gasQS™ flonic

User Manual

gasQS flonic NG-H und NG-L

The innovative gasQS™ 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.*

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Mems AG
March 2026

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Content

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:

- **gasQS flonic Datasheet**
- **gasQS flonic Safety Instructions**
- **gasQS flonic Calibration Document**
- **gasQS flonic Modbus Specification**
- **gasQS flonic List of Alarms and Warnings**
- **gasQS flonic Adjustment Manual**

gasQS™ 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 is 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. Adjustment can be done in the field using only methane as calibration gas.

Explanation of Symbols used in this Document

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

 DANGER!	**Danger** 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.
 CAUTION	**Caution** 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.
	**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 Zone –Hazardous Area with Risk of Explosive Atmosphere** Marks places which are classified as a potential ATEX zone. Special restrictions or equipment may apply.
	**CE, Communauté européenne** 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.

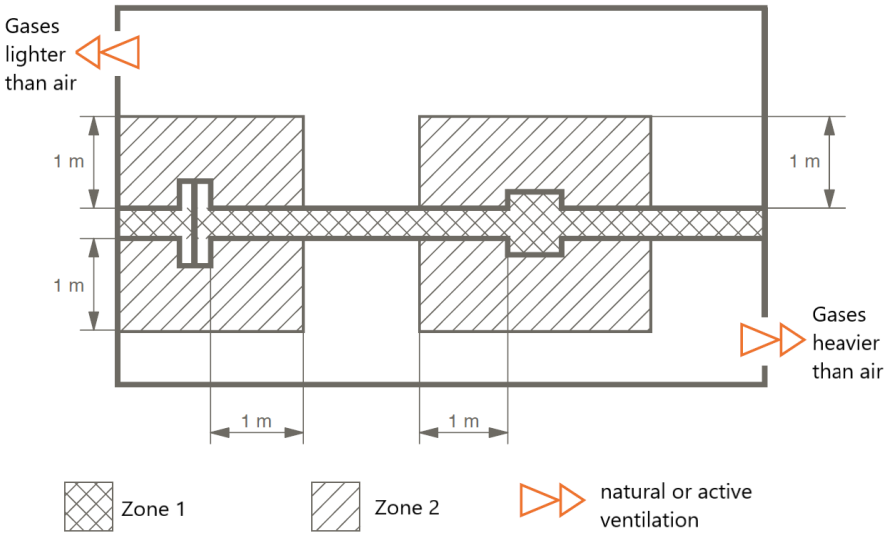


Figure 1: Classification of hazardous area inside a room with a gas line

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

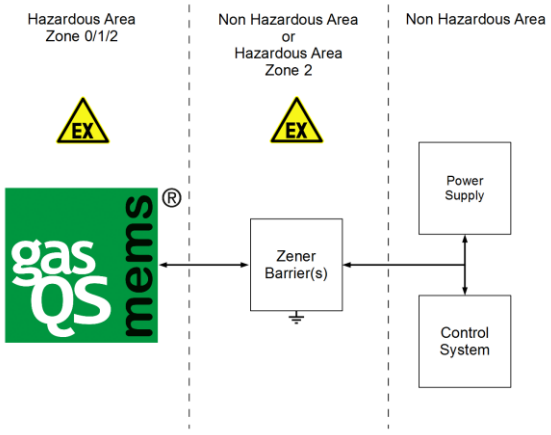


Figure 2: Zonal structure of gasQS flonic application

Product Labelling

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

Ɛx 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 ≥20 µJ (e.g.: Acetylene and Hydrogen)
T4: surface temperature max. 135 °C.
Gb: IEC equipment protection level

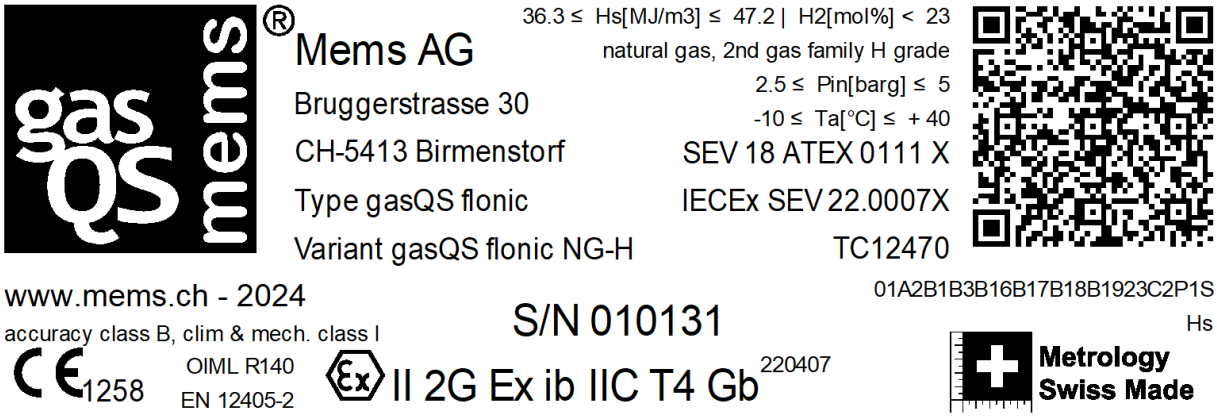


Figure 3: Labeling on the device (example)

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
[Ui] V	15,75	7,5
[Ii] A	0,723	0,75
[Pi] W	2,84	1,4
[Ci] uF	0,188	1,1
[Li] mH	0,024	0,052
[Uo] V	-	4,1
[Io] A	-	0,091
[Po] W	-	0,094
[Co] uF	-	7,9
[Lo] mH	-	0,2
Recommended Zener Barrier	STAHL 9143/10-156-160-20s	Pepperl+Fuchs Z757

DANGER!	**Intrinsic Safe RS485/CAN Output Circuit** For calculation of the intrinsic safe RS485/CAN output circuit the internal capacitance of Ci = 1.1 µF and the internal inductance of Li = 52 µH must be regarded.

Pressure Parameter

Inlet pressure	min. 2.5 bar relative max. 5.0 bar relative
Permissible overload	8.0 bar relative
Admissible pressure on outlet side	0.9 … 1.1 bar absolute

Operating Temperature

Ambient air temperature range	-10 °C to +40 °C
Maximum surface temperature	< 135 °C

Measured Media

Dry, neutral gas (filtered 10 µm)

Transport, Packaging and Storage

DANGER!

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.

Skilled Personnel

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

CAUTION!

Check

- ☐ Inspect the instrument for possible damage during transportation. Should there be any obvious damage, inform the transport company and Mems without delay.

Information

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 may only be used in conjunction with components (such as measuring cables, etc.) approved by Mems. The use of third-party components may compromise the safety of the device and lead to significant damage. The devices must only be operated by trained and competent personnel. We accept no liability for damages resulting from the use of third-party components or improper handling and operation. The devices must not be opened under any circumstances. Do not perform any customer service, maintenance, or repairs on the devices, except for periodic adjustments.

<table>
<tr><td rowspan="3"> 
DANGER!</td><td>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.</td></tr>
<tr><td>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.</td></tr>
<tr><td>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.</td></tr>
</table>

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.

<table>
<tr><td rowspan="3"> 
DANGER!</td><td>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.</td></tr>
<tr><td>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.</td></tr>
<tr><td>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.</td></tr>
</table>

Installation

<table>
<tr><td rowspan="3"> 
DANGER!</td><td>Improper Mounting
Improper installation can lead to the loss of the explosion protection and to life-threatening 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).</td></tr>
<tr><td>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.</td></tr>
<tr><td>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).</td></tr>
</table>

 **DANGER!**	**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.

 **CAUTION!**	**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.

 **Information**	**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 and outlet pressure must satisfy the specifications.

 CAUTION!	**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 (6mm Swagelok tube fitting) and 2 Nm on earth connector.

 Information	**Ensure Inline Condition** ☐ depressurized flow out is located on electronical connection side ☐ dry gas ☐ dew point of the gas mixture at least 10 K lower than the lowest operating temperature ☐ external particle filtration down to 5 µm
	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.

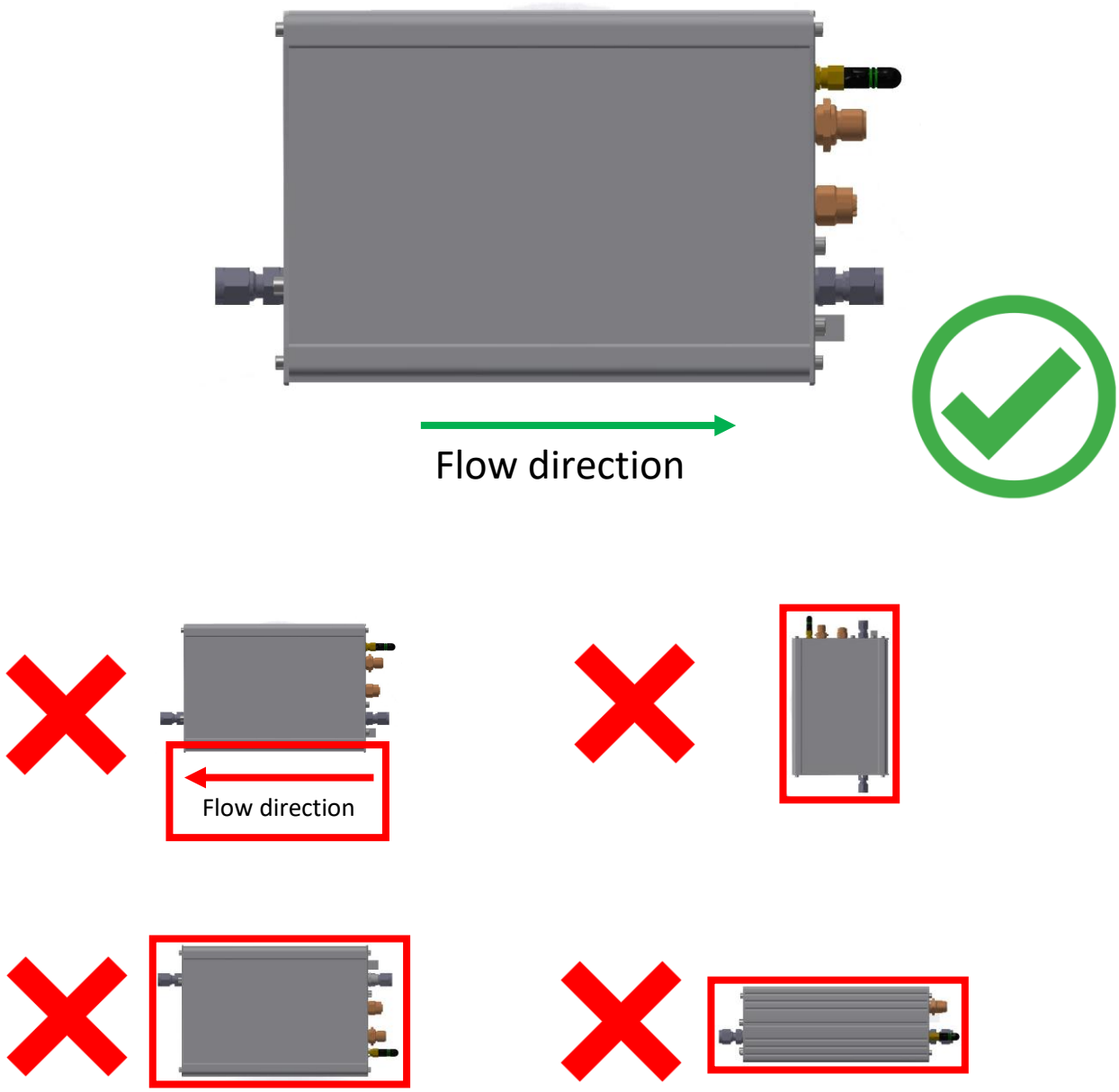


Figure 4: mounting position

Pipe Connection Diagram

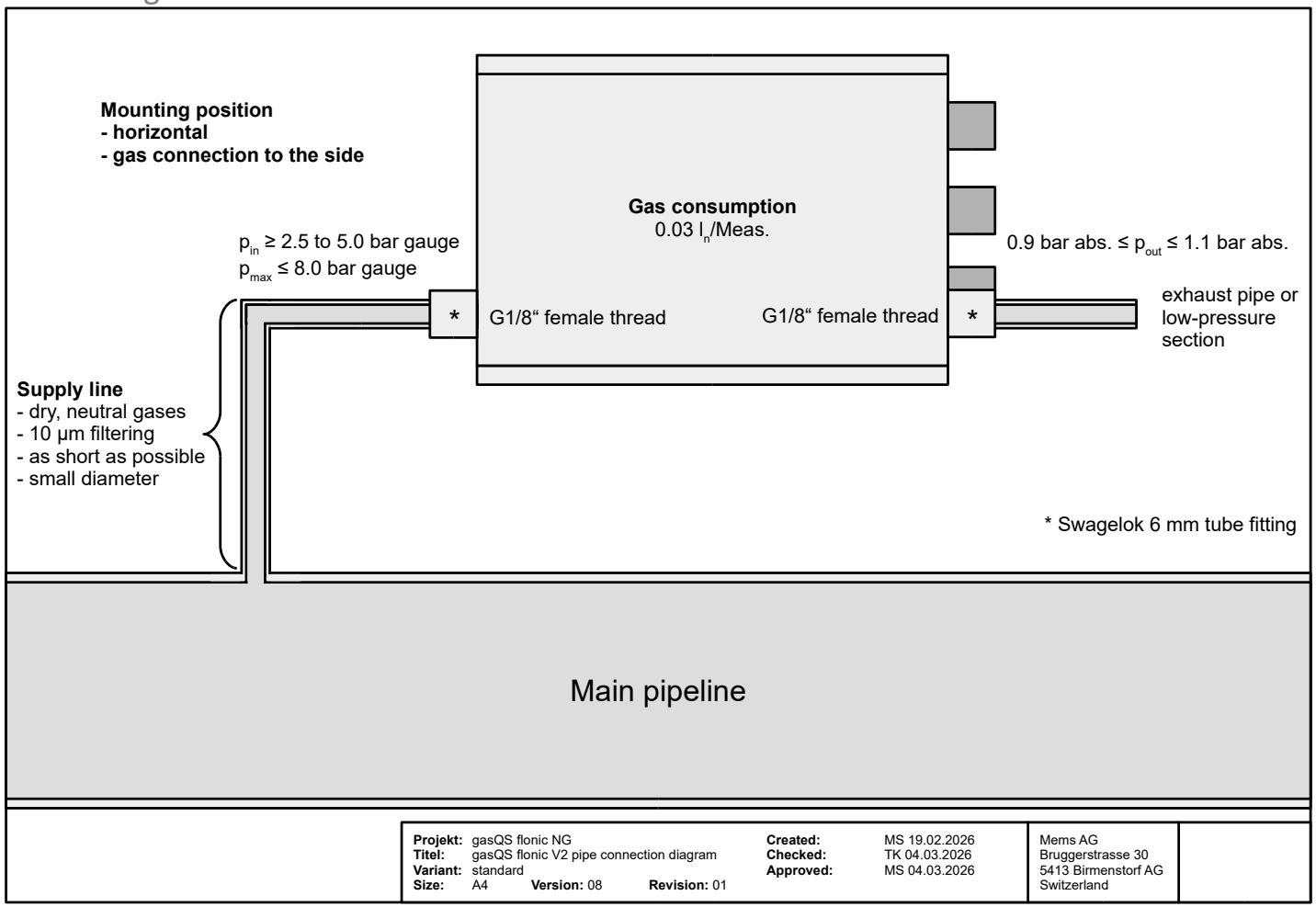


Figure 5: Pipe Connection Diagram

Electrical Connection

Required Material

- gasQS flonic instrument
- power supply (+13,5 Vdc ±5 %), which is realised with STAHL: 9143/10-156-160-20s. Power supply: 85 ... 230 VAC
- Supply cable with M12-A, socket
- Ferrite Würth Elektronik 74271131
- Capacitors Phoenix Contact PT-2.5 QUATTRO
- Communication cable with M12-A plug
- Junction M12-A
- Terminating resistor M12-A
- Zener barrier for communication (Pepperl+Fuchs Z757 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 Specification**.

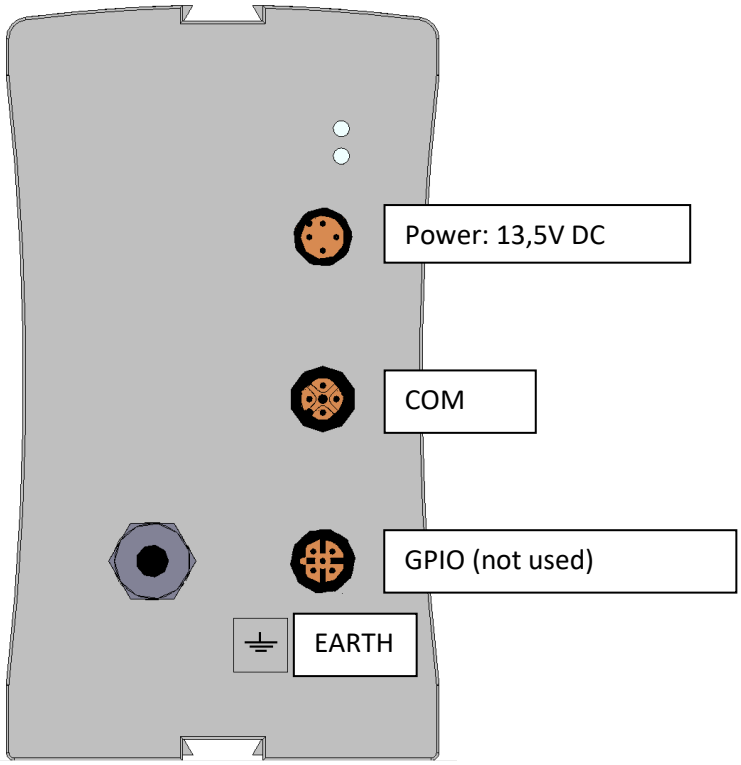
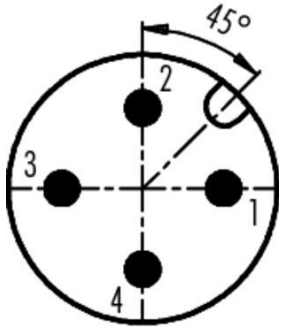
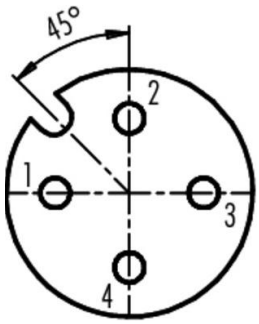
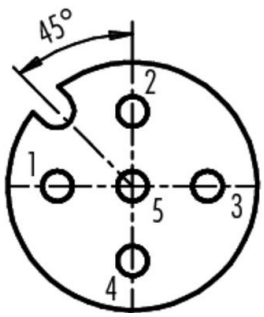
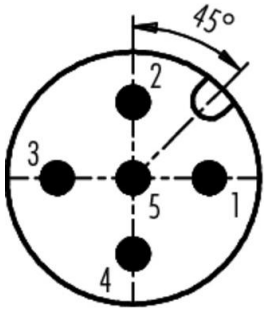
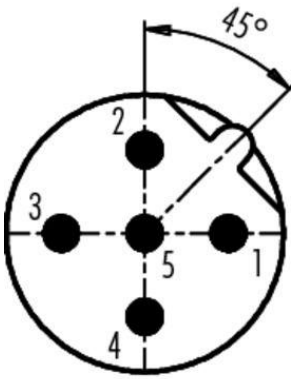


Figure 6: backplate with connections

Mechanical Interface

Power		
 *Figure 7: Power connector on gasQS instrument*	**M12-A** 1) GND 2) V+ 3) V+ 4) GND	 *Figure 8: 4-pin female connector on cable*

Communication		
 *Figure 9: COM connector on gasQS instrument*	**M12-A** 1) SHLD 2) Not Connected 3) SGND 4) RS485-Data- or CAN-H 5) RS485-Data+ or CAN-L	 *Figure 10: 5-pin male connector on cable*

GPIO (not used)		
 *Figure 11: GPIO connector on gasQS instrument*	**M12-B** 1) NC 2) NC 3) NC 4) NC 5) NC	

Electrical connection diagram (zone 1 full range of functions without gFlow)

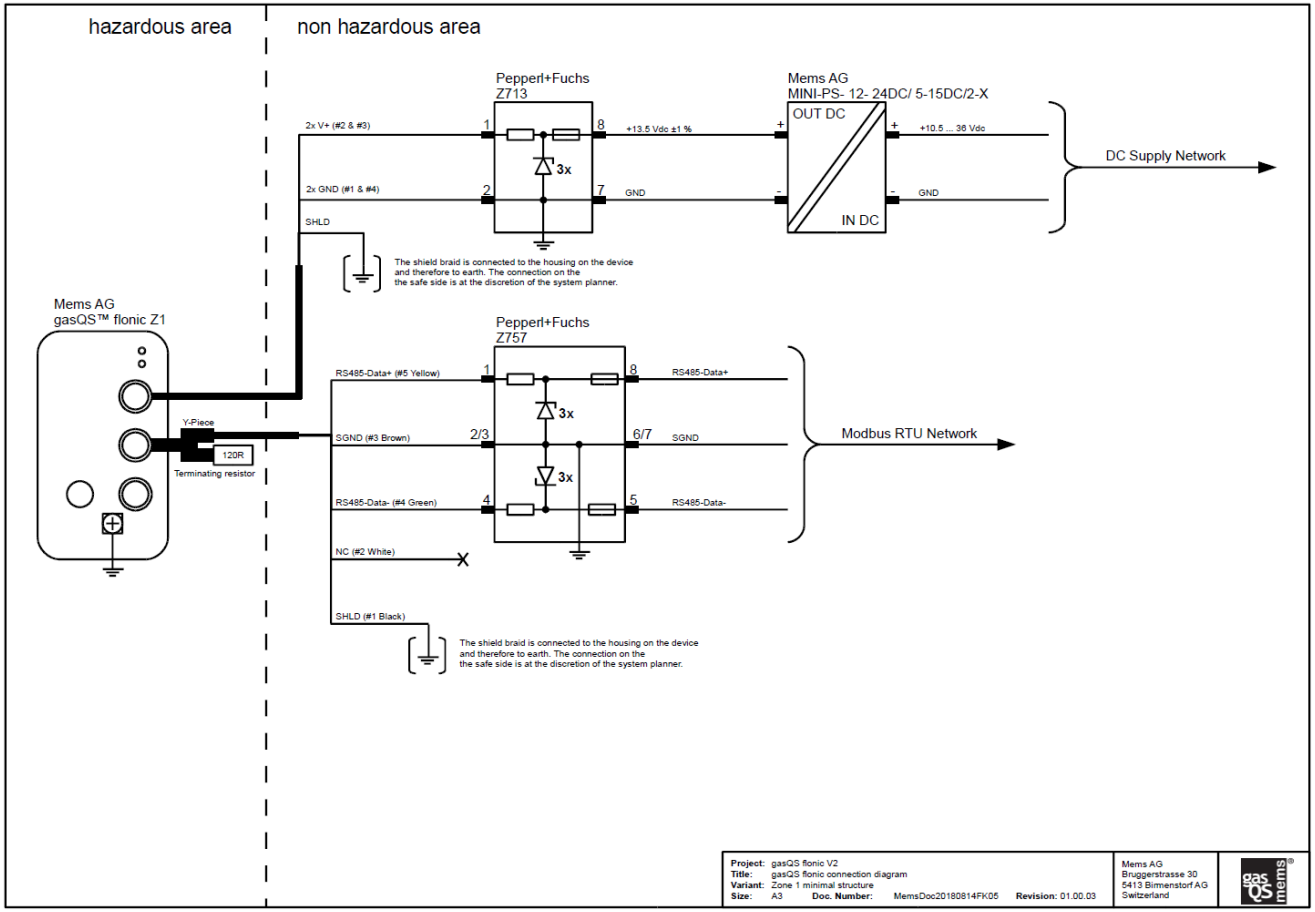


Figure 12: Electrical connection diagram zone 1 with full range of functions without gFlow

Electrical connection diagram (for device configuration or for the adjustment process without gFlow)

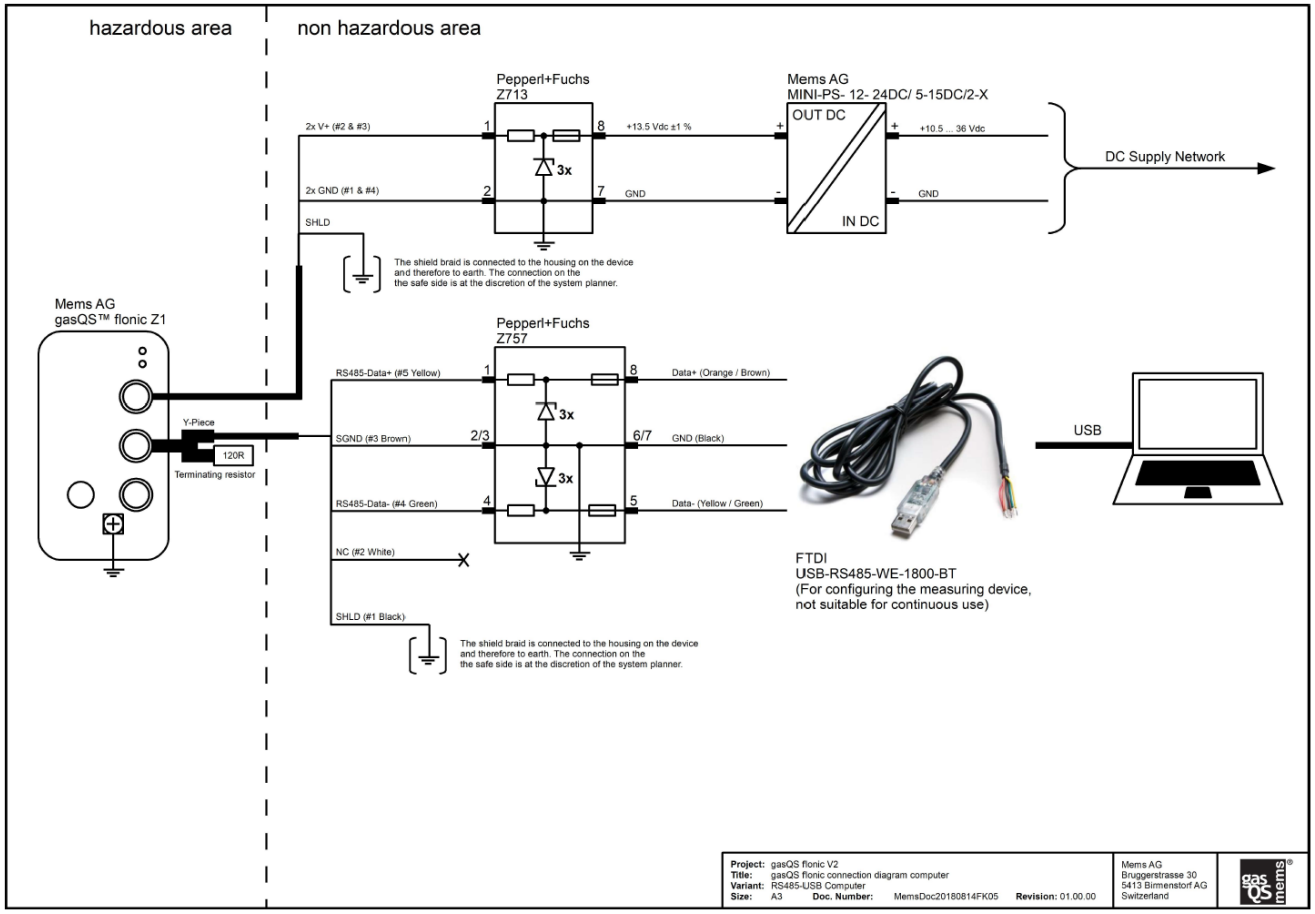


Figure 1: Electrical connection diagram for device configuration or adjustment process without gFlow

DANGER!

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).

If the device is operated with a gFlow from gAvilar, neither the RS485 signal lines nor the signal ground (SGND) must have a direct connection to earth.

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.

CAUTION!

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.

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 lower LED indicates communication status, the upper LED the status of the instrument.

LED		Color	State	
1 (upper)		**Yellow**	ON:	device busy
		Red	Flashing:	Measurement boundaries out of range Internal device error calibration error
		Green	ON:	device ready for measurement
2 (lower)		**Yellow**	ON:	frame reception or sending.
		Red	Flashing:	internal fault communication fault or configuration error
		Green	ON:	device powered

Operation Mode “Interval”

The instrument repeats the measurement at a user-defined time interval (min. 30 s, max. 24 h), whereby the full accuracy is achieved at 30 s. The required parameter sample time (time interval in seconds) and purge time (purging of the sensor in seconds) can be defined via the Modbus.

Adaptive Moving Average

To further reduce the scatter of the measured values, a simple moving average is implemented in the measuring instrument. This is a sequence of the unweighted arithmetic mean values of n=8 consecutive data points.

$$SMA^{(n)} = \frac{1}{n} \cdot \sum_{i=0}^{n-1} p(t-i)$$

In case of deviations of more than 0.5 % between the measured value and the average value, i.e. in case of a potential gas change, the moving average is discarded and the current measured value is used. For more details about the settings of the Adaptive moving average please refer to the **gasQS flonic Modbus specifications.**

Warm-up Time

After only four measurements (2 minutes), the system typically achieves an accuracy of 1%. For full precision, the measuring device requires a longer warm-up phase. In this case, tempering the measuring device is not sufficient. Measurements must be taken. If it has been switched off or has fallen into error mode (e.g. pressure too low), the first 30 measuring points (15 minutes) must be discarded.

 **Information**	**Warm-up time** For the NG-L and NG-H variants, it is essential to comply with the warm-up time.

Maintenance

General

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

 Information	**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

 Information	**Factory Calibrated** The instrument is factory calibrated. Please contact supplier or factory for re-calibration or re-ranging.

Adjustment Process

 Information	**Annual recalibration** The gasQS flonic must be adjusted once a year using the adjustment process. Please use the **gasQS flonic Adjustment Manual** for this purpose.

Disposal

 Information	**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

 DANGER!	**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.

 Information	**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).