![SonoQ logo]

SQ-FM2 PA61-M — Flow-Module DN10 for aqueous liquids

Features

- Ultrasonic Technology without moved components
- flow range from 0.3 to 30 l/min
- To a large extent independent from temperature and electric conductivity
- Almost without delay (working with speed of sound). Pulsating flows (e.g. use of membrane pumps) are possible to measure
- no risk of damage if high flow rate
- Excellent long term stability
- Widely independent from installation orientation
- Empty pipe and bubble detection possible
- Leakage detection possible

Output/interface

Hydraulic connection:
    G ½", flat sealing
Electric connection:
    TTL UART digital Interface
    Supply 3-3.3V/max 50mA

Preferred operational area

- Cooling system
- Lubricant systems
- Industrial flow monitoring
- Water distribution

Principle of Operation

This SonoQ Flow-Module provides an intelligent and compact solution to integrate the feature of flow measuring and –monitoring in application specific systems. The digital output easily fits to electronic installation side, particularly Microprocessors. The digital output also permits to transfer liquid related information for process control. The meter is using ultrasonic technology, incorporated in a time-of flight measurement method. The sonic wave is deviated by mirrors into the flow direction and absolute determination of in- and reverse flow direction propagation time as well as the relevant receive amplitudes is performed. This allows calculating flow-, reliability and liquid quality characteristics.

features

Ultrasonic wave propagation is very common not only in flow measurement. The mechanical wave also includes information of propagated media. The SonoQ Flow-Module provides following information, flexible analyzable by the application:

• Speed of sound	This value is a powerful indicator to identify or control liquids, because this value is mainly depending on compressibility and density (but also on temperature) If many small air bubbles are available, this value will likely reduce because of scattering.
• Estimated temperature	In most cases the temperature dependence of speed of sound in aqueous liquids is quite similar to this of pure water. The estimated temperature is considering this relation and can predict the temperature from speed of sound value in a limited temperature range.
• Up- and down sensitivity	This value gives the receiving amplitude in and against flow direction. If these are quite different, very high flow is very likely. If at stable conditions, these values are decreasing, aging of system or defect or deposits could be reasons. If the viscosity of the liquid is changing, most likely these values will reduce. Also air bubbles have influence to that value because of scattering.
• Empty pipe	Status error register is indicating some problems, but the empty pipe information is very helpful, not only for state control but also for start processes.
• Low-flow	If the low flow suppression is set to zero, there is a range in which flow may be detected (also using historical data) and distinguished from zero flow. This can help to detect leakage.
• Error rate	Especially scatterer like air bubbles and particles are causing false single measurements. If this rate is increasing, it is likely that bubbles/particles or separation is available.

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Application

Application	Flow monitoring of aqueous liquids for industrial application Domestic water monitoring and residential water monitoring
Measuring range	Flow rate 0.3...30 l/min Flow detection< 0.3 l/min is possible ^{Remarks}
Measuring principle	Ultrasonic time-of-flight (tof) measurement with mirror supported U-section
Air bubble detection	Yes
Empty section detection	Yes
Nominal Pipe size	DN10
Process connection	G ½" flat sealing
Operating temperature	5..60 °C
Ambient temperature	0..50 °C
Storage temperature	0..70 C
Humidity	<80%, not condensing
Max. working pressure	10 bar
Materials in contact with liquid	suitable for potable water (Grivory JHT1V-4 FWA, EPDM, steel 1.4301 (304)

Electrical data

Operating voltage	3-3.3 VDC
Reverse polarity protection	no
Current consumption	<30mA typ. ; < 50mA peak $^{at\ max.\ speed\ and\ max.\ communication\ rate}$

Input/output

Digital 2-Wire UART	TTL UART, Modbus Protocol

Accuracy / repeatability

Flow measurement

Method	Estimation based on speed of sound
Accuracy	± 4% of measured value ± 0,1 l/min within flow rate ± 2% or ± 1% for special calibrated versions are possible
Repeatability	0,1 l/min
Response time	Adjustable: 0.1, 1, 2, 5, 10, 30s

Temperature measurement

Accuracy	± 2 K (for water with ϑ < 50 °C)
Repeatability	1 K

Remarks:

The Flow Module is not only giving flow as output, but also some information suitable to control the integrity of the flow system or to identify/surveil the liquid. The recombination of this information to such state estimations can only be done by the system integrator. Often by combination of different values identification upon users' needs may be established.

Example:
Flow detection < 0.3 l/min. is possible, but the accuracy of the system will decrease.
By using a combination of the other parameters like this Speed of Sound, Sensitivity up- and downstream, Status error / Empty pipe, Error rate; Low-flow-suppression
- Leakage detection
- Empty Pipe detection
- Bubble detection
is possible.

Order information

Article	Description
SQ-FM2PA61-10M	Flow module DN10 incl. electronic with UART, PA61-pipe, ultrasonic transducer
SQ-FM2PA61-10EK	Flow module SQ-FM2PA61-10Me incl. USB-Adapter, USB-Cable and PC-Software

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