A Novel Concept of a high Accuracy Calibration Rig

Accredited acc. to ISO/IEC 17025 (mass flow rate)

Content

- Origin of Technology (The „Flow“ Company)
- Lower uncertainty, why?
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EMATEM Sommerschule 2009

Endress+Hauser

The "Group" Endress+Hauser

- Holding company in Reinach, Switzerland
- 19 production facilities in 11 countries
- Endress+Hauser sales centers in more than 44 countries
- Representatives in over 70 other countries
- 8400 Employees worldwide

Endress+Hauser

Endress+Hauser Flowtec AG

The Flow Company of E+H

Suzhou (CHIN)

Aurangabad(IN

- **Established in 1977**
- **1241 Employees**
- **Flowmeter development and production: Coriolis-, Vortex-, Ultra-Sonic-, Electromagnetic- and thermal mass flow- meters**

Cernay (FR)

Greenwood(US

Reinach (CH)

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High Precision Flowmeters

- Customer demand: higher accuracy flow meters for expensive fluids. The new E+H Promass 83/84F accuracy specification, with a ±0.05% option, demanded more precise calibration facilities.
- Up until now, there had been no traceable production calibration rigs in the world, where this high level of accuracy could be proven and verified.
- Our own rigs (± 0.05%) were also not able to provide this verification end to end (turn down).

Objective

To develop rigs for the high-precision calibration of Promass 83/84F option 0.05% mass flow meters, with the following properties:
- fully traceable
- accredited to ISO 17025
- suitable for production

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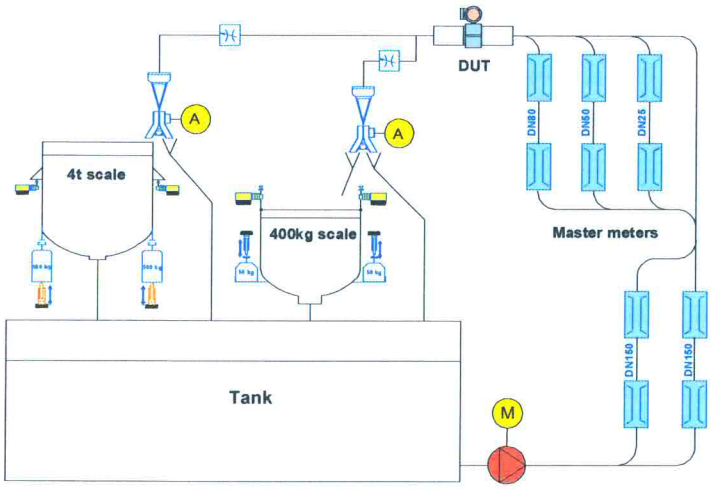
The Rig (PremiumCal)

Simplified rig drawing (FCP 7.1.5)



A - flow diverters

M – frequency controlled pumps

DUT – Device Under Test

Weighing systems: 400kg and 4000kg

Approved weights: 7x50 kg and 9x500 kg suspended around tanks

2 large underground tanks with 300m³ capacity each

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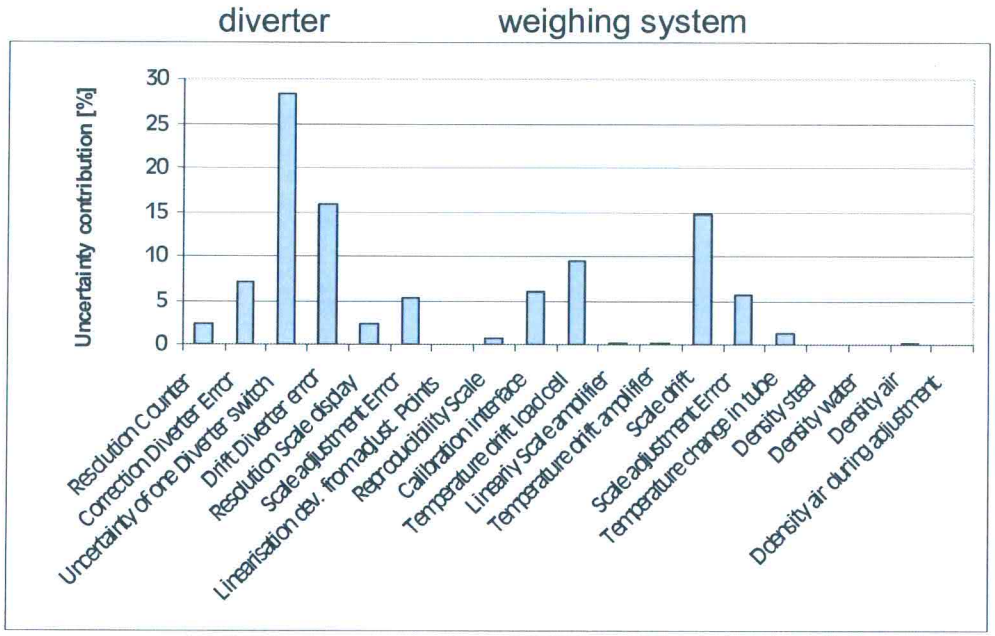
Uncertainty Elements

Extract out of 30 uncertainty elements



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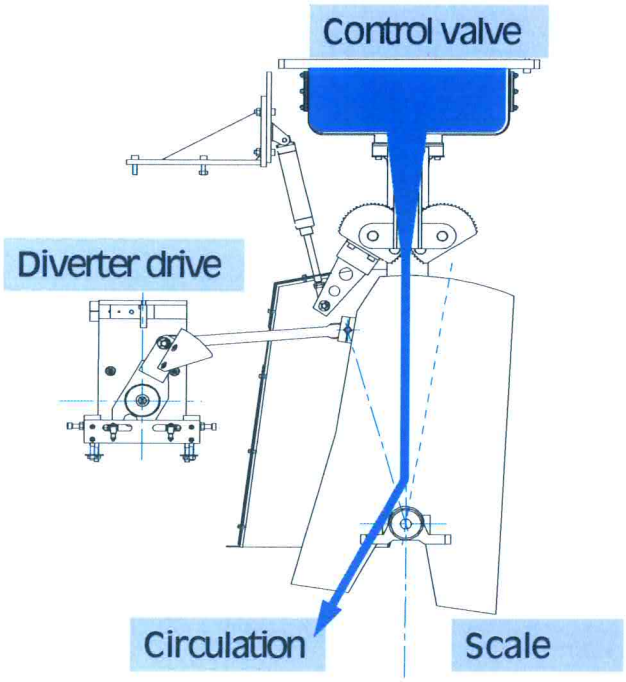
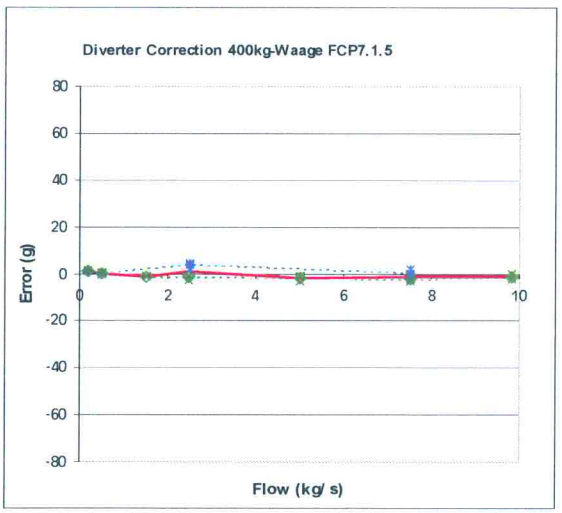
Diverter Check



Every 2 weeks:
Diverter-check

Linearisation of Diverter deviation curve



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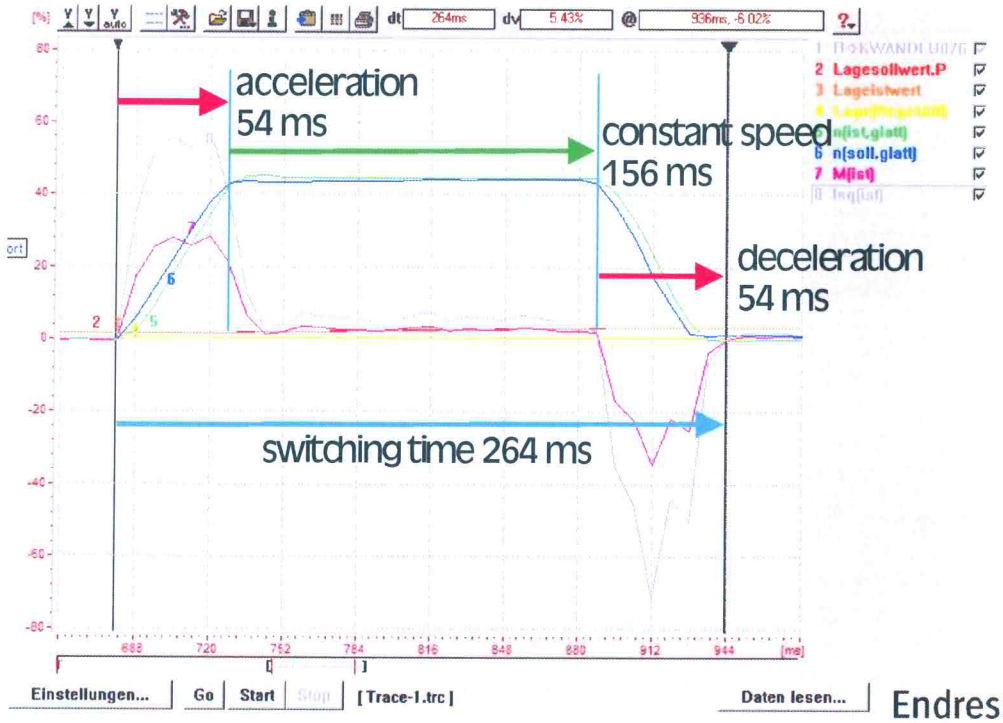
Diverter Drive



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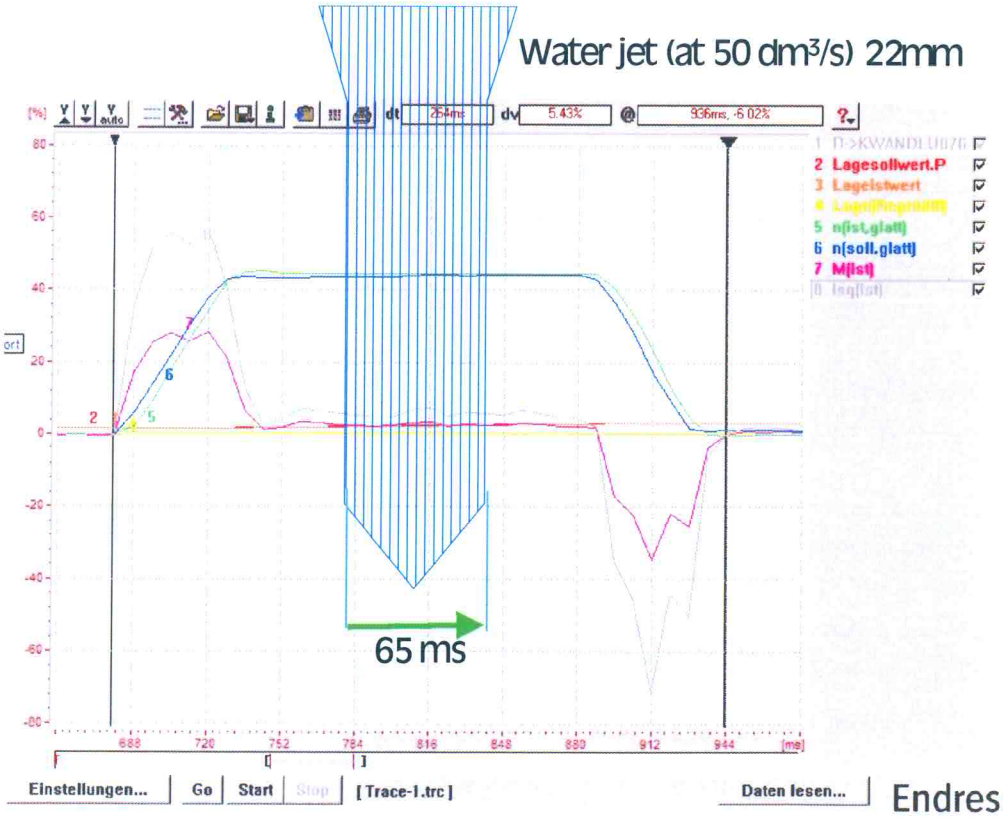
Diverter Drive



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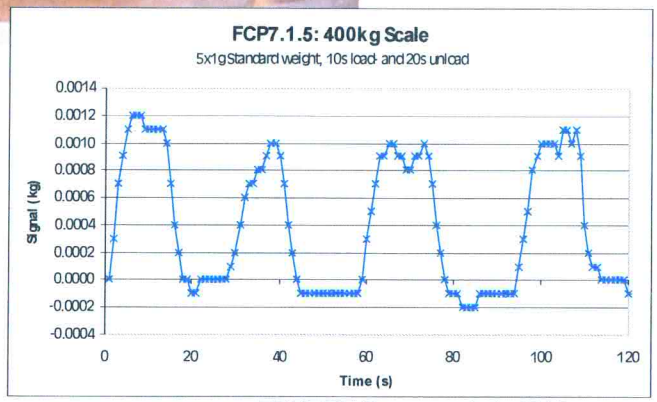
Scale Resolution

Check of scale resolution

Placing of a 1g certified weight on top of the 400kg weighing tank



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Weights / Load Cells

Certified weights F2

	Standard		PremiumCal	
Weight [kg]	OIML Classes	Tolerance	OIML Classes	Tolerance
20	M1	±1g		
50			F 2	±0.8g
500	M1	±25g	F 2	±8g

Load cells C6

	Standard	PremiumCal
Typ	Z6FC4	Z6FC6
Pieces	1	3
OIML R 60 Class	C4	C6
Non-linearity [%]	<±0.0150	<±0.0110

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Certified Weights

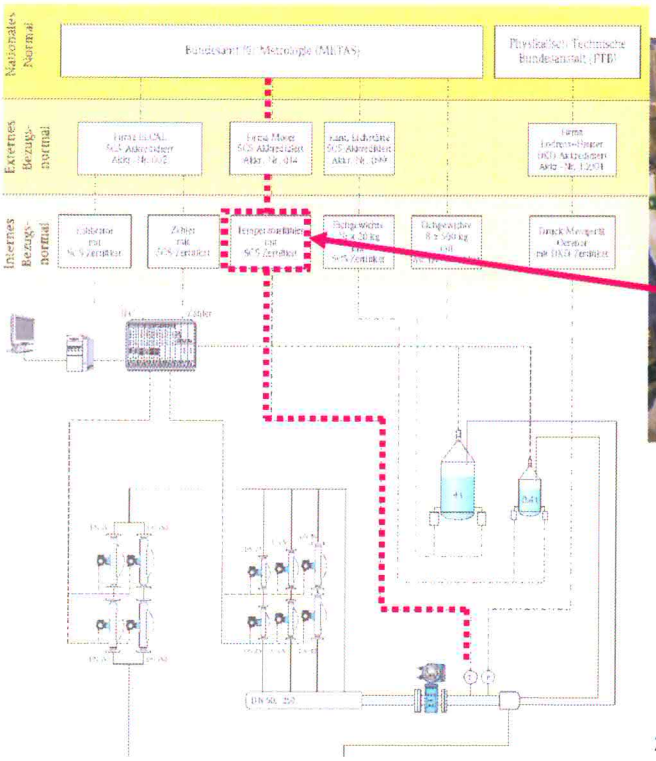
Certified weights OIML class F2.

Polished stainless steel

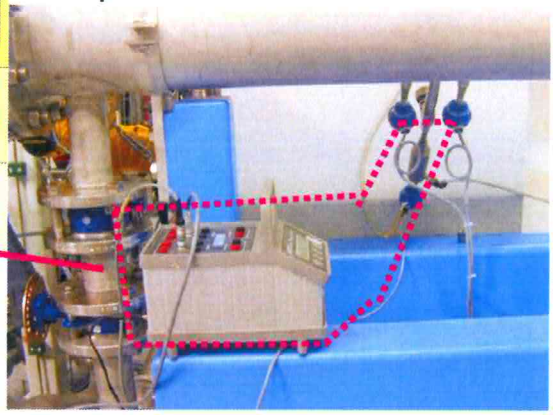
500 kg +/- 8g.

Sitting on mobile carriers to be hitched to the side of the Tank.

Traceability (Temperature)



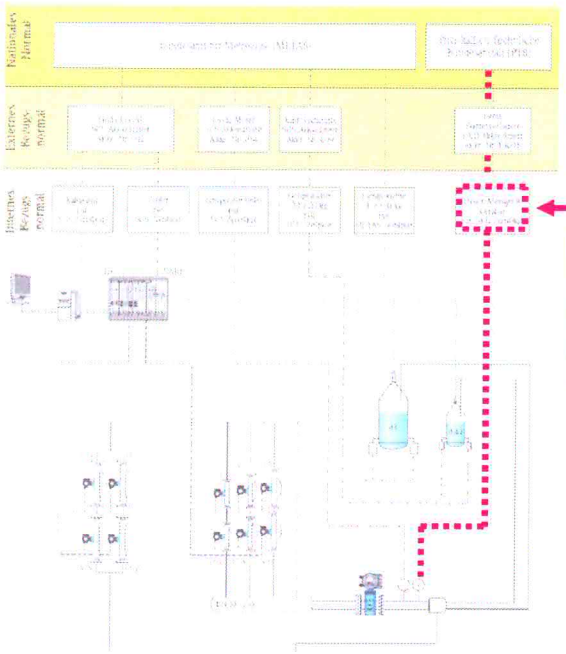
Temperature sensor check

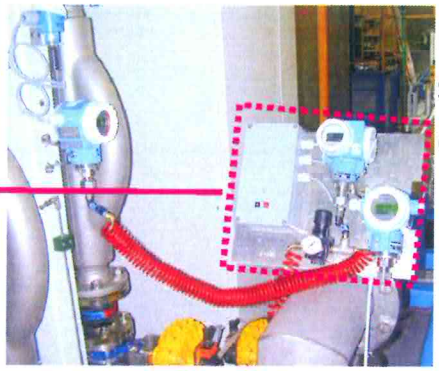


Annually:
Comparison with SCS reference sensor (calibrator + temp. sensor)

Every 2 weeks:
Sensor cross-check

Traceability (Pressure)





Pressure sensor check

Annually:
Comparison with SCS reference sensor (calibrator + pressure sensor)

Every 2 weeks:
Sensor cross-check

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Traceability – Flowmeter / Rig

Standard kilo at (BIPM) Paris
Measuring uncertainty = +/_ 0.000001%
+/- 10 microgram

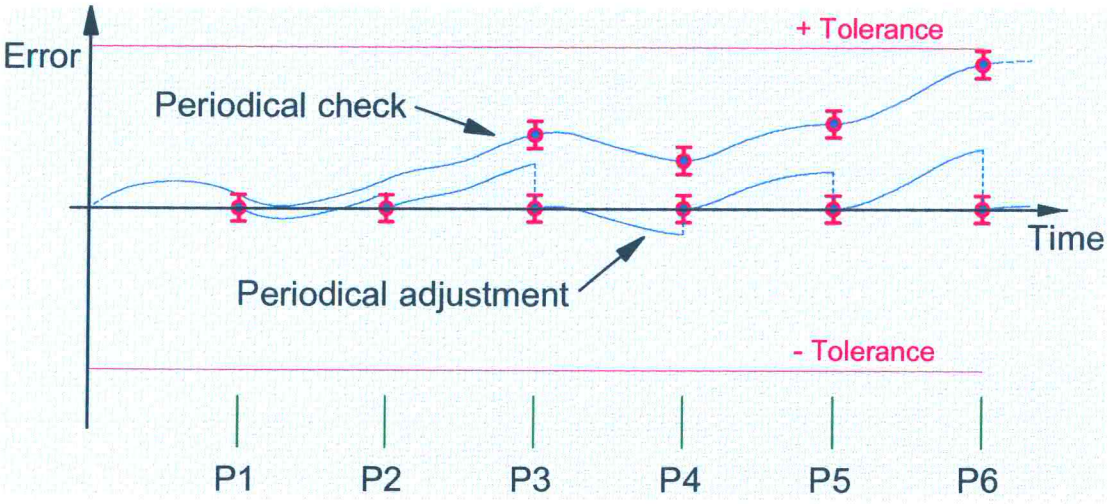
National Standard kilo of METAS
Measuring uncertainty = +/_ 0.0001%
+/- 0.5g/500 kg, duplicate No 38

Gravimetric scale of E+H Flowtec
Traceable weights of OIML class F2
+/- 0.8g/50 kg = 0.0016%

PremiumCal rigs in Reinach and Greenwood
Measuring Uncertainty +/- 0.015%
accredited acc. to ISO 17025

Promass 83/84F DN 08 – 250
Option 0.05%

Narrow Tolerances



Change from "Periodical check" to "Periodical adjustment"
Time span from P to P = 2 weeks (diverter check)

Calibration Intervals

- Very narrow tolerances for the whole system
- To be on the safe side, and until we have enough data to be sure how long we can finally extend calibration intervals, we remain within the two weeks.
- One calibration cycle takes between 6 and 8 hours
- Calibration, fully automatically over weekends

Summary

- Uncertainty of ±0.015% is very demanding and ambitious
- Requirement of technical know how is high
- Calibration time of a flow meter (PremiumCal / Promass 83/84F +/- 0.05%), is twice as long as under standard calibration regime
- To guarantee the uncertainty over time is cost and time consuming
- The added value for the customer, backed by standards, justifies the big investment

Thanks for your attention!

The Team!