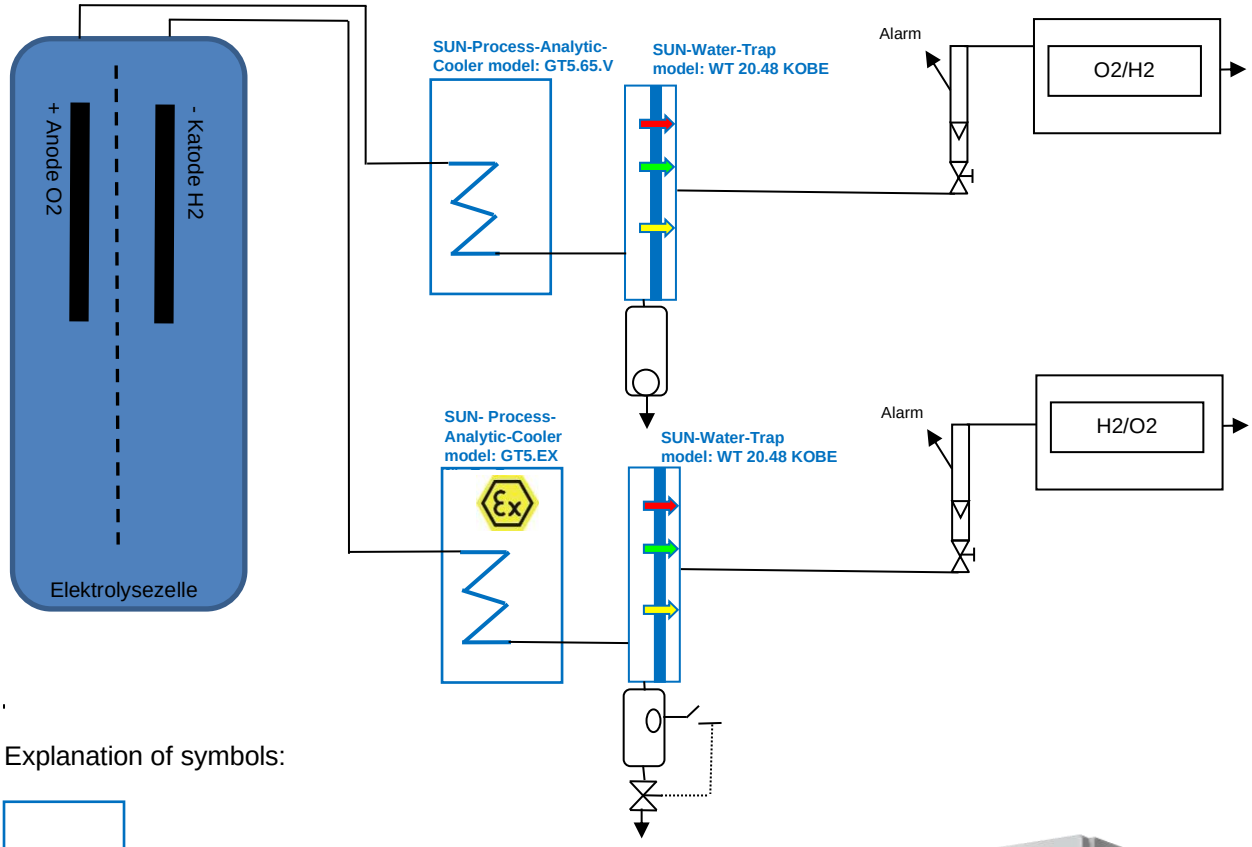
Technical report of gas analytic technology to the topics:

Gas analysis technology, gas processing, extractive gas analysis, green hydrogen, electrolyzer, power to gas and power to liquid, process analysis, process analysis technology (PAT)

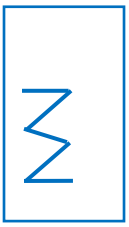
Safety-related operational measurement of oxygen (O2) and hydrogen (H2) on electrolysers for the production of hydrogen.

In the course of climate change, there is an increasing focus on the production of **renewable hydrogen**, so-called **green hydrogen**. **Power to gas** and **Power to liquid** processes are being used to replace fossil fuels.
The hydrogen electrolysis is monitored for gas quality, impurities and explosive gas mixtures (oxyhydrogen) by means of extractive gas analysis technology from **SUN-Control-Analytik-GmbH®**.
Via electric current, the individual compounds are separated from each other during water electrolysis (2H2O >> 2H2 + O2). If the electric current comes from renewable energy sources (sun, wind), it is considered green hydrogen.

Gas flow diagram:



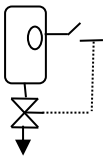
Explanation of symbols:



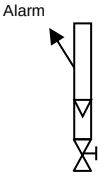
SUN-analytic gas cooler model: GT5.65.V

SUN-Water-Trap model: WT 20.48 KOBE

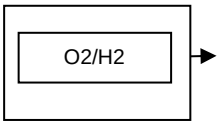
Automatic condensate drain



Condensate vessel
with float switch



Flow meter with regulator valve and alerting



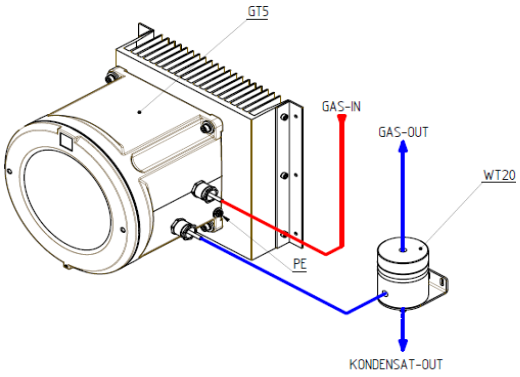
Gas analyser

Function description:
The electrode gas is cooled down to a defined dew point via the **Process-Analytic-Cooler** model GT5.65.V from **SUN-Control-Analytik-GmbH®** . An automatic condensate drain removes the resulting liquid.
The **Water-Trap** model WT 20.48 KOBE with the built-in **SUN-Control-Analytik-Membrane®** protects the high-quality analyzer from penetrating condensate and fine dust.
The gas flow monitoring is carried out by a variable area flow meter with a regulating valve. Optical and electrical alarms are standard. The analyzer converts the required gas concentrations into an analog or digital signal, which is processed further as a control, regulation and alarm signal.

The alternative to installation in potentially explosive areas is the Process-Analytic-Cooler model GT5.EX is available. zur Verfügung.

The company **SUN-Control-Analytik-GmbH®** is an official supplier of gas analysis technology for **hydrogen electrolysers.**

EU - Baumusterprüfbescheinigung



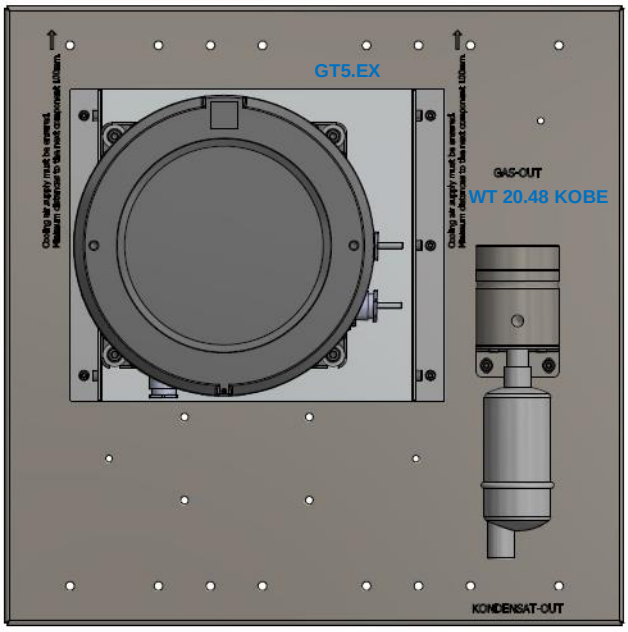
IEC/EN 60079-0, 60079-1, 60079-31

EPS 17 ATEX 1 072
Gas: Ⓔx II 2G Ex db IIC T4 Gb (Tamb +60°C)
Ⓔx II 2G Ex db IIC T6 Gb (Tamb +40°C)
Staub: Ⓔx II 2D Ex tb IIIC T130° Db (Tamb +60°C)
Ⓔx II 2D Ex tb IIIC T80° Db (Tamb +40°C)

IECEx EPS 17.0036
Gas: Ex db IIC T4 Gb (Tamb +60°C)
Ex db IIC T6 Gb (Tamb +40°C)
Staub: Ex tb IIIC T130° Db (Tamb +60°C)
Ex tb IIIC T80° Db (Tamb +40°C)

Installation example:
The picture shows an analysis Mounting plate with the components listed in the gas flow plan:

-SUN- Process-Analytic-Cooler model: GT5.EX
-SUN-Water-Trapmodel: WT 20.48 KOBE
- Automatic condensate drain



Hydrogen fact sheet:

-Non-toxic, colorless, odorless gas
-Combines with oxygen to give water (H2O)
-Burns with an invisible hot flame
-Norm density 0.089 kg/m³, west lighter than air
-Ignition range 4 - 77 vol.%, ignition temp.: 560°C
-Most abundant element on earth.
-Highly flammable -Keep away from ignition sources
-Forms dangerous gas mixtures with oxygen (oxyhydrogen)
-High diffusion rate
-conversion 1 ppm = 0.08 mg/m³

-Consider material selection (danger of hydrogen embrittlement of metals such as pipes and instrumentation components)
-Environmentally friendly properties, with air emission-free combustion to water
-Considered an energy carrier of the future that will replace fossil fuels in the medium term

Hydrogen production with color assignment:

Gray hydrogen:	Standard process via steam reforming of fossil fuels.
Blue hydrogen:	Based on gray hydrogen, CO2 emissions are reduced by earth storage.
Turquoise hydrogen:	H2 production via thermal methane pyrolysis, CO2 bonding/processing possible
Green hydrogen:	Electrolysis process produces H2 and O2. Feeding of the Elo via renewable energies. e.g. wind or photovoltaic power.

Hydrogen storage options:

Easy:	Pressurized storage in cylinder bundles or caverns.
Expensive:	Refrigeration via cryogenic process at -250°C
New:	H_2 is chemically coupled and stored in carrier material (metals/oils)
Known:	H_2 and CO_2 synthesis to methanol, already realized in petrochemistry
Interesting:	Ammonia production via green H_2 and N_2. Industrial use and infrastructure available

Oxygen fact sheet:
-Colorless, odorless, combustion-promoting gas -Strong oxidant.
-Important component in combustion -Danger of asphyxiation in the event of oxygen deficiency
-Norm density 1.429 kg/m³ -Conversion 1 ppm = 1.33mg/m³

-Strong oxidizing agent and, under unfavorable conditions, can cause carbons such as oils, greases and particles to spontaneous combustion. To avoid such undesirable reactions in plant components, the SUN-Control-Analytik offers a coordinated cleaning procedure for the surfaces in contact with the media.

After the **SUNOX100-Process**, the surfaces in contact with the media are free of residues.

Technology leader in Hydrogen-Sample-Handling
Made in Germany

Hydrogen tested
Ready for the future energy
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