



More than **sensors + automation**



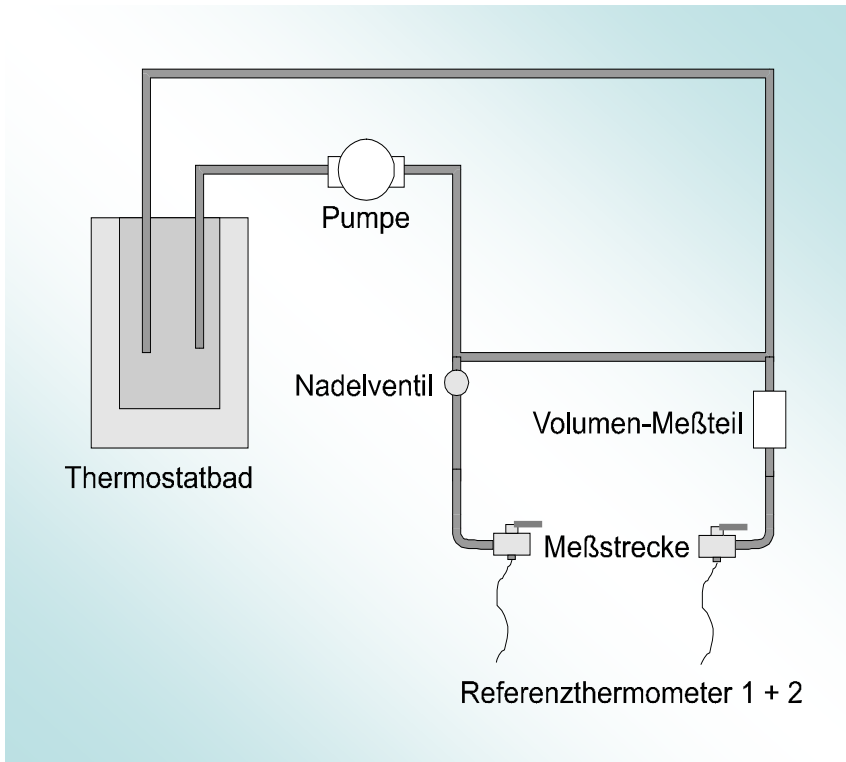
Influence of the Measuring Fluid for the Temperature Measurement

12. Internationale EMATEM-Sommerschule Kloster Seeon, 21. – 23. 09. 2016
Dipl.-Phys. Mathias Nau + Dipl.-Ing. Günter Leitgen



The test conditions

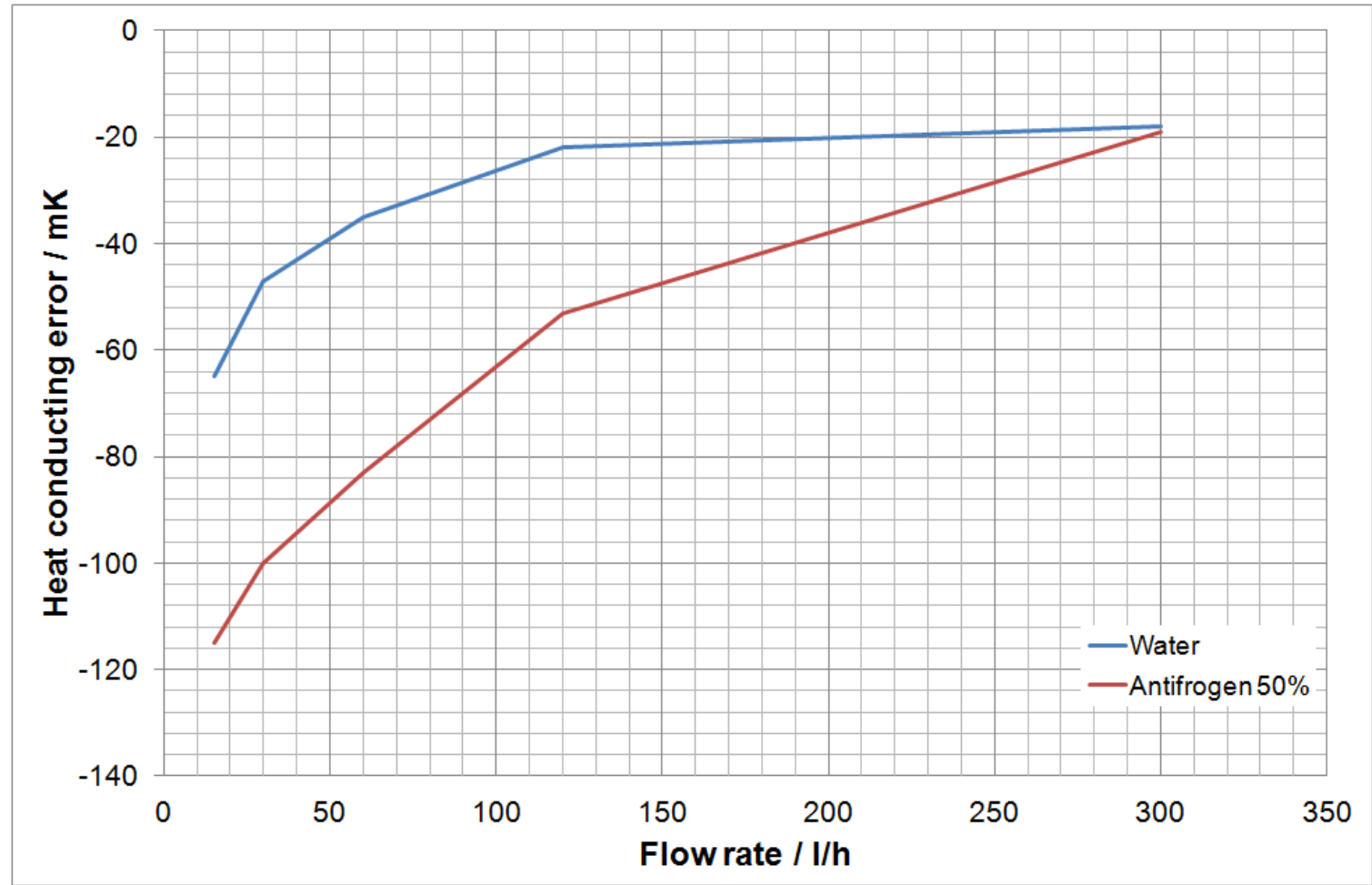
- Measuring length
 - 65 cm
- Temperature range
 - 30 °C ... 80 °C
- Flow rate
 - 15 l/h ... 300 l/h



Test conditions II

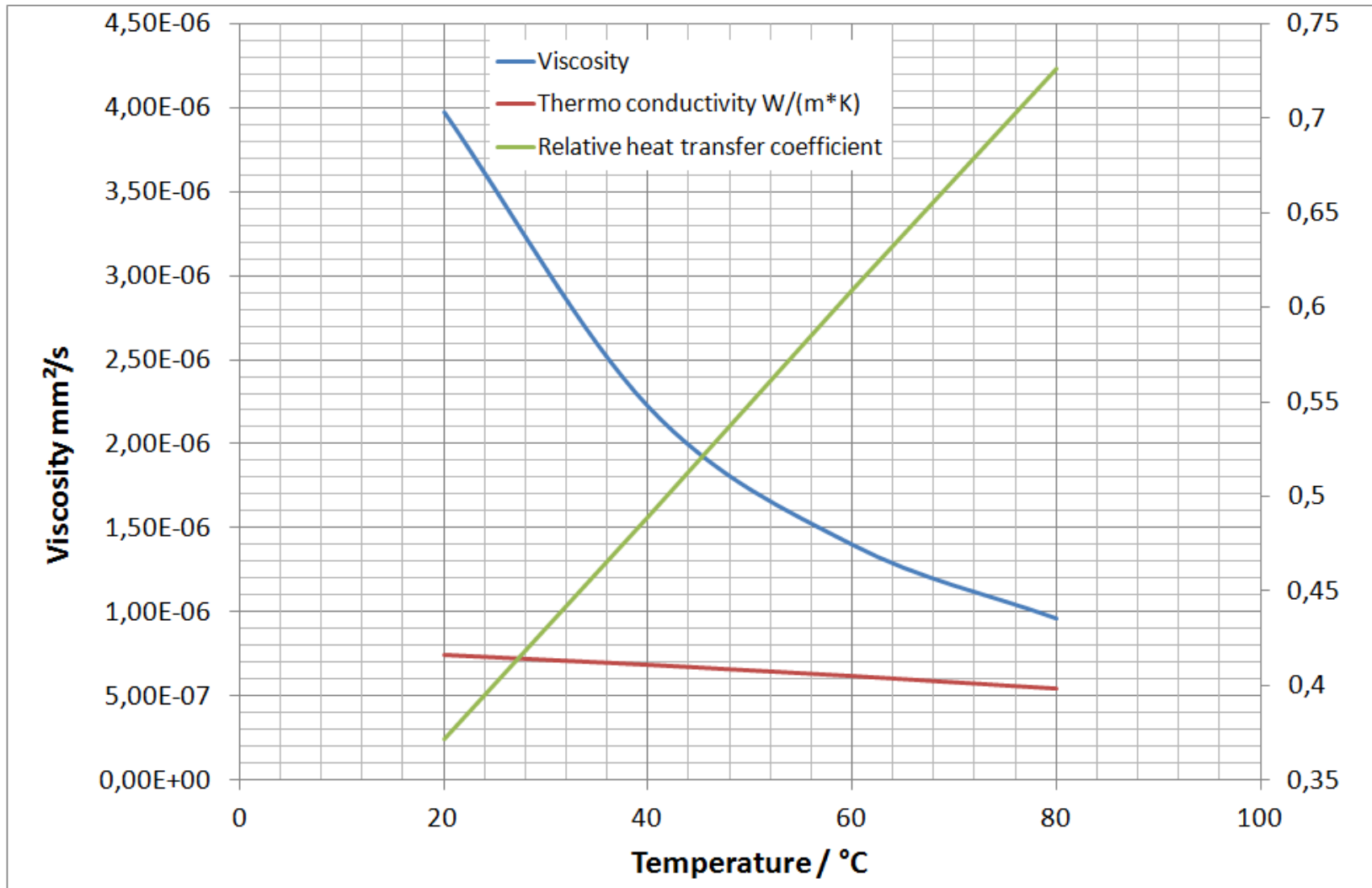
- Temperature probe
 - 5,2 mm x 45 mm probe according to BEV_A0445_2112_2007 Rev. 4
- Installed in a ball valve
- Measuring temperature 65 °C
- Medium
 - Water
 - Antifrogen 50%

First results



Discussion

- Influence of the temperature (viscosity) ?
 - Viscosity
 - Heat capacity
 - Heat transfer coefficient



Source: <http://www.schweizer-fn.de/>

Example

- Flow Temperature = 80 °C
- Return Temperature = 60 °C
- Heat Conducting Error
 - In water at 80 °C: -50 mK
 - In water at 60 °C: -33 mK
- Relative Heat Transfer Coefficient for Antifrogen N (50%)
 - At 80 °C: 0,726
 - At 60 °C: 0,609
- Heat Conducting Error
 - In Antifrogen N at 80 °C: -69 mK
 - In Antifrogen N at 60 °C: -55 mK
- Additional Error by changed Heat Transfer of AntifrogenN
 - 0,01% (MPE 0,95%)

Example II

- Flow Temperature = 12 °C
- Return Temperature = 18 °C
- Heat Conducting Error
 - In water at 12 °C: 30 mK
 - In water at 18 °C: 16 mK
- Relative Heat Transfer Coefficient for Antifrogen N (50%)
 - At 12 °C: 0,327
 - At 18 °C: 0,36
- Heat Conducting Error
 - In Antifrogen N at 12 °C: 92 mK
 - In Antifrogen N at 18 °C: 45 mK
- Additional Error by changed Heat Transfer of AntifrogenN
 - 0,53% (MPE 2%)

Conclusion

- Heat transfer is influenced by the different fluids
 - In praxis the effect must be considered
- First measurement shows the differences between water and AntifrogenN (50%)
- Case studies show the influence of the temperature difference
 - Further investigations must confirm
 - Temperature dependency
 - Different installations of the temperature probes (flow sensor, pocket, etc.)



More than **sensors + automation**



Thanks for your attentions!

