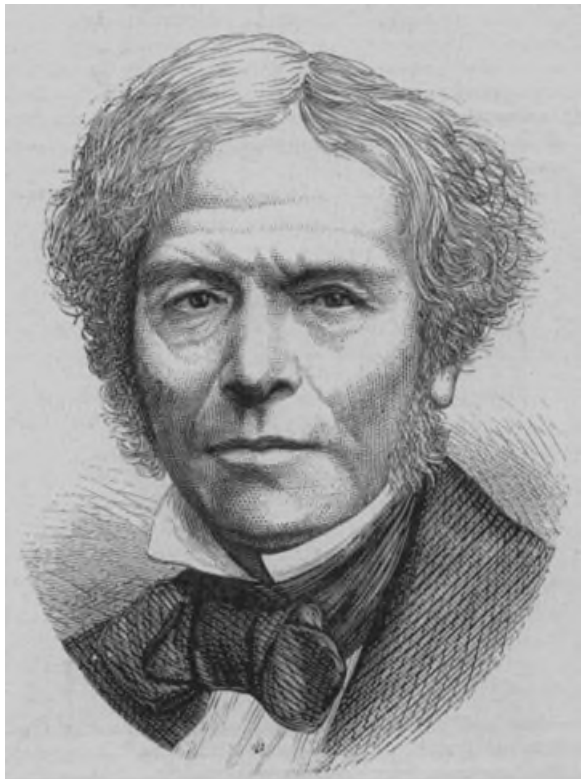
Electro Magnetic Flowmeter

Measuring Principle

Objective of this learning module

- The participant understands…
- …the history of the technology
- …the physical principle of an electro magnetic flowmeter (EMF)
- …the general design of an EMF
- …the grounding concept of an EMF
- …the function of the empty pipe detection
- …the advantages and limitations of an electro magnetic flowmeter

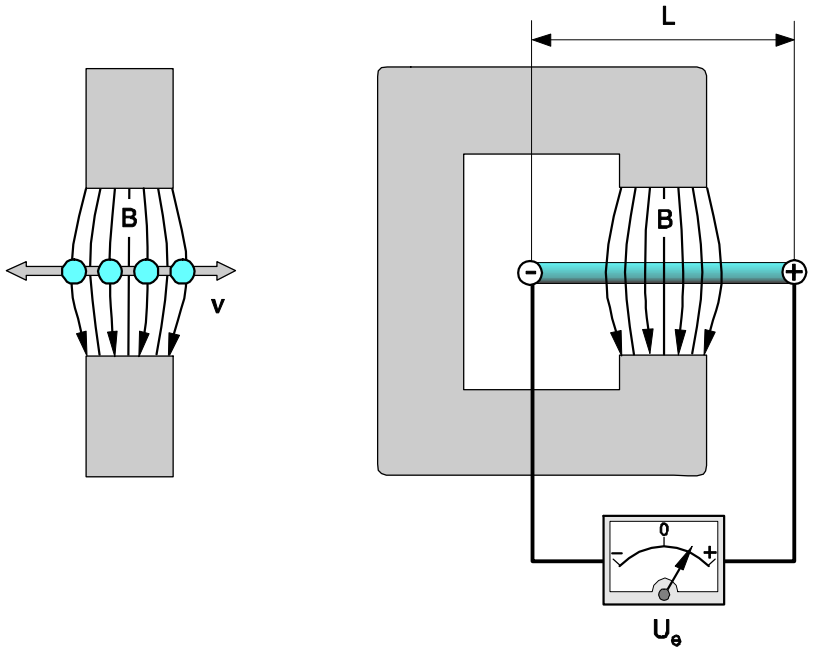
Michael Faraday



- Born in Newington Butts (London, UK) 22.September 1791
- Died 25. August 1867 in Hamton Court (UK)
- Contributed mayor findings in the science of electricity and chemistry
- Defined the law of induction

http://en.wikipedia.org/wiki/Michael_Faraday

Physical Basics of EMF



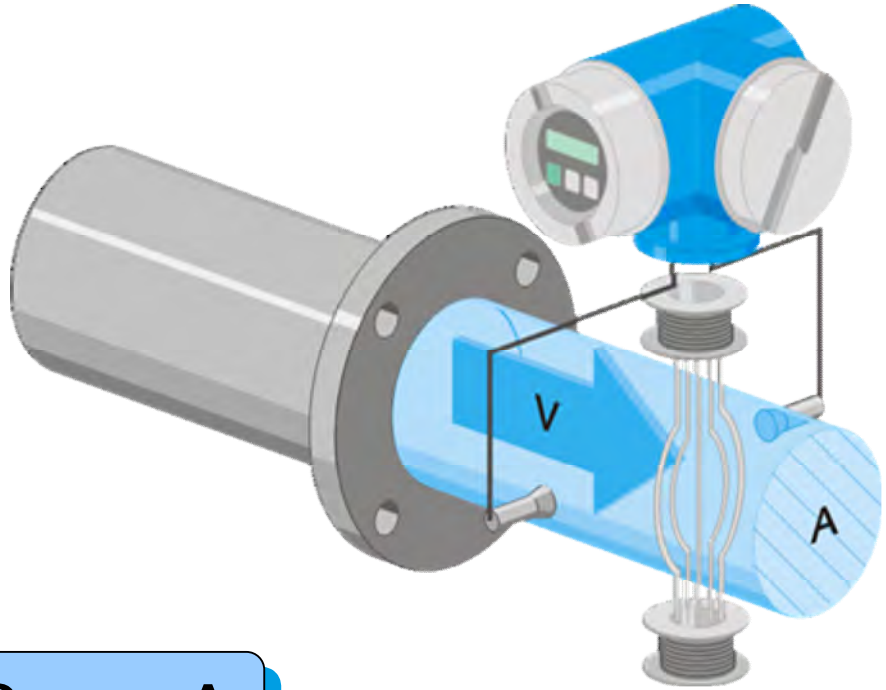
A voltage is induced in an electric conductor is moved through a magnetic field.

Faraday's Law

$$U_e = B \times L \times v$$

***B* = Strength of Magnetic Field**
***L* = Length of Conductor**
***v* = Velocity of Conductor**

Measuring Principle



$$Q = v \times A$$

Q = Volume flow
v = Flow velocity
A = Pipe area

$$U_e = B \times L \times v$$

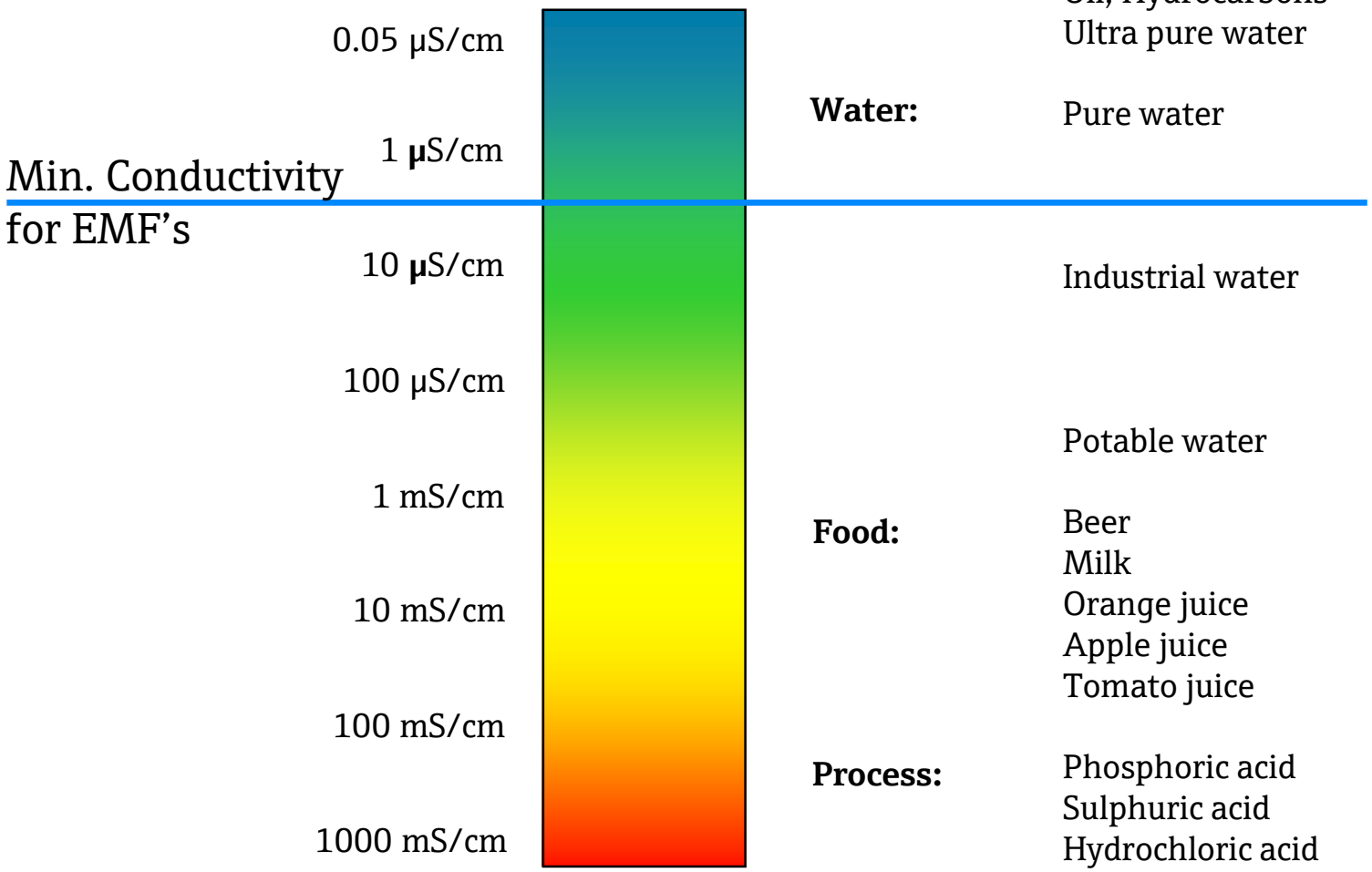
B **= Strength of Magnetic Field**
L **= Length of Conductor**
v **= Velocity of Conductor**

$$U \sim v$$

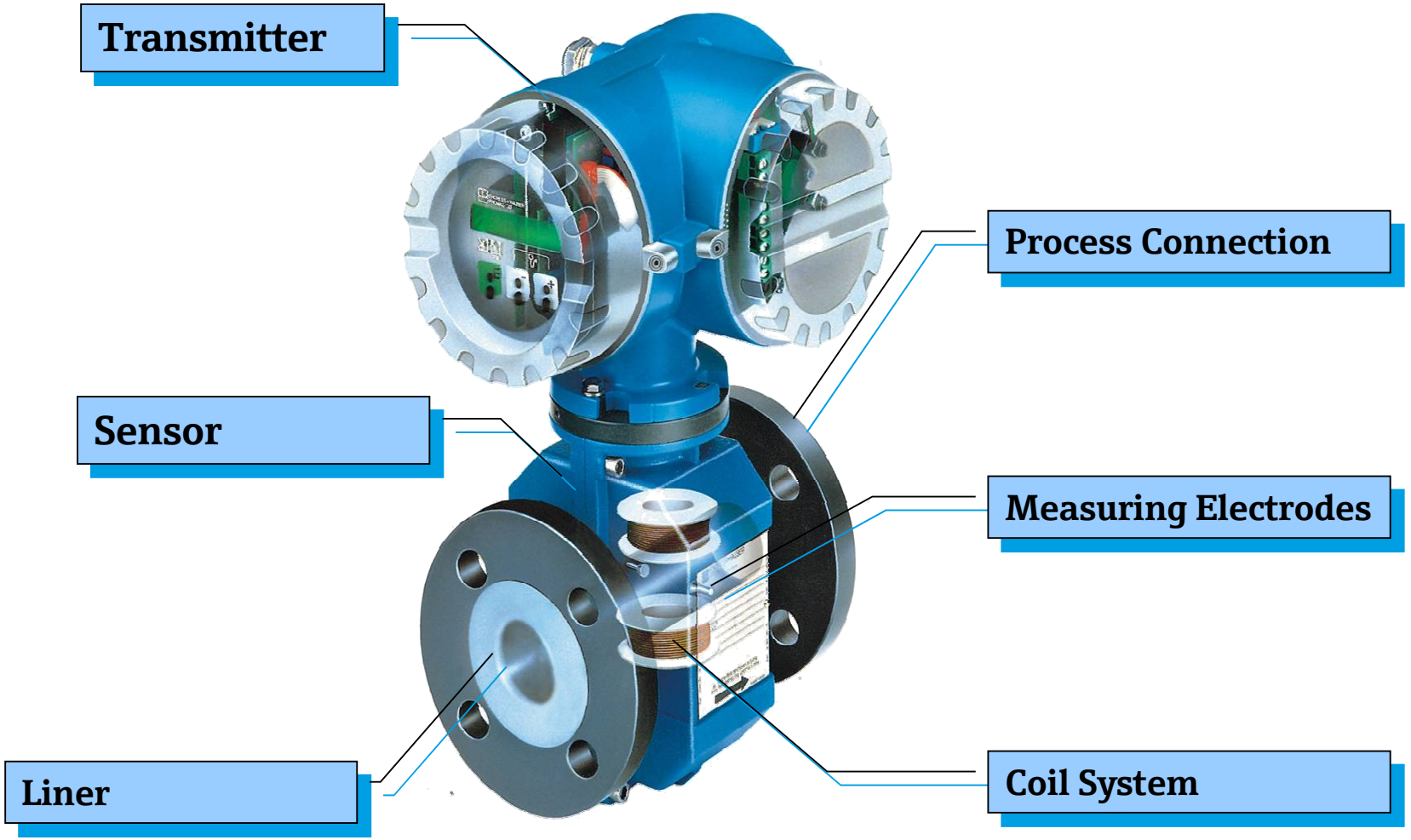
U = Induced voltage
v = Flow velocity

Approx. 300 µV per m/s

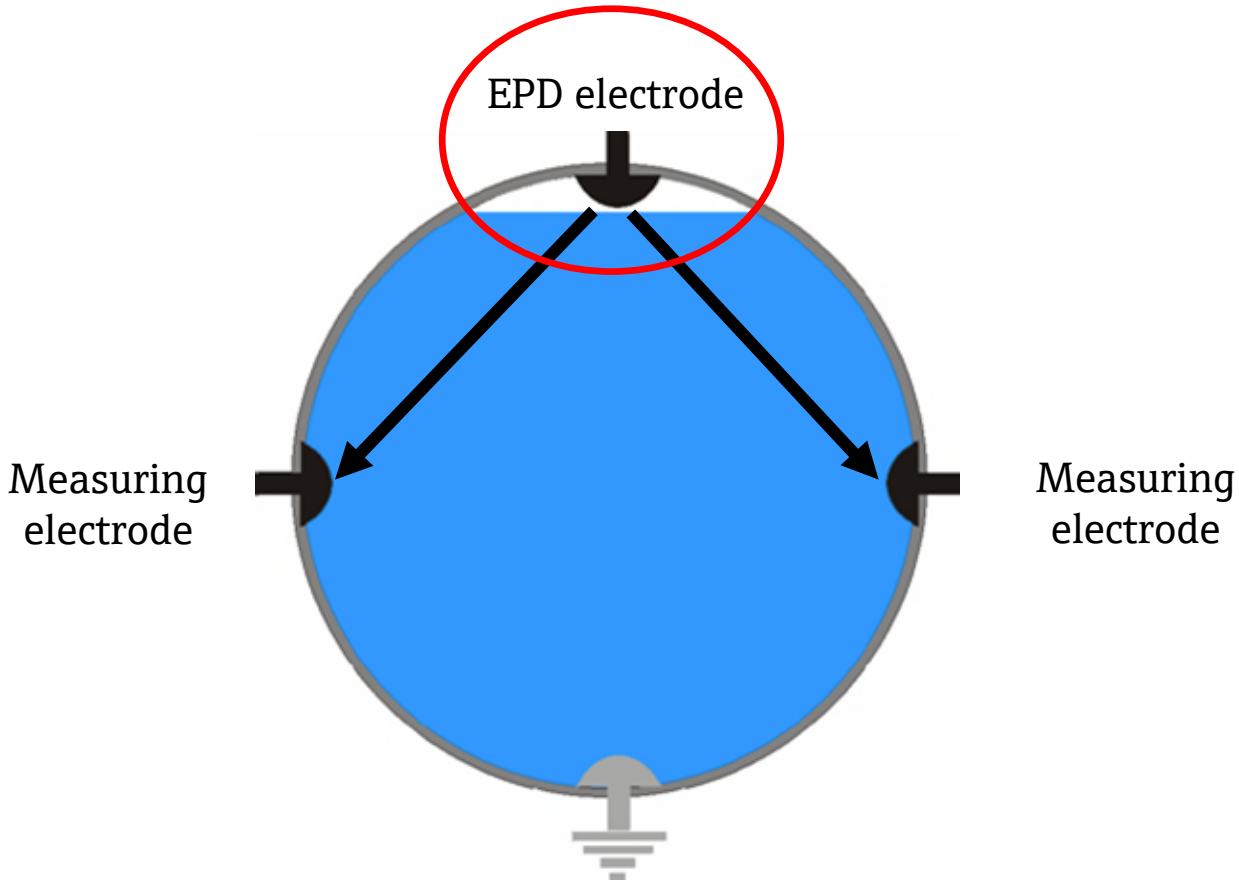
Ranges of Conductivity in Liquids



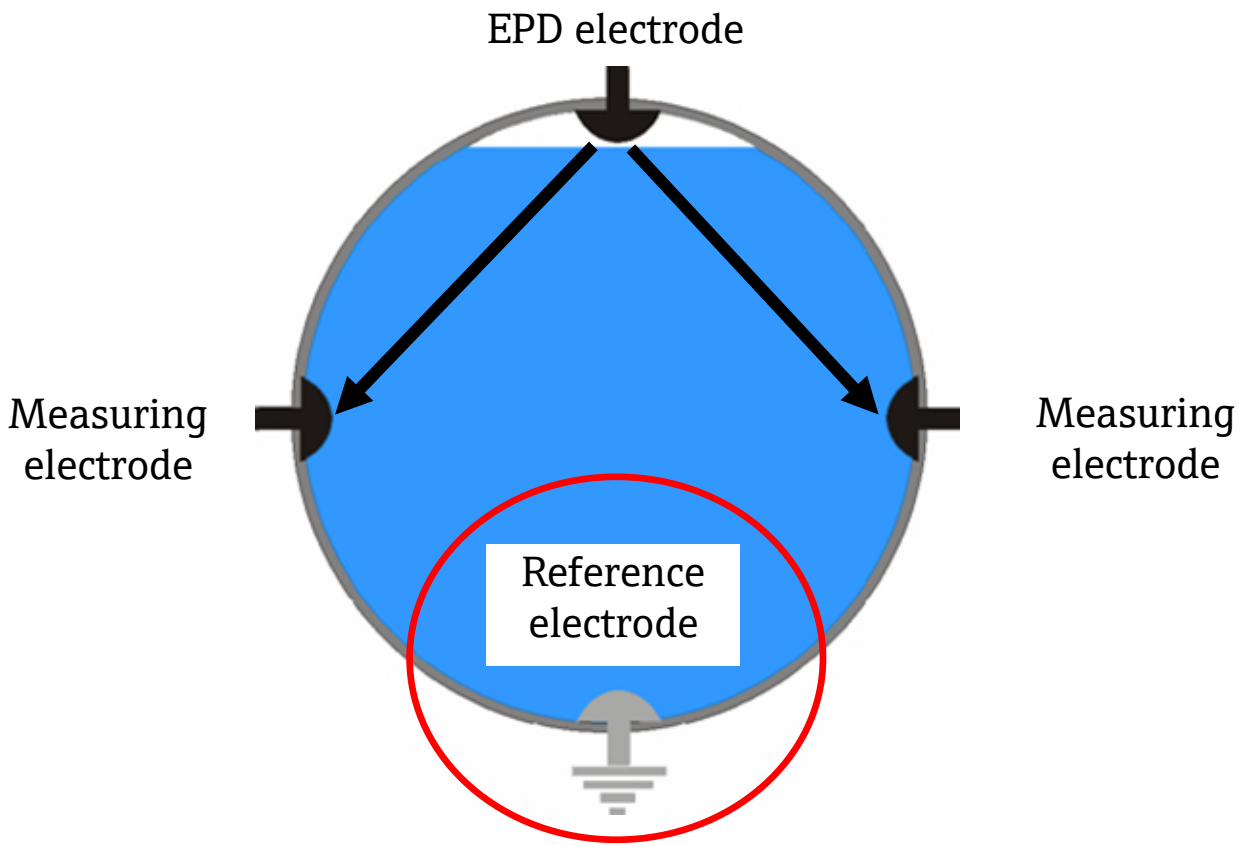
Basic Meter Construction



Empty Pipe Detection (EPD)

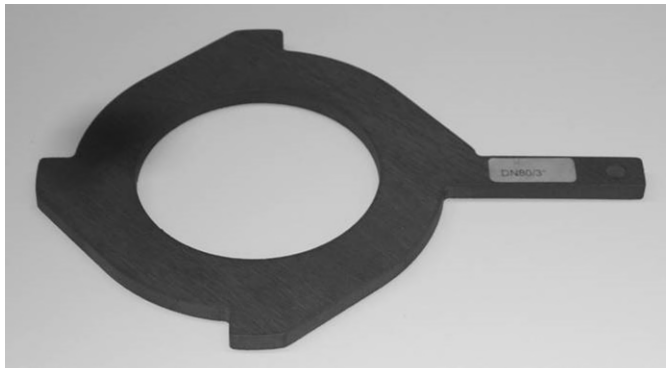


Reference Electrode



Ground Disks

- In certain application the standard solution with reference electrodes is not suitable
- Alternatively ground disks can be used
- The disks are available in stainless steel and Alloy C22 as a standard accessory and PTFE/Carbon as a TSP
- It is recommended to use two disks, one up- and one downstream of the EMF

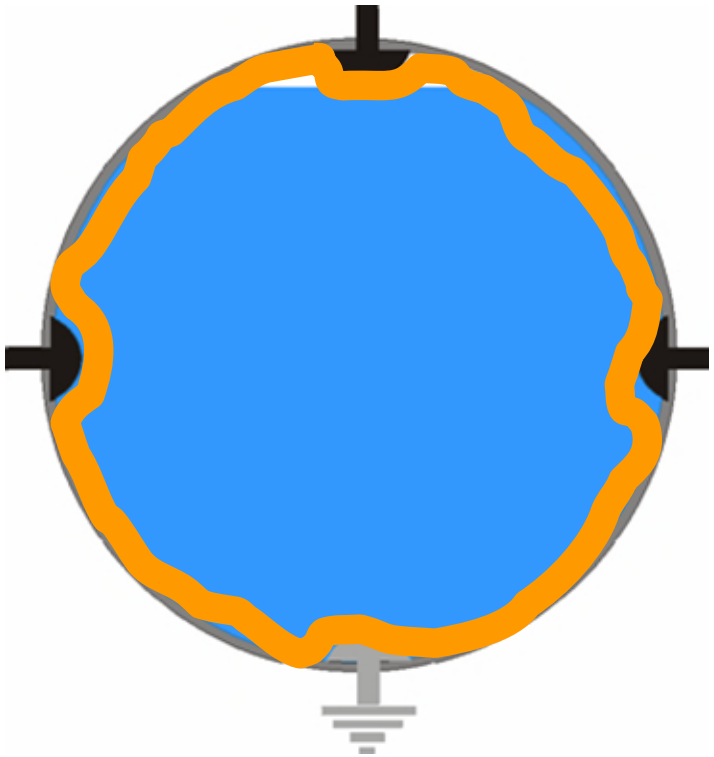


Grounding Wiring

- In metallic pipes it is always recommended to wire an additional grounding connection
- Grounding cables are available as a standard accessory or can be supplied by the end-user himself

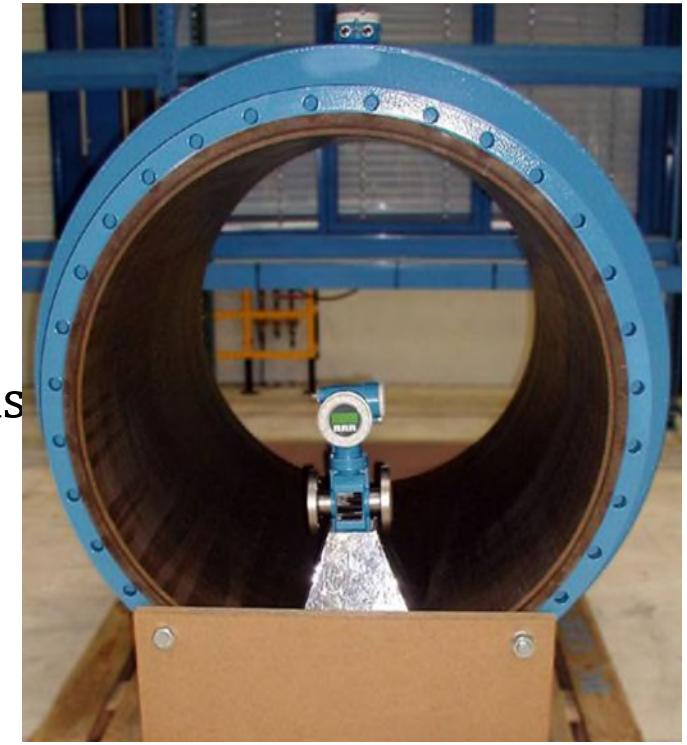
Build-up on Measuring Electrodes

- Build-up at the electrodes will reduce performance or lead to non-function of the measuring system
  - Conductive coating leads to electrical short circuit
  - Non-conductive coating leads to isolation of the signal
- In both instances will the reading become smaller until the system finally drops out
- Such applications should be avoided since only regular cleaning will ensure good results



Advantages of the Magmeter Technology

- No Pressure Loss
- No Moving parts
- Bi directional
- Easily cleanable
- Measurement is unaffected by changes in viscosity, dens
- Able to handle from clean liquids to slurries
- High turndown ratio
- Wide diameter range
- Short upstream straight run requirements
- Wide range of materials compatibility



Limitations of the Magmeter Technology

- For conductive liquids only
- Max. temperature 180 °C due to material restriction
- Conductive or non-conductive coating affects performance

Questions