www.mems.ch



# gasQS flonic

## User Manual





The innovative gasQS<sup>™</sup> technology is intellectual property of Mems AG. Since 2014 gasQS is a registered trade mark.

**WARNING!** Please read the safety instructions carefully before installing and operating the instrument. Nonobservance of those guidelines could result in personal injury and/or damage to the equipment





Even though care has been taken in the preparation and publication of the content of this manual, we do not assume legal or other liability for any inaccuracy, mistake, misstatement or any other error of whatsoever nature contained herein. The material in this manual is intended for information purposes only, and is subject to change without notice.

> Mems AG October 2018

Current terms and conditions apply. Details are available on www.mems.ch

Document Name: Document Number: Last Update: gasQS\_flonic\_UserManual\_MemsDoc20170930AD11\_1\_E MemsDoc20170930AD10 2021-10-21; Tibor Fuchs



## Contents

General Information4
Aim of Document4
gasQS <sup>™</sup> Technology4
gasQS flonic4
Explanation of Symbols used in this Document5
Certification for Hazardous Areas6
Product Labelling7
Electrical Parameter
Pressure Parameter9
Transport, Packaging and Storage10
Instrument Preparation and Operation11
Instrument Preparation and Operation



## **General Information**

### Aim of Document

This user manual describes the general functions of the micro electromechanical, OEM sensor gasQS flonic and gives important information about its handling.

For additional information please refer to the following documents:

- gasQS flonic Datasheet
- gasQS flonic Safety Instructions
- gasQS flonic Calibration Document
- gasQS flonic Modbus-RTU Protocol Specs

### gasQS<sup>™</sup> Technology

With gasQS, Mems AG provides the technology to use natural gas and biogas in an efficient and environmentally friendly manner.

Natural gas is used in many countries around the world as a source of energy for many years already; its significance will ever more grow in importance in the future. However, power output, efficiency and environmental compatibility of the various gas applications are affected by the ever more rapidly changing gas compositions of new gas sources (biogas, LNG, power-to-gas). The effect of these fluctuations can be compensated and processes optimized through determination of the gas quality – today the domain of expensive process and laboratory analytics.

### gasQS flonic

The flonic is a microelectromechanical gas quality measurement device. Based on its CMOS chip microthermal flow sensor in combination with a sonic nozzle and two on/off valves, thermal conductivity, heat capacity and relative density of natural gas are measured. From these parameters, calorific value or Wobbe index are correlated.

Compared to process gas chromatographs, the typical analytical tool to determine gas parameters, this standalone device needs no carrier gas, is robust, compact and inexpensive. It also provides a control output for automatic calibration in the field.

# **mems**<sup>AG</sup>

### Explanation of Symbols used in this Document

#### Safety symbols in this document are used equal to those in the gasQS flonic Safety Instructions.

DANGER!	<b>Danger</b> Indicates an imminently hazardous situation which might result in serious injury or death as well as severe damage to property or equipment, if not followed.
	<b>Caution</b> Indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not followed.
INFORMATION	Information Points out useful tips, recommendations and information for efficient and trouble -free operation.
< Ex	ATEX European Explosion Protection Directive (Atmosphère = AT, explosible = EX) Instruments bearing this mark comply with the requirements of the European directive 2014/34/EU (ATEX) on explosion protection.
EX	<b>EX Zone –Hazardous Area with Risk of Explosive Atmosphere</b> Marks places which are classified as a potential ATEX zone. Special restrictions or equipment may apply.
CE	<b>CE, Communauté européenne</b> Instruments bearing this mark comply with the relevant European directives.



## **Certification for Hazardous Areas**

The gasQS flonic was certified for Zone 1 applications on the basis of the specifications of the SUVA (Swiss Accident Insurance Institution) (see Figure 1). Please contact the Mems or SUVA for further information.



**Zener Barrier**<br/>In accordance with the ATEX regulations (IEC60079) electrical connections **MUST** be<br/>conducted through separate Zener barriers.**DANGER!**Otherwise the flonic is not suitable for operation inside explosive atmospheres. The<br/>barrier protects the instrument from interferences of the supply and control system.



Figure 2: Zonal structure of gasQS flonic application



## **Product Labelling**

The instrument fulfils the following type of explosion protection (ATEX):

#### Ex II 2G Ex ib IIC T4 Gb

- II 2G: ATEX group and category
- ib: intrinsic safe in zone 1
- IIC: explosion group with ignition energy of  $\geq 20 \mu J$  (e.g.: Acetylene and Hydrogen)
- T4: surface temperature max. 135 °C.
- Gb: IEC equipment protection level

	Mems AG     Bruggerstrasse 30     CH-5413 Birmenstorf	ATEX certificate number	
	Device Type	Tlow ≤ Ta ≤ Thigh	ലാത്തെ
www.mems.cn	device S/N		order key
<b>C €</b> <sub>1258</sub>	<b>Ex</b> ATEX marking	ATEX batchcontrol	Made in Switzerland

Figure 3: label on instrument

The instrument has been designed and built solely for the intended use described here, and may only be used accordingly.

The technical specifications contained in the gasQS flonic Datasheet must be observed. Improper handling or operation of the instrument outside of its technical specifications requires the instrument to be taken out of service immediately and inspected by an authorised Mems service engineer.



## **Electrical Parameter**

Supply voltage +13,5 Vdc ±5 %

Power consumption < 1.0 W

	Supply	RS485/CAN	GPIO		
[Ui] V	15.75	7.5	28.0		
[li] A	0.723	0.75	0.1		
[Pi] W	2.84	1.4	0.7		
[Ci] uF	0.188	1.1	0.003		
[Li] mH	0.024	0.052	0.010		
[Uo] V	-	4.1	-		
[lo] A	-	0.091	-		
[Po] W	-	0.094	-		
[Co] uF	-	7.9	-		
[Lo] mH	-	0.2	-		
Recommended	Pepperl+Fuchs	Pepperl+Fuchs	Pepperl+Fuchs		
Zener Barrier	Z713	Z757	Z728		



#### Intrinsic Safe RS485/CAN Output Circuit

For calculation of the intrinsic safe RS485/CAN output circuit the internal capacitance of Ci =  $1.1 \mu$ F and the internal inductance of Li =  $52 \mu$ H must be regarded.



## **Pressure Parameter**

Inlet pressure	min. 4.5 bar absolute
	max. 6 bar absolute
Permissible overload	9.0 bar absolute
Outlet pressure	max. 1.4 bar absolute

## **Operating Temperature**

Ambient air temperature range	-10 °C to +55 °C
Maximum surface temperature	< 135 °C

## Measured Media

Dry, neutral gas (filtered 10  $\mu\text{m})$ 





## Transport, Packaging and Storage

#### Damaged Material

Putting a product which manifests a visible damage into operation can be extremely hazardous. If the product manifests a visible damage stop and make sure it cannot be inadvertently put into use again.



Information

#### **Skilled Personnel**

The unit may only be installed by people who have undergone appropriate technical training and possess the necessary experience.



#### **Scope of Delivery**

- Assembled gas quality instrument; including preassembled sealing and protection cap(s).
- □ Keep the packaging, as it offers optimal protection during transportation (e.g. changing installation location, shipment for repair).

#### **Protection Cap**

Enclosed to prevent internal damage or pollution to the instrument during transport and storage. Remove the protection cap(s) only just before installing the instrument to minimise risk of pollution.



## Instrument Preparation and Operation

### **General Warnings**

The gasQS flonic must only be used in combination with components (such as measuring cables etc.) approved by Mems. The use of third-party components can affect the safety of the devices and result in significant damages. The devices must only be used by trained and competent personnel. We do not accept liability for damages resulting from the use of third-party components or incorrect handling or operation. The devices must at no time be opened. Do not carry out any service, maintenance or repairs on the instruments. Return instruments to Mems for recalibration or repair.

#### **Appropriate Instrument**

Before installation, commissioning and operation ensure that the appropriate instrument has been selected in terms of measuring range, design and specific measuring conditions. Nonobservance can result in serious injury and/or damage to the equipment.

#### **Escaping Gas**

Escaping gas can lead to serious injury. In the event of failure, components can be ejected at elevated speed or gas exhausted under high pressure.

□ Open the connections only after the system has been depressurised.



- Ensure that the pressure in the system as a whole cannot exceed the lowest maximum pressure of any of its components. If variations of the pressure level or different pressure levels are to be expected in the system, components must be used that can withstand the maximum expected pressure levels and peaks.
- □ Observe the working conditions in accordance with gasQS flonic Datasheet.
- □ Actions or alterations to the gas quality instrument, which are not described in these operating instructions, are not permitted.
- □ Ensure that the mounting point has been made absolutely free from burrs and is clean.
- □ After installation, use a gas leak detector sensitive to the used gas to ensure that there is no leak.

#### **Safety or Emergency Stop Installation**

Do not use this instrument in safety or emergency stop systems. Incorrect use of the instrument can result in serious injury.



### Skilled Personnel

Skilled personnel have knowledge of measurement and control technology. With their experience and knowledge of country-specific regulations, current standards and directives they are capable of carrying out the work described and independently recognising potential hazards.

#### **Hazardous Areas**

Observe the information given in the applicable type examination certificate and the relevant country-specific regulations for installation and use in hazardous areas (e.g. IEC 60079-10, IEC 60079-14, IEC 60079-20). Nonobservance can result in serious injury and/or damage to the equipment.



#### **Additional Regulations**

For hazardous media such as flammable gases, in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.

#### **Skilled Personnel**

The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described above.

Keep unqualified personnel away from hazardous areas.

# mems<sup>AG</sup>

### Installation

#### **Improper Mounting**

Improper installation can lead to the loss of the explosion protection and to lifethreatening situations.

Adhere to the permissible ambient and medium temperatures which are valid for this area on the basis of the specified temperature classes.

Protect the instrument from heat sources (e.g. pipes or tanks).



#### Appropriate Instrument

Before installation, commissioning and operation ensure that the appropriate instrument has been selected in terms of measuring range, design and specific measuring conditions. Nonobservance can result in serious injury and/or damage to the equipment.

#### **Hazardous Areas**

Observe the information given in the applicable type examination certificate and the relevant country-specific regulations for installation and use in hazardous areas (e.g. IEC 60079-10, IEC 60079-14). Nonobservance can result in serious injury and/or damage to the equipment.

Reduce the risk of creating hazardous areas by controlling and monitoring the gas release in relation to the properties of the specific media (e.g. IEC 60079-20).



#### **Escaping Gas**

In the event of failure, components can be ejected at elevated speed or gas exhausted under high pressure.



- Ensure that the pressure in the system as a whole cannot exceed the lowest maximum pressure of any of its components. If variations of the pressure level or different pressure levels are to be expected in the system, components must be used that can withstand the maximum expected pressure levels and peaks.
- □ Ensure that the mounting point has been made absolutely free from burrs and is clean.
- □ After installation, use a gas leak detector sensitive to the used gas to ensure that there is no leak.

#### Calibration

Make sure that the device to be installed has been calibrated for the type of gas present in the system. Nonobservance not only could lead to possible damage due to erroneous process control value but even hazardous situations could emerge.



#### **Flow Direction and Outlet**

The flonic has only one predefined flow direction. The instrument inlet can be directly connected to the gas line or tank and releases the media pressure free through the outlet located on the electronical connection side.

It is **NOT** possible to feed the sample gas back into the inlet pressure section due to the required pressure drop.



#### **Controlled Gas Release**

Mems recommends

**continuous purge bypass** – keep outline atmosphere above *UEL (non-hazardous)* Split the inline and conduct it parallel to the instrument over a pressure dropper and reunite it with the outline. The inlet pressure has to be five times the outlet pressure.



#### **Pollution and Abrasion**

Make sure there is no pollution inside the sensor in- and outlet before connecting the instrument.

Do **NOT** use any lubricant or sealant. Abrasion can damage or even destroy the sensor.

#### Mechanical Stress, Liquids and Dirt



Do **NOT** insert any item into the openings. mechanical stress, liquids and dirt may damage or destroy the sensor. Warranty excludes failures and damage caused by the customer, such as contamination, improper electrical hook-up, dropping etc.

#### **Mounting Position**

The instrument has to be mounted upright in **horizontal position with electrical and process connections directing to the side** (see Figure 4). Otherwise the specified measurement performance cannot be guaranteed.

#### Maximum Torque

To avoid mechanical damage, please **DO NOT** drive more than 6 Nm torque on instruments threads (G1/8") and 2 Nm on earth connector.

Information	<ul> <li>Ensure Inline Condition</li> <li>depressurized flow out is located on electronical connection side</li> <li>dry gas</li> <li>dew point of the gas mixture below 10 K of the lowest operating temperature</li> <li>external particle filtration down to 5 µm</li> </ul>
	Best Measuring Performance The measurement will be carried out on a small amount of sample gas at low flow rates. For low latency results install a purge bypass and avoid long gas lines.





Figure 4: mounting position



Pipe connection diagram



Figure 5: Pipe Connection Diagram

Mems AG | Bruggerstrasse 30 | CH – 5413 Birmenstorf | +41 (0) 56 470 92 00 | info@mems.ch

17/26

18/26

Rev. 11



### **Electrical Connection**

#### Required Material

- gasQS flonic instrument
- power supply (+12 Vdc -5/+10%) (Pulse ML series recommended)
- supply cable with M12-A, female connector
- communication cable with M12-A, male connector
- Y-junction M12-A
- termination resistor M12-A
- Zener barrier for supply (Pepperl+Fuchs Z713 recommended)
- Zener barrier for communication (Pepperl+Fuchs Z757 recommended)

#### **Optional Material**

- GPIO cable with M12-B female connector
- Zener barrier for GPIO (Pepperl+Fuchs Z728 recommended)

There are three electrical connections on the gasQS flonic (see Figure 6). The chapter Mechanical Interface shows the exact pin out and pin location of the different M12 connectors. Mems AG uses a Modbus-RTU protocol to communicate. For more details please refer to **gasQS flonic Modbus-RTU Protocol Specs**.





#### Mechanical Interface





### 20/26

Rev. 11



Electrical Connection Diagram (Zone 1 full functionality)

Figure 13: Electrical Connection Diagram Zone 1 with full functionality

Mems AG | Bruggerstrasse 30 | CH - 5413 Birmenstorf | +41 (0) 56 470 92 00 | info@mems.ch



hazardous area non hazardous area Pepperl+Fuchs Z713 Mems AG MINI-PS- 12- 24DC/ 5-15DC/2-X OUT DC 2x V+ (Ex-i) +13.5 Vdc ±1 % +10.5 ... 36 Vdc -+ DC Supply Network **∆**3x 2x GND (Ex-i) GND GND IN DC Mems AG gasQS™ flonic 01AxBxC2Px Pepperl+Fuchs Z757 00 RS485-Data+ (Ex-i) RS485-Data+ **☆**3x SGND (Ex-i) SGND 2/3 6/7 Modbus RTU Network <sup>™</sup>3× Ø  $\bigcirc$ RS485-Data- (Ex-i) RS485-Data-Project: gasQS fonic V2 Title: gasQS fonic connecton diagram Variant: Zore 1 minimal structure Size: A3 Doc. Number: MemsDoc20180814FK05 Revision: 01.00.03 Mems AG Bruggerstrasse 30 5413 Birmenstorf AG Switzerland 

Electrical Connection Diagram (Zone 1 minimal functionality)



Mems AG | Bruggerstrasse 30 | CH - 5413 Birmenstorf | +41 (0) 56 470 92 00 | info@mems.ch





#### **Electrical Connections**

For installation in hazardous areas ensure that the enclosure is potentially equalized.

To increase immunity against electromagnetic interference, Mems AG recommends connecting the shield of the cable to earth at both ends. Attention for applications in hazardous areas, it must be ensured that potential equalization exists between the various earthing points (i.e. between the hazardous area and safe area). For more information please refer to standard EN 60079-14.



Connect the instrument only to intrinsically safe circuits (Ex ia).

Cover flying leads with fine wires by an end splice (cable preparation).

#### **Supply Voltage**

Ensure that supplied voltage adheres to the specified electrical characteristics and never exceeds the maximum limit. (see **gasQS flonic Datasheet**)

#### **Cable Modifications**

Do not shorten, extend or replace the provided cable without consultation of an authorized Mems service engineer.



#### **Electrostatic Discharge (ESD)**

ESD can damage equipment, impair electrical circuitry and can result in complete or intermittent failures. Always place the protective caps on the connector when they are not used and do not touch the connector pins.

# mems<sup>AG</sup>

### Operation

The gasQS flonic has no external switches. Mems recommends to turn on the power supply first and then connect the top M12 connector at the instrument. The upper LED indicates communication status, the lower LED the status of the instrument.

LED		Color	State	
	Yellow		Switched ON:	frame reception or sending.
1		Rod	Switched ON:	internal fault
(lower)		Neu	Flashing:	communication fault or configuration error
		Green	Switched ON:	device powered
		Yellow	Switched ON:	device busy.
2 (upper)		Red	Switched ON:	measurement boundaries out of range.
		Green	Switched ON:	device ready for measurement
1 & 2		Red/Green	Flashing alternately:	Bootloader active

#### **Operation Mode Interval**

The instrument repeats the measurement in a user defined time interval (min. 60 s, max. 24 h). The required parameter sample time (time interval in seconds) and purge time (purging of the sensor in seconds) can be defined over the Modbus.

#### **Operation Mode On Request**

The instrument performs a single measurement cycle as soon as a measurement command is received over the Modbus.

For more details about the Modbus protocol please refer to gasQS flonic Modbus-RTU Protocol Specs.

#### Bootloader Mode

In case there is no firmware installed, the instrument will stay in bootloader mode and waits for the download of the firmware over Modbus. The bootloader can also be triggered over the Modbus to update the installed firmware.

For more details about the bootloader please refer to gasQS flonic Modbus-RTU Protocol Specs.



## Maintenance

### General

	Power Off Do NOT separate when energized.
DANGER!	Power supply must be switched off and disconnected at main before cleaning or repair.
	Pressurized Connections Do NOT open pressurized connections.



#### **Maintenance and Repairs**

At normal use, no routine maintenance is required to be performed on the instrument. For further information contact supplier or factory. Have repairs performed by the manufacturer only to prevent losing warranty claim.

### Calibration



### Disposal



#### Disposal

Dispose of instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the instrument is supplied.



## Troubleshooting

#### **Pressurized Connections**

Open pressurized connections only after the pressure of the system or the appropriate section has been released to atmospheric level.



#### **Damaged Instruments**

Instantly remove the instrument from service and mark it to prevent accidental usage if it becomes damaged or unsafe for operation.

Have repairs performed by the manufacturer only.



#### **Common Source of Failure**

Please verify in advance, if the correct pressure is being applied (valves/ ball valve etc. open), the right supply voltage and wiring has been chosen.



Failure	Possible Cause	Procedure
Instrument does not boot	No/incorrect voltage supply	Adjust the voltage supply to correspond with the Operating Instructions *)
	Cable break / connection loss	Check connections and cable
Output signal diverges from expected value	Instrument is not calibrated for used gas mixture.	Check documentation
	Residual gas inside the instrument or its inlet pipe	Make sure that the pipe is purged completely with new gas mixture.
	Instrument is not mounted in horizontal position.	Put installation out of operation and mount instrument as described in chapter Installation.
	Micro-thermal sensor is damaged.	Contact the manufacturer

In case of unjustified reclamation, we may charge a reclamation handling expense.

\* Make sure that after the setting of the unit is working properly. In case the error continues to exist send in the instrument for reparation (or replace the unit).