11. SPECIAL APPLICATION RANGEABILITY OR TURNDOWN RATIO UP TO 1:36

The flow rate value is calculated with the following **formula**:

$$Q = K\sqrt{\Delta P}$$

Q   flow
K   constant taking into account the fluid and piping specificities
ΔP   differential pressure

The uncertainty of the flow rate is minimal at 100% of the maximum flow rate (Qmax) for which the differential pressure device is designed. The operating range of the differential pressure transmitter must also be selected in order to be as close as possible to the differential pressure measured at the maximum flow rate.

The turndown ratio of a flowmeter is also refered to as its rangeability. It corresponds to the ratio between the maximum and the minimum mesurable flow rates with a minimum measurement uncertainty. Thus, the higher rangeability, the more capable is the flowmeter to accurately measure flow rates well below the maximum flow rate.

In general, differential pressure flowmeters have a rangeability of 1: 6, i.e. it will keep good measurement accuracy for flow values ranging from 100 % down to 16 % (i.e. Qmax / 6) of the maximum flow.

If the measurement uncertainty must remain low over a wider flow range, it is necessary to mount two differential pressure transmitters in parallel: the first will measure 100 % to 16 % of the maximum flow while the second will take over for the lower range of flow rates from 16 to 2% of the maximum flow.

Thus, the differential pressure flowmeter can reliably and with great accuracy measure flow rates ranging from 2 to 100 % of the maximum measurable flow rate. We refer to a rangeability of 1:36.

Flowmeter rangeability

E (%)
overall measurement
uncertainty

— Transmitter 1
— Transmitter 2

Transmitter 2   Transmitter 1

$Q_{max/36}$ $Q_{max/6}$ Q_{max}

rangeability 1:6 with transmitter 1

rangeability 1:36 with transmitter 1&2