, pressure balanced design of coaxial valves allows reliable handling of liquid, gaseous, and contaminated media with minimal space requirements, even at high pressures. The robust design of our valves makes them especially long-lasting and low-maintenance.

Your requirements: In the shipping sector, components must be able to withstand corrosive environments, vibrations and high temperatures.

Our valve technology: coax® valves are highly resistant – the selection and combinations of different materials, and the use of specialized seals and protective coatings ensures reliable resistance to corrosive media and environments such as marine air or saltwater. Corrosion-resistant stainless steels, including duplex steels, are also available options in our diverse portfolio.

A range of certificates confirm that our products fulfill marine-specific requirements, making us a reliable and competent partner.



Machine and plant construction



Marine



Chemicals industry



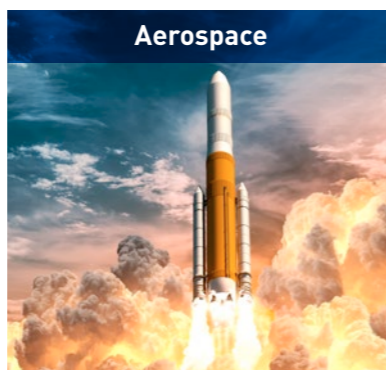
Energy



Oil and gas



Construction industry and transportation



Aerospace

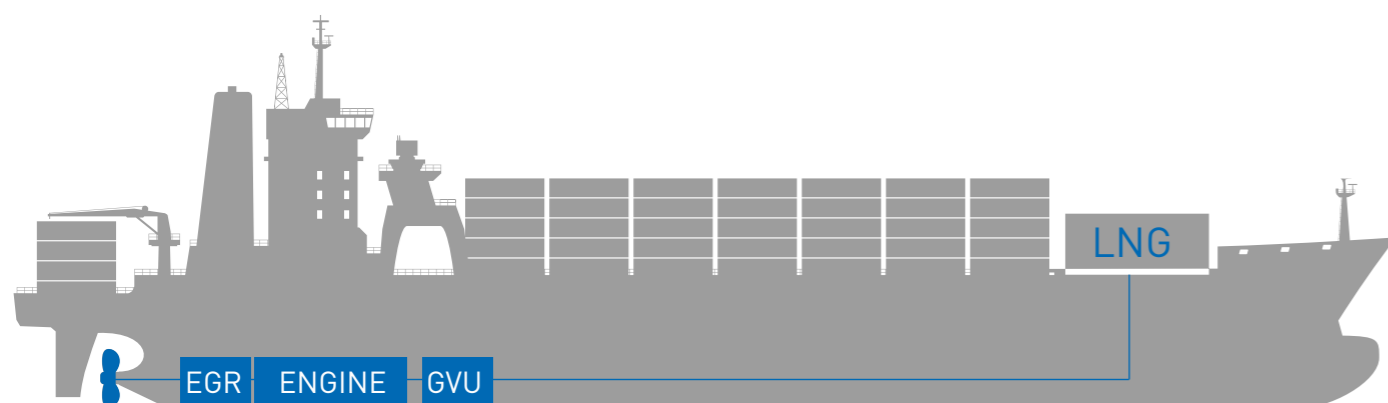


Hydrogen

coax® solutions for the Marine Industry

The propulsion system is the heart of any ship. Components must function properly. You can rely 100 % on coax® valve technology.

Liquefied natural gas is used as an environmentally-friendly alternative to conventional fuels like heavy crude oil. Using LNG has enormous economic advantages, as it significantly reduces emissions of sulphur, nitrogen oxide and fine dust as well as CO₂ emissions.



Use of coax® valve technology in the propulsion system

EGR = Exhaust gas recirculation

GVU = Gas valve unit

LNG = Liquefied natural gas

2/2 way coaxial direct acting valves, MK/FK series

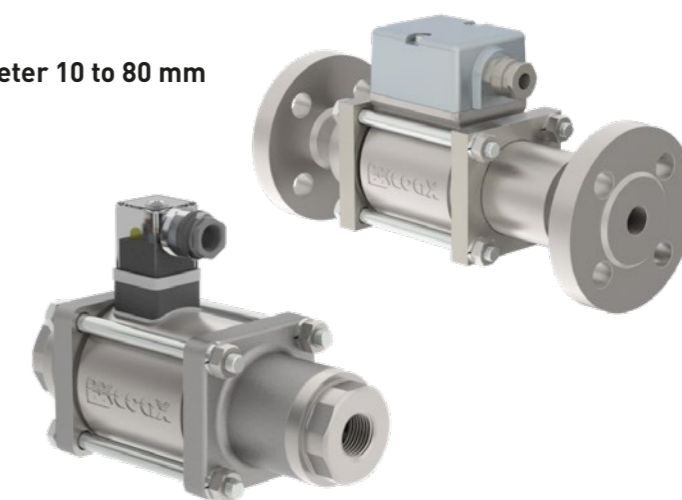
Electrically activated solenoid valves – nominal diameter 10 to 80 mm

Options for application:

- › Ship engine
- › Exhaust gas treatment and recirculation (EGR)
- › Azimuth thruster/Azipod
- › Bilge water treatment
- › Ballast tank

Advantages:

- › Pressure balanced and compact design
- › Hermetically sealed towards the outside, suitable for underwater use
- › Fast and reliable switching
- › No compressed air supply required



2/2 way externally controlled valves, VMK/VFK/FCF series

Pneumatically or hydraulically controlled valves – nominal diameter 8 to 250 mm

Options for application:

- › Gas valve unit (GVU)
- › Reliquefaction of boil-off gas (BOG)
- › Air separation
- › Fuel tank

Advantages:

- › Adjustable switching times
- › Pressure balanced and compact design
- › Energy-efficient thanks to low control air consumption
- › Low-maintenance and dirt-resistant
- › High flow rate



Overview of coax[®] Valve Technology in the Marine Industry

Air separation

2/2-way coaxial externally controlled valves



Ship engine

2/2 way coaxial direct acting valves



Exhaust gas treatment and recirculation

2/2-way coaxial direct acting valves



Power generation

2/2-way coaxial direct acting valves



Compressed air preparation/adsorption dryer

High pressure lateral valves



Gas valve unit

2/2 way coaxial externally controlled valves



Bilge water treatment

3/2-way coaxial direct acting valves



Azimuth thruster/Azipod

2/2-way coaxial direct acting valves



Example Application

Gas Valve Unit

Application description:

The liquefied natural gas (LNG) is stored on board the ship at -162 °C, since it is possible to store more energy in the same volume when the gas is in a liquid state. The LNG is re-heated shortly before use, when it enters the gas valve unit, returning it to its gaseous state. A gas valve unit supplies a connected gas engine with the correct quantity of combustible gas at the specified pressure. In case of an emergency, or when stopping gas operation, the gas must be able to be closed off quickly and reliably. Gas valve units can be used to supply gas engines on land, in addition to supplying dual fuel engines in shipping applications.

Valve technology requirements:

The gas valve unit contains shut-off and gas vent valves. A valve failure can cause engine damage, so valves need to be highly reliable and free from leaks. To fulfill high safety requirements, a space-saving "Double Block and Bleed (DBB)" design is used – in this configuration, two valves are used to block off the gas, and another valve is used for venting.

coax® solution:

Shut-off valves: FCF (nominal diameter: 50-150 mm)

Function: Normally closed, NC

Materials: Aluminum, galvanized steel, special seals

Properties: Back pressure tight, bi-directional operation possible

Explosion protection: ATEX Zone 1

Options: Limit switch



Vent valves: VFK (nominal diameter: 15-50 mm)

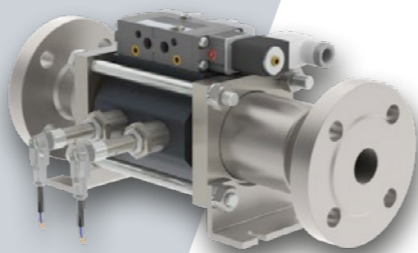
Function: Normally open, NO

Materials: Stainless steel, galvanized steel, specialized seals

Properties: Back pressure tight, bi-directional operation possible

Explosion protection: ATEX Zone 1

Options: Limit switch, mounting bracket

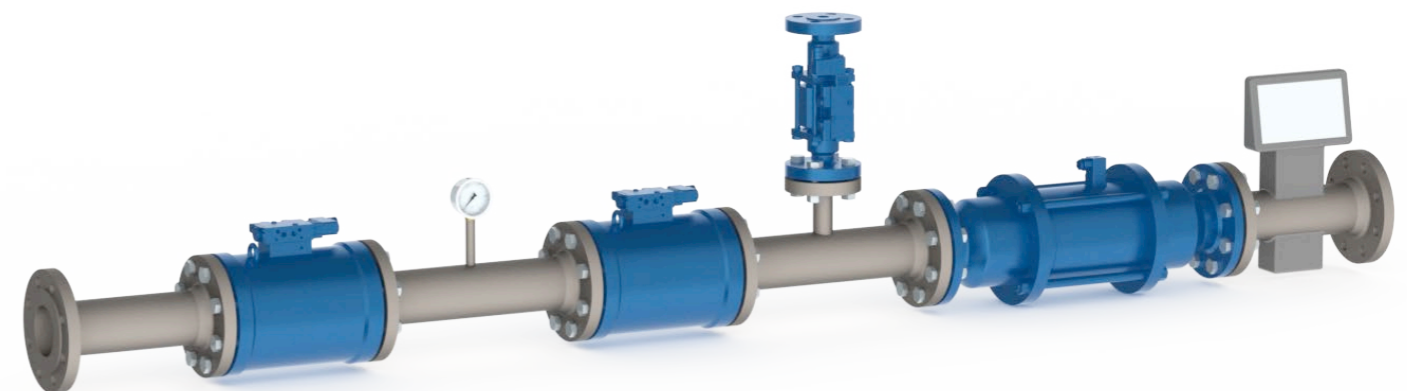


Added value for our customers:

- › We offer technically streamlined valves for gas control systems designed to fulfill specific customer requirements. Specialized housing and seal materials are used, depending on the medium and environment. In addition, accessories and specialized connections make coax® valves highly adaptable.
- › coax® valves impress with a 100 % tightness – even when exposed to back pressure.
- › A compact valve with a large nominal diameter? The coax® FCF series makes it possible by combining these two features: It is lightweight and compact, making it a space-saving option. An efficient solution – even at larger nominal dimensions.
- › Thanks to the integration of limit switches, the end-position display offers added control and safety during operation.

At a Glance:

- › **Application:** Gas valve unit
- › **Requirements:** Shut-off and vent valves
- › **Solution:** Coaxial externally controlled valves: compact FCF series for secure shut-off, VFK series in NO version for venting
- › **Added value:** Secure and efficient operation thanks to compact, lightweight design and excellent seal, even when exposed to back pressure



Example arrangement of coax® valve technology in a gas valve unit

Example Application

Dual Fuel Engine

Application description:

Dual fuel engines can be operated with two types of fuel – gaseous or liquid – and offer a high level of flexibility. Gas operation takes advantage of environmental advantages. If the gas feed is interrupted, the engine can still be operated with liquid fuel. Multiple coax® valves are used in the engine compartment – including to start the engine with compressed air. For safety reasons, the gas lines are flushed with an inert gas such as nitrogen, especially for dual fuel engines. This is required, for instance, to clear the lines of residual fuel.

Valve technology requirements:

The purge valves must switch in a very quick and reproducible manner. Reliability is essential to ensure smooth gas operation. In addition, installation space around the engine is limited, meaning the valves need to be as compact as possible. Compressed-air lines take up unnecessary space in the system, so our electrically operated valves are a profitable alternative.

coax® solution:

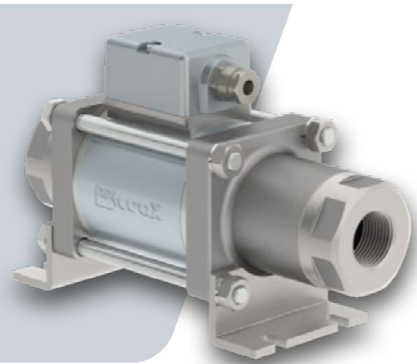
Purge valve: MK (nominal diameter: 10-50 mm)

Materials: Nickel coated brass, stainless steel

Properties: Back pressure tight

Certificates: ATEX Zone 1, SIL3

Options: Limit switch, retaining bracket, vacuum testing, terminal box



Added value for our customers:

- › coax® direct acting solenoid valves are electrically operated, which, conversely, means that no compressed air is required for switching. That means they take up less space, and can be used in difficult to access areas of the engine. Another advantage is that our valves switch quickly, with times under 30 ms. In short: thanks to their compact and pressure-compensated design, coax® valves are a highly efficient and space-saving choice.
- › Do you want to know, quickly and easily, if everything will work? That can be difficult with valves which are hard to access and often barely visible, this can be difficult. coax® valves are equipped with limit switch

sensors. These sensors generate a signal indicating whether the valve is open or closed. This lets you see at a glance whether everything is working properly and complete reliable functional checks.

- › Maintenance on the high seas can be difficult, time-consuming, and costly. Thanks to our high-quality, long-lasting valve technology, we guarantee low-maintenance operation.
- › We offer a broad range of accessories. From specialized seals to coatings and special connections – each coax® valve is adapted to the specific application.

At a Glance:

- › **Application:** Dual fuel engine
- › **Requirements:** Purge valves
- › **Solution:** Coaxial direct acting valves: MK series for reliable use with minimal space requirements
- › **Added value:** Low-maintenance operation, reliable, fast switching in less than 30 ms



Quality & Certificates

100 % quality testing = 100 % reliability

We conduct 100 % testing of the valves in our own testing laboratory. We use high-quality materials and modern technology to make our products extremely reliable.

We have a comprehensive quality management system, verified by multiple system certificates.

- › **DIN EN ISO 9001: 2015**
- › **Pressure Equipment Directive 2014/68/EU**
Module A2, Module B, Module D, Module H/H1
- › **Certified welder in accordance with**
AD 2000 data sheet HP0 and DIN EN ISO 3834-2
- › **RoHS Directive 2011/65/EU**
- › **REACH**
- › **IECEX QAR**
- › **ATEX QAN**

In addition, multiple product certifications confirm that our valves are reliable in use.

coax® valves have ATEX and SIL-3 certificates, among others, and are certified for use in explosion-hazard and safety-relevant areas, including Zone 0.

Upon request, our valves can undergo acceptance by the ship classification association DNV-GL, LR, BV, ABS, RINA or CCS. We furthermore meet the material requirements of NACE MR 0175.

- › **DVGW**
- › **TÜV**
- › **ATEX**
- › **IECEX**
- › **SIL 3**
- › **UL/CSA**
- › **EAC**

Our Experts Experience Customer Focus

With a global network of partners, we are always close to our customers. We understand their markets and their needs.

To know exactly what is most important to you, our distribution experts work closely alongside you. That helps us keep your needs in mind at all times. It also gives you the assurance that you are getting what you really need.

Service & Customized Solutions

You can count on us

Our valve designs are just as diverse as the requirements of our customers. There's a good reason our product portfolio includes over 60,000 valves. Our experienced team of experts reviews each application carefully, working to develop the most economically efficient valve design for you, based on a variety of parameters. Temperature, pressure, medium, and much

more make the difference. In addition, we offer a wide range of materials, seals and accessories. Thanks to our many years of experience, we are experts who handle the details so you can keep the bigger picture in mind.





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