Engineering the Planet

Welcome to the Hydrocene

ETO's Hydrogen Portfolio

The Stuff the Energy Transition is Made Of

The hydrogen atom is first in the periodic table of chemical elements. As a gas in its molecular form (H_2), hydrogen is the smallest, lightest and most volatile molecule. In nature, unbound molecular hydrogen as a primary energy source rarely occurs. Therefore, hydrogen must be extracted from water with the help of electrolysis, which requires a great deal of energy. In the case of "green hydrogen", the energy required for this extraction – between 40 and 80 kWh per kilogram of hydrogen produced – will come from future surplus capacities of renewable energy sources. This makes hydrogen a key enabler of the energy transition. The colorless and odorless gas marks the dawn of a new energy era – the Hydrocene. With its hydrogen product portfolio, ETO GRUPPE aims to play a pioneering role on the road to a green hydrogen economy.

Dr. Michael Schwabe
CEO of ETO GRUPPE

Hydrogen – Key Element of the Energy Transition

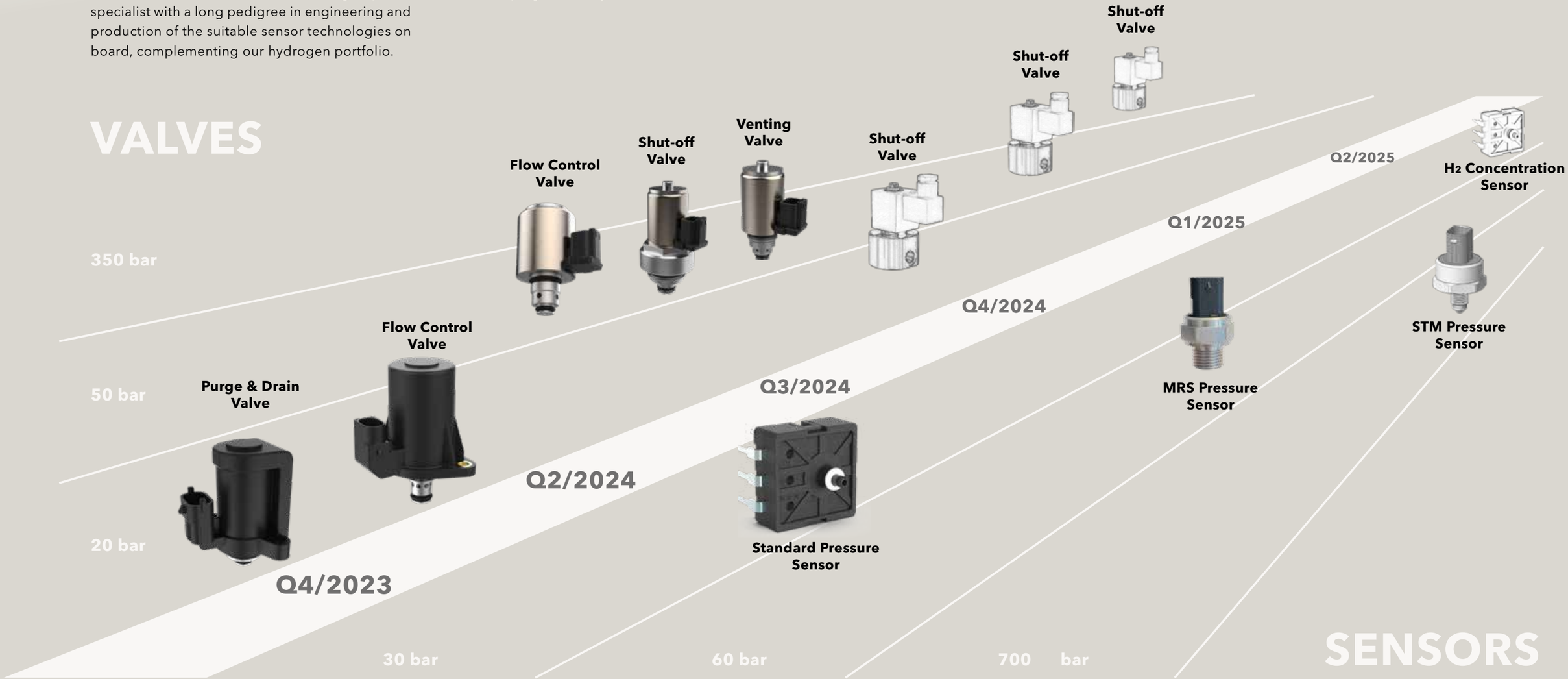
Our Hydrogen Route Is Mapped Out

In hydrogen applications, the ETO GRUPPE offers its customers solutions along the entire value chain. ETO provides you with valves for a wide range of applications and different pressure ranges. With ETO SENSORIC, we even have a groupwide specialist with a long pedigree in engineering and production of the suitable sensor technologies on board, complementing our hydrogen portfolio.

We have layed out our strategy in our hydrogen roadmap. In addition to highly specialized pressure sensors, we are engineering a hydrogen concentration sensor as well. It is therefore worth keeping a close eye on ETO.

"ETO engineers and produces modules, valves and sensors for all hydrogen applications."

Oliver Thode
Vice President Technology



Why ETO Is Your Ideal Development Partner

For over 75 years, ETO GRUPPE has been shaping industries with innovative products, and since 2021, we've extended our expertise to the hydrogen economy. Drawing on decades of experience in product development for leading automotive, commercial vehicle, and industrial manufacturers worldwide, we have excelled in the production of valves and sensors for pneumatic applications. The common ground in technical requirements between pneumatic and hydrogen technologies allows us to bring products to market much faster. Our approach to engineering is driven by a customer-first philosophy, leveraging modular design platforms that efficiently transform tailored technical solutions into high-quality, mass-produced products.

"Decades of experience, a modular development platform and an international network of production sites from small to large series - ETO is your ideal partner for the development of hydrogen technology solutions."

Oliver Thode
Vice President Technology

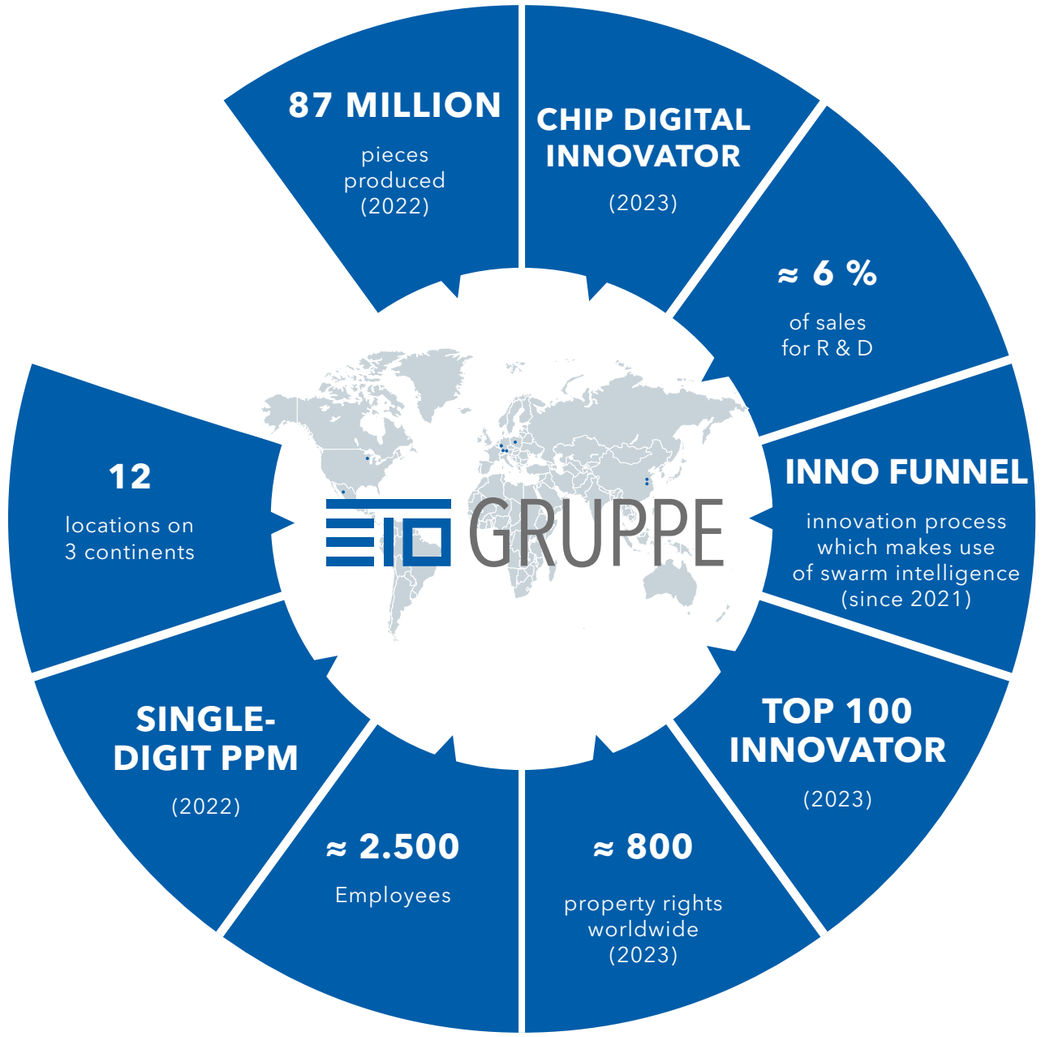
"With the help of the fuel cell test bench, we and our partners may test and optimize new hydrogen products under real-world conditions – an invaluable advantage."

Sven Roos
ETO Project Manager in the Hydrogen Field

INNOVATION THROUGH SWARM INTELLIGENCE

As a foundation-managed company, ETO GRUPPE has always put a focus on research and development, investing more than many of our competitors for decades. This commitment to innovation is evident in the numerous patents and awards we've earned. To fuel creativity, we've implemented processes that harness the collective intelligence of our employees, unlocking their full innovative potential. In the field of hydrogen technology, we've established partnerships with leading universities, research institutes, and industry experts. This collaboration enhances our development capabilities. Since 2023, we've been utilizing a fuel cell test bench to evaluate our products in various operational conditions within a hydrogen environment, ensuring that they meet practical demands long before they reach the market.

Everything Speaks for ETO



WORLD MARKET AND TECHNOLOGY LEADER

ETO Products Set Standards – Time and Again

ETO GRUPPE has consistently been a trailblazer in multiple fields. We are recognized as global leaders in solenoid valves for commercial vehicles and two-pin actuators for passenger car camshafts. We also lead in the development and application of magnetic shape memory materials. Early on, we embraced digitalization, integrating electronics and software with our hardware solutions. Today, we are dedicated to achieving technological leadership in hydrogen-related products as well.

"We are geared to the optimum, and our future hydrogen sensors will be good examples of this. In their development, we focus on everything important: functional reliability, response and decay times, durability and price."

Oliver Feirer
Head of Development with ETO SENSORIC

"ETO not only develops innovative products with unique product benefits. We also manage to mass-produce them in top quality – and that across all plants, i.e. in close proximity to our customers worldwide. "

David Muffler
Head of Business Development
at the ETO GRUPPE

Our extensive experience in large-scale production for the automotive and commercial vehicle sectors, coupled with high automation, global quality standards, and standardized processes, ensures exceptional reliability. With error rates in the single-digit parts per million (PPM), we maintain an unwavering commitment to top-tier quality.

ETO Technology for Electrolyzers

H_2 Shut-off Valve (SOV)

Nominal diameter	6 mm
Voltage range	22 to 32 V
Peak current	0.65 A
Hold current	0.25 A
Inlet pressure	up to 45 bar
Burst pressure	110 bar
H_2 flow	35 kg/h @ Δp = 0.5 bar
Temperature range	-40 to 125 °C
Actuation	PWM (Peak & Hold)
Protection class	IP6K9K
Response time	ca. 50 ms
H_2 leakage	1E-4 mbar l/s

H_2 Flow Control Valve (FCV)

Nominal diameter	2.9 mm
Voltage range	22 to 32 V
Control current range	0.6 to 1.2 A
Inlet pressure	up to 45 bar
Burst pressure	110 bar
H_2 flow	35 kg/h @ Δp = 15 bar
Temperature range	-40 to 125 °C
Actuation	PWM (current control)
Protection class	IP6K9K
Response time	ca. 25 ms
Hysteresis (10…90% @ 350 Hz)	< 15 % FS
Linearity (10…90% @ 350 Hz)	< 10 % FS
H_2 leakage	5E-4 mbar l/s

H_2 High Pressure Sensor

Nominal pressure	up to 700 barR
Overpressure	1400 barR
Burst pressure	2100 barR
Temperature range	-40 to 125 °C
Protection class	IP6K9K
Accuracy	< 1.5 % FSO
Supply voltage	5 V

Our Range for Heaters and Power Supply

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Burst pressure	110 bar
H_2 flow	35 kg/h @ Δp = 0.5 bar
Temperature range	-40 to 125 °C
Actuation	PWM (Peak & Hold)
Protection class	IP6K9K
Response time	ca. 50 ms
H_2 leakage	1E-4 mbar l/s

H_2 Purge & Drain Valve (P&D)

Nominal diameter	2.3 / 3.5 mm
Voltage range	9 to 16 V
Nom. current	2 A
Inlet pressure	4 barA
Burst pressure	tbd
H_2O flow	35/90 g/s @ Δp = 1 bar
Temperature range	-40 to 110 °C
Actuation	PWM (Peak & Hold)
Protection class	IP6K9K
Response time	ca. 20 ms
H_2 leakage	5E-4 mbar l/s

H_2 Low Pressure Sensor

Nominal pressure	up to 10 barA/barR
Overpressure	16 barA/barR
Burst pressure	30 barA/barR
Temperature range	-40 to 120°C
Protection class	-
Accuracy	< 1.5 % FSO
Supply voltage	5 V

Fuel cell

Electrolyzers

H_2 ICE

Domestic Heating and Power Generation

Products for H2-Combustion Engines

H2 Flow Control Module (FCM)

The H2 flow control module may be equipped with ETO valves and sensors for shutting off, measuring, regulating, and venting.

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H2 leakage	5E-4 mbar l/s

H2 Venting Valve (VV)

Nominal diameter	2.2 mm
Voltage range	22 to 32 V
Peak current	0.6 A
Inlet pressure	up to 30 bar
Burst pressure	110 bar
H2 flow	35 kg/h @ Δp = 13 bar
Temperature range	-40 to 125 °C
Actuation	voltage-controlled
Protection class	IP6K9K
Response time	ca. 20 ms
H2 leakage	1E-4 mbar l/s

H2 High Pressure Sensor

Nominal pressure	up to 700 barR
Overpressure	1400 barR
Burst pressure	2100 barR
Temperature range	-40 to 125 °C
Protection class	IP6K9K
Accuracy	< 1.5 % FSO
Supply voltage	5 V

Clean Solutions for Cold Combustion

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Overpressure	16 barA/barR
Burst pressure	30 barA/barR
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H_2 Flow Control Valve (H_2PCV)

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Burst pressure	110 bar
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Temperature range	-40 to 125 °C
Actuation	PWM (current control)
Protection class	IP6K9K
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TELL US YOUR H_2 WISHES

Are you looking for valves or sensors with different performance values? No problem! ETO is used to realizing individual customer specifications. Our design principles create the ideal conditions for this. We can also develop completely new products according to your specifications. Talk to us about the future of the hydrogen economy.

Oliver Thode or David Muffler will be happy to answer your questions:

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