



Soluciones para la medida de hidrógeno

PRESENTACIÓN DE LA EMPRESA

Iberfluid pretende que sus clientes mejoren su **productividad y seguridad**.

Estamos presentes en los principales mercados industriales desde **hace más de 40 años**.

Nuestras soluciones son **personalizadas a las necesidades de cada cliente**.

Instalación y puesta en marcha
Servicio de asistencia técnica
Mantenimiento y calibraciones
Proyectos llaves en mano
Formación



IBERFLUID INSTRUMENTS, S.A. trabaja constantemente para liderar las aplicaciones de medición de caudal en diferentes sectores industriales



Oil & Gas y Distribución



Química



Farmacéutica y Alimentaria



Aplicaciones marinas



OEMS / EPC



Laboratorios y R&D



Generación Térmica



Siderúrgica

Application: Rheonik and Hydrogen

Pioneering and leading into the future!

Welcome to Rheonik 2.0
Independent Coriolis Manufacturer
German Engineering and Manufacturing



High Pressure Hydrogen Coriolis Flow Meters
www.rheonik.com

Rev 1.1-ST – July 2018

Application: Rheonik and Hydrogen

Pioneering and leading into the future!

- Overview Hydrogen Mobility
- Rheonik in Hydrogen Dispensers
 - First installations
 - Actual status
 - Market opportunities
- Rheonik in Hydrogen trailers
 - Actual projects
 - Market opportunities



Application: Rheonik and Hydrogen

Pioneering and leading into the future!

Rheonik is market and technology leader in Hydrogen metering:

- Longest experience of all manufacturers in H₂ metering
- Largest installed base globally
- Largest product range starting from 1g/min
- Highest pressures up to 1.500 bar
- Cryo-Hydrogen as liquid and Hydrogen as gas
- Stationary and mobile installations
- Latest Electronics Design with **AssuranceFactor**®
- Best performance in class – proved by national labs and customer tests



#1 in Hydrogen metering

Rheonik – first in the application, pioneering the technology:

1990 First Compressed Natural Gas (CNG) Coriolis Flow Sensor for
hundreds of CNG filling stations in Italy

2003 First 1000 bar Coriolis Flow Sensors for the start of Hydrogen Industry of
car fueling

2009 Installation at Shanghai H₂-fueling station

Avg. 4 cars per day.

350 bar technology.

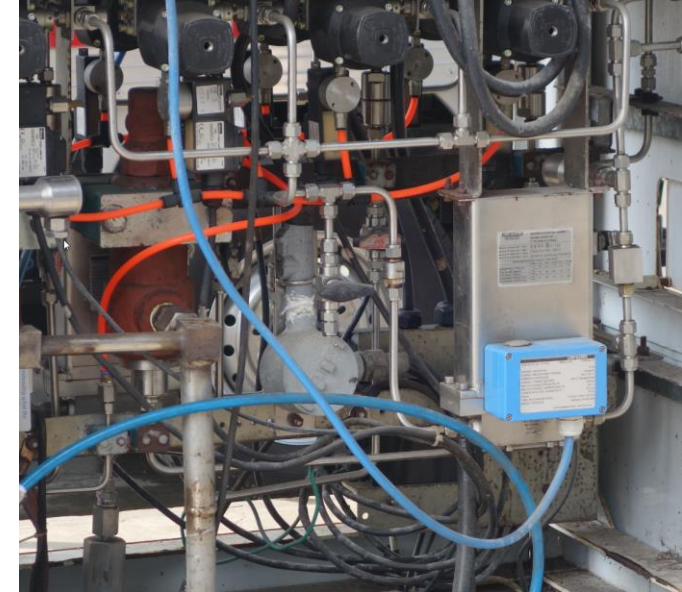
Meter continuously
in service since 2009

2016 Engineering Partner of IVYS – DOE-Project: Advanced Hydrogen
Dispenser Technology

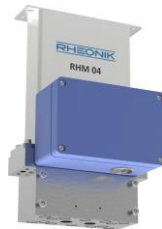
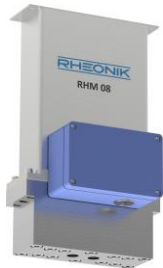
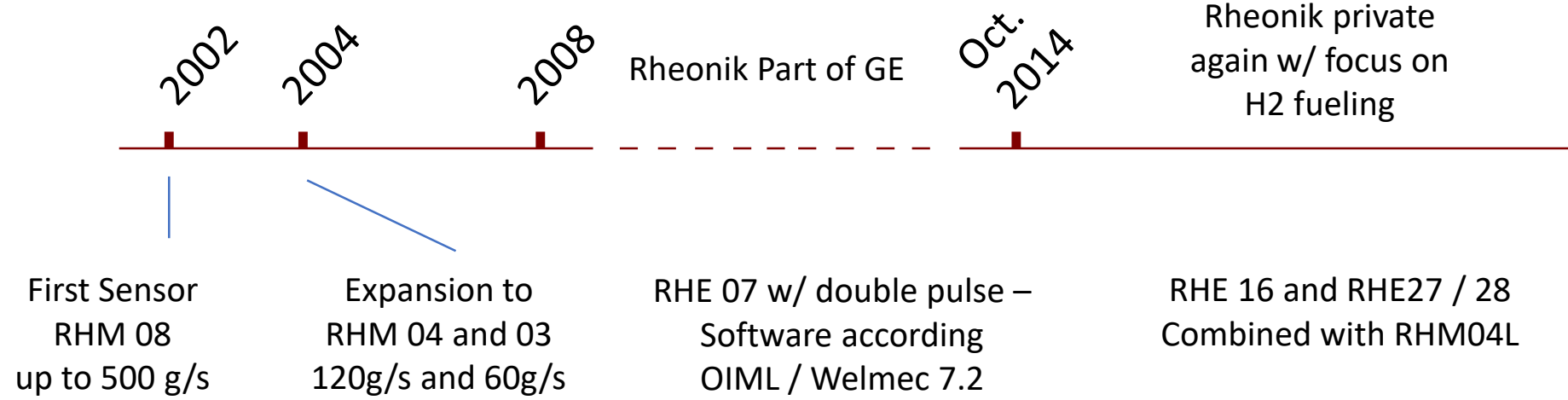
2016 Intense testing with RHE16 and RHM 04 L – temperature compensation
is key

2017 Key supplier for Linde Gas, excellent test results.

2017 Contact to major metrology labs/orgs.: NMI, PTB, LNE, NREL, KRISS, H₂-
Mobility, NOW, CEP



Solid 900 bar H₂ Measurement solutions since 2002 !



Increased momentum for hydrogen applications:

Market Driver: CO₂, green house gas, NO_x, Diesel, Clean Energy

Key regions: USA (California), Germany, Japan

Future regions: China, all W-Europe, USA, Korea

<http://www.hydrogencarsnow.com>

Think beyond cars:

- hydrogen/fuel cell forklifts
 - hydrogen/fuel cell busses
 - hydrogen/fuel cell truck's
 - hydrogen/fuel cell train's
- Even: hydrogen/fuel cell ferries



Overview Hydrogen Mobility

First 100% Fuel Cell Hydrogen Truck



NIKOLA ONE™

- 100% ZERO EMISSIONS
- HYDROGEN POWERED
- 800 - 1,200 MILE RANGE
- 15 MINUTE REFILL TIME
- NEVER PLUG IN
- 100% ELECTRIC DRIVE
- THE END OF DIESEL ENGINES
- 1/2 THE OPERATING COST COMPARED TO DIESEL
- 2,000 FT. LBS TORQUE
- 1,000 HORSEPOWER
- 320 kWh BATTERY
- 1 MILLION MILES FREE* HYDROGEN FUEL
- REGENERATIVE BRAKING
- NO COMPETITION

RESERVE YOURS FOR ONLY \$1,500

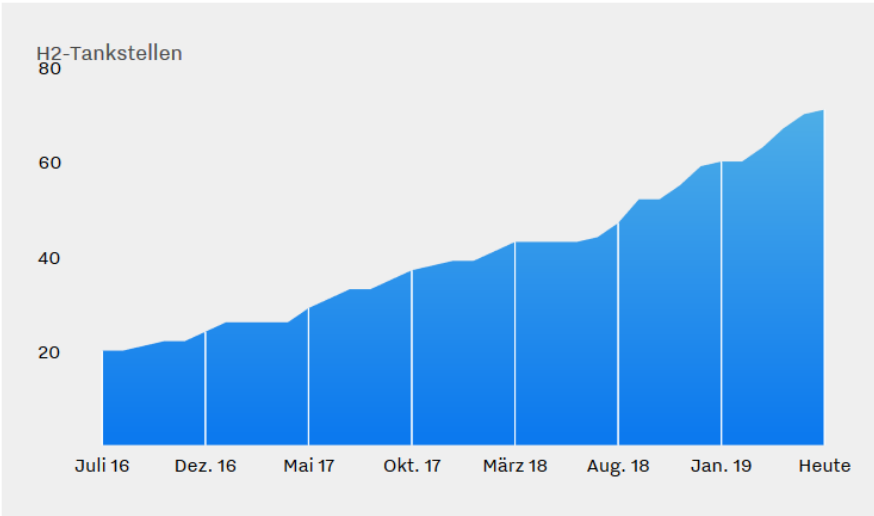
100% Refundable deposit

U.S. Xpress

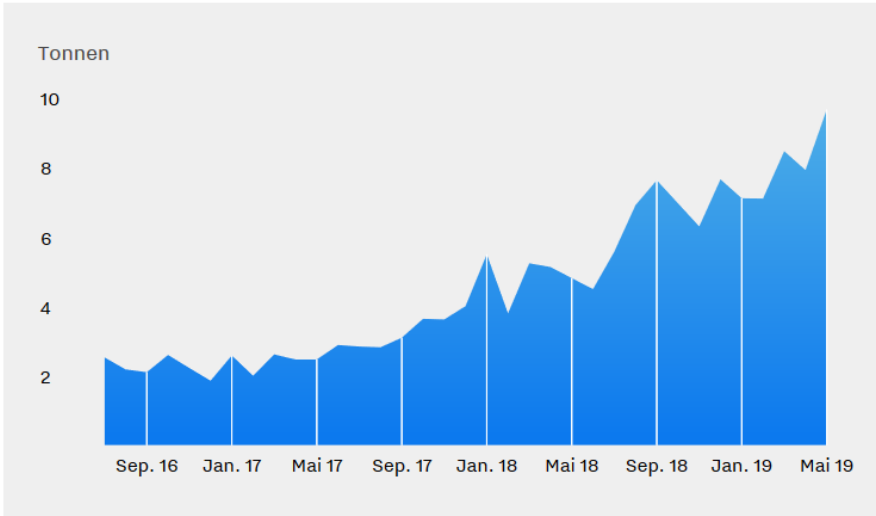
H₂

Hydrogen Market DE+EU Overview

Number of Stations in Service



Hydrogen Dispensed:



Actual Stations in Service:

Germany: 70 (End of 2019: 100)
Europe: 116 (End of 2019: 180)

Expected in 2025:

Germany: 400
Europe: 800

<https://h2.live/>

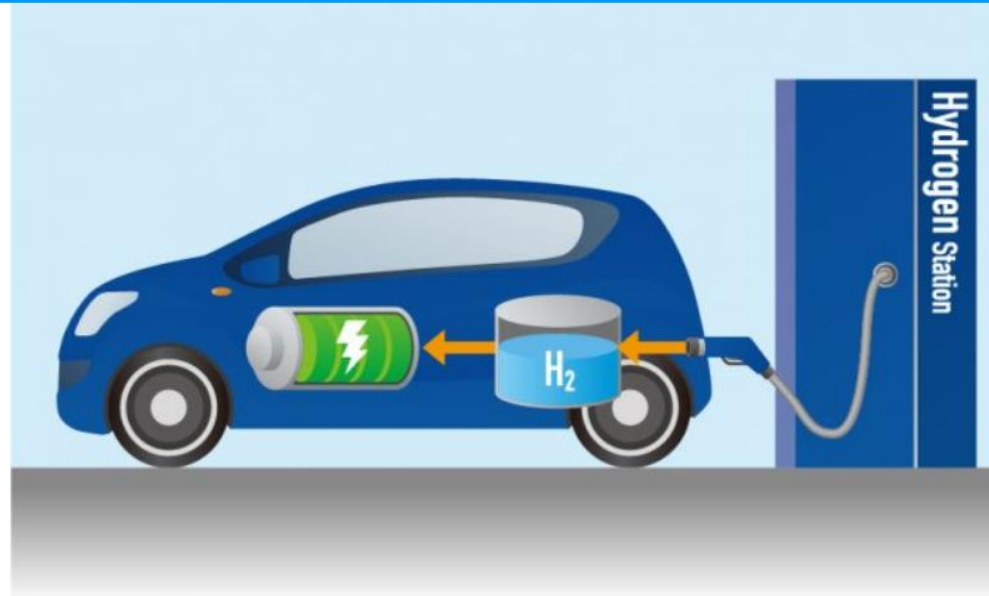


NMi appointed to issue Dutch certificates for CG dispensers

Legal Situation:

All major national labs are waiting for the first OIML / MID-certified Coriolis meter for hydrogen dispensers.

All test results of Rheonik's meters so far have shown, that Rheonik's RHM's/RHE's will meet the OEM spec's.



18 September 2017

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As of this week NMi is appointed to issue Dutch certificates for Compressed Gas dispensers. The Dutch legislation has been changed 1 November 2016. As of this date, market access is only possible for nationally approved CNG (or Hydrogen) dispensers. This means that a manufacturer should acquire a national approval in the Netherlands. These approvals are based on the OIML R 139 (2014).

Hydrogen metering: -> Rheonik is the first choice !

350 bar technology:

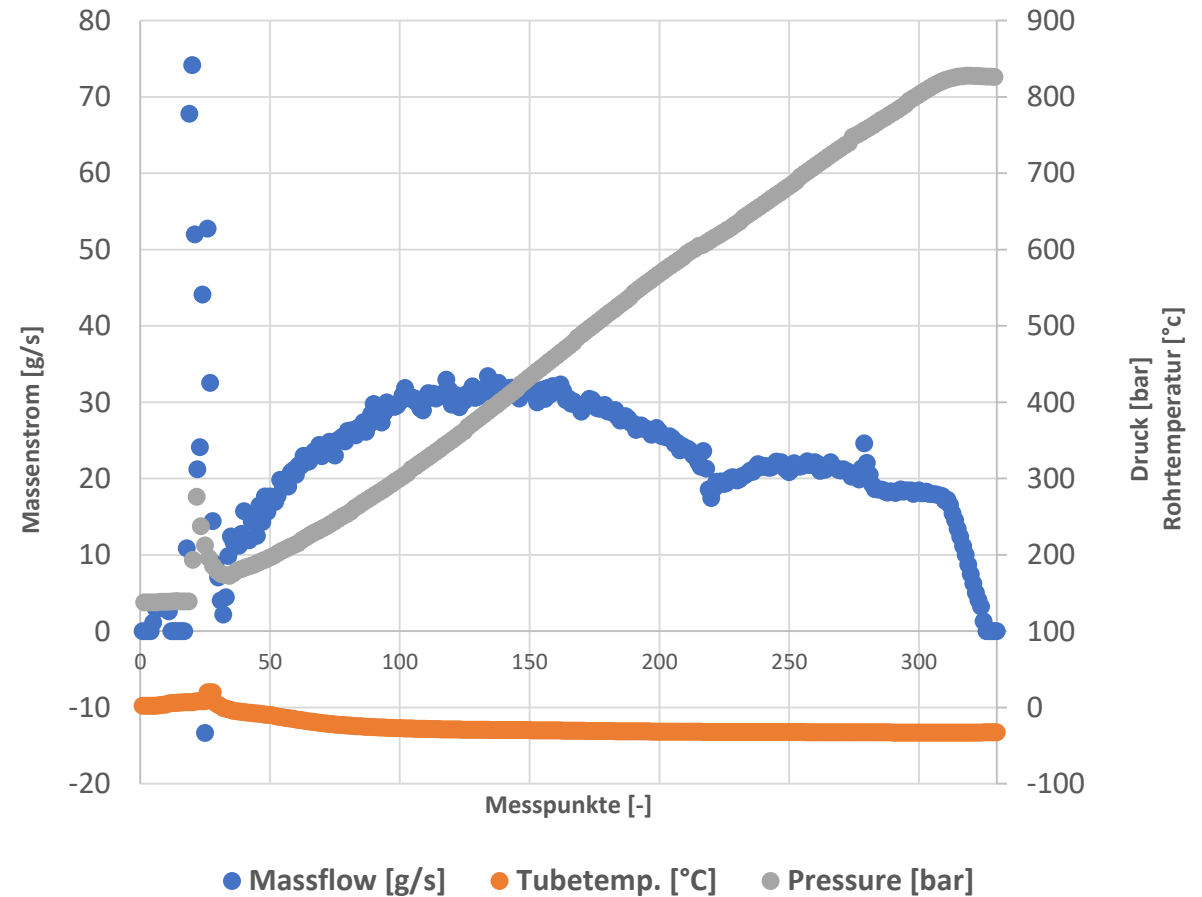
- Busses
- Forklifts
- Cars gen. 2 tanks

700 bar technology:

- Cars gen. 3 and 4 tanks
- > Rheonik RHM's work in the cold, as well in the warm section with highest precision!

Next gen SAE fueling protocol 1000 bar ?

- > RHM's are ready for it!



High Pressure H₂-fueling SAE 700 bar



Test Results at Linde Nov. 2016, July 2017

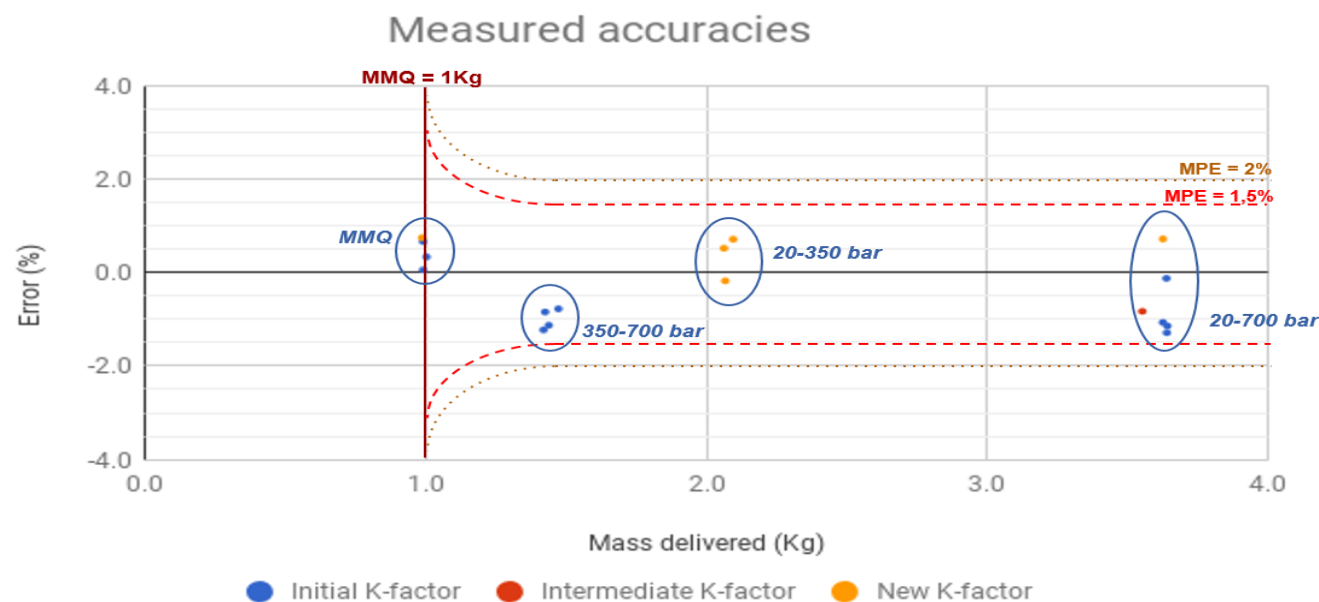
	Competition	RHM	RHM Opt.	Rheonik [kg]	RMS [kg]	Abweichung [%]	Abweichung [kg]		Korr:	Mit KF 5032,178
Sdev.	15,90073995	10,75665611	10,5723847	5,489066	5,299	3,587	0,190	NP: 4,46	0,205	0,908
Avg. Diff.	3,65	1,12	0,00	5,529934	5,291	4,516	0,239		1,134	1,813
# in spec	1	6	8	0,588338	0,559	5,248	0,029	NP: 4,81	1,867	2,527
# total	15	15	15	1,049243	1,0485	0,071	0,001		-3,311	-2,517
Hitrate	7%	40%	53%	1,572892	1,528	2,938	0,045		-0,444	0,276
				2,231049	2,173	2,671	0,058		-0,710	0,017
				1,089442	1,047	4,054	0,042		0,672	1,363
				1,037447	1,008	2,921	0,029		-0,460	0,260
				1,080978	1,043	3,641	0,038		0,260	0,961
				1,032568	1,001	3,154	0,032		-0,228	0,486
				1,148997	1,113	3,234	0,036		-0,147	0,565
				2,667359	2,514	6,100	0,153		2,719	3,357
				2,903661	2,8215	2,912	0,082		-0,470	0,251
				2,565086	2,498	2,686	0,067		-0,696	0,030
				2,531653	2,506	1,024	0,026		-2,358	-1,589
				2,564364	2,507	2,288	0,057		-1,093	-0,357
				2,271564	2,211	2,739	0,061		-0,642	0,083
				2,659162	2,531	5,064	0,128		1,682	2,347
				2,94277	2,8515	3,201	0,091		-0,181	0,532



-> Great results at real life conditions H2 fueling at T -40°C
 -> Rheonik out-performed the competition out of the box !

Competitive advantage:

- Best performance in the cold section and warm section of an H₂-dispenser
- Smallest footprint of all competitors
- Largest installed base in H₂ dispensers globally
- OIML / MID approval in process
- RHE27 / 28 designed to be OIML-ready
- 2 weight's & measures approvals in California
- Global service and support
- First choice for the market leaders



Competitive advantage:

- Best performance in the cold section and warm section of an H2-dispenser
- Smallest footprint of all competitors
- Largest installed base in H2 dispensers globally
- 350 bar and 700 bar technology, ready for the 1000bar technology
- Competitive prices even at 350 bar technology
- RHE27 / 28 designed to be OIML-ready
- 2 weight's & measures approvals in California
- Global service and support
- First choice for the market leaders





- The Market
- Technical Aspects
- Actual Technology / Competition
- USP's / Where to go



Application: Hydrogen Trailer Unloading

- The Market:
200bar / 300 bar trailers -> 500 bar trailers
Germany: 180 H2 trailers
350 high pressure gas trailers
Europe: 350 H2 trailers
USA: >300 trailers
- Legal requirement in Europe:
Traceable measurement according to
MID-Directive installed until Dec 2020



**Highest accuracy - short unloading time -
connected to On-Board-Unit - ready for 500 bar trailers -
quick and easy recalibration!**

Application: Hydrogen Trailer Unloading

- Rheonik's Omega Coriolis Advantage:
 - > Best performance for H₂ High Flow Rates
 - > Compact package fit's ideal into the trailer, short flange-to-flange length
 - > Ready for 500 bar storage technology
- Field test finished at Linde's 200bar and 300 bar trailers
- 22 Trailer in operation with a Rheonik Metering System (>200 till end 2020)
- Reference Metering System is as well a Rheonik Omega Coriolis



Application: Hydrogen Trailer Calibration 300 bar



Application: Hydrogen Trailer Calibration 200 bar







flow

Eichnormal: LG Prüfstand Waage Prüfling: FlowMass

0 %

Durchfluss	-9,72 t/h	Fehler	n. def.	%
Eichnormal	0,00 kg	Gesamtmenge	5104,85	kg
Prüfling	0,00 kg	Zeit	00:58:19	hh:mm:ss

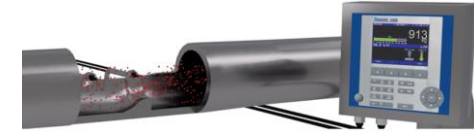
Drucken	Nr	Start kg	Stop kg	Eichnormal kg	Prüfling kg	F abs kg	F rel %	q %	q t/h	Kommentare
<input checked="" type="checkbox"/>	13	1550,00	1800,00	250,00	249,54	-0,46	-0,18	52,75	6,33	
<input checked="" type="checkbox"/>	14	1850,00	2100,00	250,00	249,96	-0,04	-0,02	52,68	6,32	
<input checked="" type="checkbox"/>	15	2150,00	2400,00	250,00	248,88	-1,12	-0,45	73,98	8,88	
<input checked="" type="checkbox"/>	16	2450,00	2700,00	250,00	249,94	-0,06	-0,02	75,77	9,09	
<input checked="" type="checkbox"/>	17	2750,00	3000,00	250,00	249,24	-0,76	-0,30	75,63	9,08	
<input checked="" type="checkbox"/>	18	3050,00	3300,00	250,00	249,56	-0,44	-0,18	75,31	9,04	
<input checked="" type="checkbox"/>	19	3350,00	3600,00	250,00	249,46	-0,54	-0,22	75,31	9,04	
<input checked="" type="checkbox"/>	20	3650,00	3900,00	250,00	250,44	0,44	0,18	36,21	4,34	
<input checked="" type="checkbox"/>	21	3950,00	4200,00	250,00	250,33	0,33	0,13	33,31	4,00	
<input checked="" type="checkbox"/>	22	4250,00	4500,00	250,00	250,21	0,21	0,08	33,28	3,99	
<input checked="" type="checkbox"/>	23	4550,00	4800,00	250,00	250,65	0,65	0,26	25,14	3,02	
<input checked="" type="checkbox"/>	24	4850,00	5100,00	250,00	250,40	0,40	0,16	24,09	2,89	
<input checked="" type="checkbox"/>	25	5150,00	5400,00	0,00	0,00	0,00	0,00	81,00	0,72	

DE 11:57 27.11.2018

**WE ARE
EXTREME** CORIOLIS FLOW TECHNOLOGY
THAT OFFERS MORE



Customer : Linde Germany
Service : Liquid H2
Temperature : - 255 DegC



- USP's:
 - Omega Coriolis handles high flow velocities -> faster unloading
 - Omega Coriolis is available for 500 bar storage technology
 - Omega Coriolis is very compact -> fit's installations restrictions very well
 - Omega Coriolis has custom designed adaption -> good for retrofit business
- Where to go?

Key: High pressure ... the higher the better!



Can it be even more environmentally friendly?

The Hydrogen Fuel Cell E-Bike :



Bicycle	
Total weight	~ 23.6 kg
Maximum speed in electric mode	25 km/h
Motor power	250 w
H2 system	
Max. working pressure	340 bar
Storage capacity	33gr H2, corresponding to 1,000 Wh
Range per fill	> 100 km
Fuelling time	1 – 6 min
Fuel cell lifetime	5 years
Fuel cell efficiency	~ 50%
Buffer battery	60 Wh

<http://www.irunonhydrogen.com>

Advantages of the Omega Sensor



- Working horse of the industrial flow measurement
- 30 years experience and thousands of meters globally installed
- State of the art Electronics with RHE2x platform
- Full line Coriolis manufacturer from 1mm tubes till 12" meters
- Various Material for Tubes and wetted parts
- Best performance for high pressure applications
- Highest raw signal compared to all other tube shapes !
Best Signal to Noise Ratio !
- State of the art electronics with ASSURANCE FACTOR[®]
Hardware Lock, Color Display with Scheme acc. to NAMUR

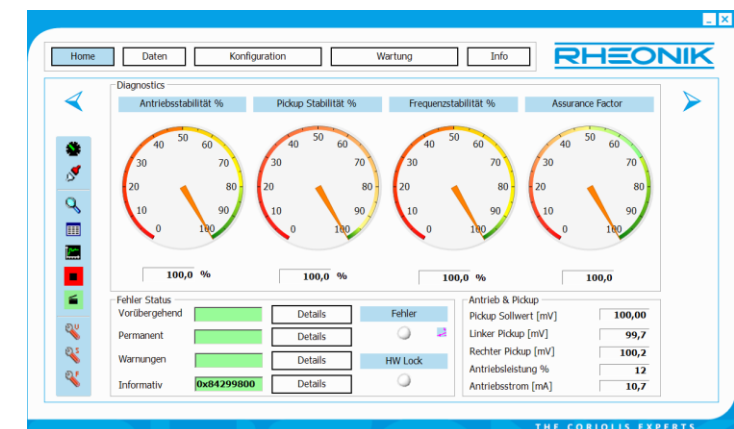
RHE2x – The New Transmitter Line. Key Features

Communication: Modbus, USB
 Advanced Diagnostics: Assurance Factor[®]
 Color Backlight Display – Namur Color Code
 Hardware-Lock



RHE.com Software
 with Data Logger

ASSURANCE FACTOR [®]			
White	Amber	Blue	Red
Normal Operation <i>No faults present. All parameters within expected limits. Meter fully operational</i>	Operation Not Optimal <i>Sensor subject to noise / changing conditions in pipe. Measurement quality may be compromised</i>	Operation at Limit <i>Sensor experiencing disturbance. Measurement quality compromised</i>	Measurement Failure <i>Sensor experiencing extreme disturbance / meter in fault. Measurement offline</i>





Soluciones para la medida de hidrógeno

MUCHAS GRACIAS