### <u>Pipe flow measurement</u>



	Types of meters	
	In-line flow meters	Indirect flow meters
	<ul> <li>Mechanical velocity meters</li> <li>Turbine type</li> <li>Impeller type (small paddle wheel)</li> <li>Propeller type</li> <li>Proportional type</li> <li>Venturi with by-pass</li> </ul>	Instantaneous electric power meter
/	Electromagnetic flow meters	
	<ul> <li>Acoustic meters</li> <li>Doppler type (fixed or portable)</li> <li>Transit time type (fixed or portable)</li> </ul>	

### Mechanical meters

# Mechanical meters



### <u>Turbine meter</u>





















### Proportional (bypass) meter





### Mechanical meters

### **Advantages**

- Need no electricity to operate, which give them the capability to be installed at remote sites.
- Available for a wide flow range.
- Robust and easy to use.

### Disadvantages

- Susceptible to blocking by larger physical impurities (impeller meters to a lesser degree) install after a filter or strainer.
- Relatively low accuracy (within ± 10% in practice) if the installation conditions are anything less than ideal.
- Accuracy can deteriorate over time due to wear.
- Difficult to install in existing pipelines (and remove)
- These meters may need additional tamper protection in certain cases.

### Electromagnetic meters

### Electromagnetic meters



# Working principle





### Insertion type EM meter



### Electromagnetic meters

#### <u>Advantages</u>

- Short inlet / outlet sections required for stable flow
- Relatively insensitive to flow profile disturbances
- No moving parts
- Causes no obstruction in water flow path.
- No pressure drop (no flow obstruction)
- High accuracy

- Wide flow range
- Robust with only minimal routine
   maintenance
- Can be buried (vandalism proof)
- Difficult to tamper with, without detection

#### **Disadvantages**

- Relatively expensive compared to mechanical meters
- Power supply required
- Larger sizes are difficult to handle due to weight
- Electronic components vulnerable to lightning damage
- Sensitive to electromagnetic interference
- Inaccurate at low flow velocities (requires at least 2 m/s in pipe)
- Repairs require skilled technicians
   and specialised equipment
- The formation of chemical coatings, or even organic material, will depend on the characteristics of the water and developments of depositions should be monitored, especially on the insertion electrodes.

# <u>Acoustic (ultrasonic)</u> <u>meters</u>







### Transit time meter (portable)



### Doppler meter (portable)



### Doppler meter (portable)





### <u>Ultrasonic meters</u>

#### Advantages

- No contact between the transducers and the water required.
- Easy installation for temporary use.
- Wide range of flows can be measured with the same meter.
- No moving parts
- No additional head loss in the pipe line
- One size meter for all pipe sizes.
- Portable models are generally robust.
- Wide range of flow data is captured (velocity, flow rate, volume, energy, etc.)
- Empty pipe can be detected.

#### Disadvantages

- The Doppler meter requires minimum size and concentrations of particles in the water being measured.
- Both meter types are very sensitive to flow profile variations.
- Requires external power if used for extended periods (portable models usually have built-in rechargeable batteries).
- High cost, especially good quality portable transit time meters.
- Repairs require skilled technical staff with specialised equipment.

### Meter selection

#### **Technical Data**

Model	IRT 80	IRT 100	IRT 150	IRT 200	IRT 250	
Size – (Flange, see price list)	80 mm	100 mm	150 mm	200 mm	250 mm	
Pressure - Maximum (m)	160 metres					
Flow Rate q <sub>max</sub> (m <sup>3</sup> /h) -Note 1	150	250	500	900	1 400	
Flow Rate q <sub>nominal</sub> (m <sup>3</sup> /h)	90	125	250	450	750	
Flow Rate q <sub>transitional</sub> (m <sup>3</sup> /h)	10	11	15	30	70	
Flow Rate q <sub>min</sub> (m <sup>3</sup> /h)	5	7	10	18	20	
Straight pipe requirement	10 d before and 5 d after		10 (5) d before and 5 (3) d after meter			
Electronic Volume	100 Litre, 1 m <sup>3</sup> , 10 m <sup>3</sup>		1, 10, 100 m <sup>3</sup>			
Installation	Any position (horizontal, vertical or inclined)					
Accuracy q <sub>transitional</sub> to q <sub>max</sub>	± 2%					
Accuracy q <sub>min</sub> to q <sub>transitional</sub>	± 5%		± 5%			
Head Loss	See graph					
Maximum register capacity	10 <sup>6</sup> m <sup>3</sup> /h	10 <sup>7</sup> m³/h		10 <sup>8</sup> m <sup>3</sup> /h		
Minimum register capacity	1 litre	10 litre		100 litre		

### Cost comparison (150mm meters)

Device	Approx. Price (excl VAT)	Installation cost (if available)	Meter reading cost (if available)
Turbine type	R 6 500		
Paddle wheel type*	R 10 000		
Woltmann type*	R 13 000		
Ultrasonic (permanent)	R 35 000		
Propeller*	R 55 000	R3000-R5000	
Electromagnetic*	R 30 000		
- Battery operated option	R 32 000		
- For automatic meter reading, add:	R 8 500		R100 per month
Flocheck (indirect)**	R 11 500	R 8 500	
- For automatic meter reading, add:	R 3000		R100 per month

\*indicates pulse output included

\*\* minimum 20 units