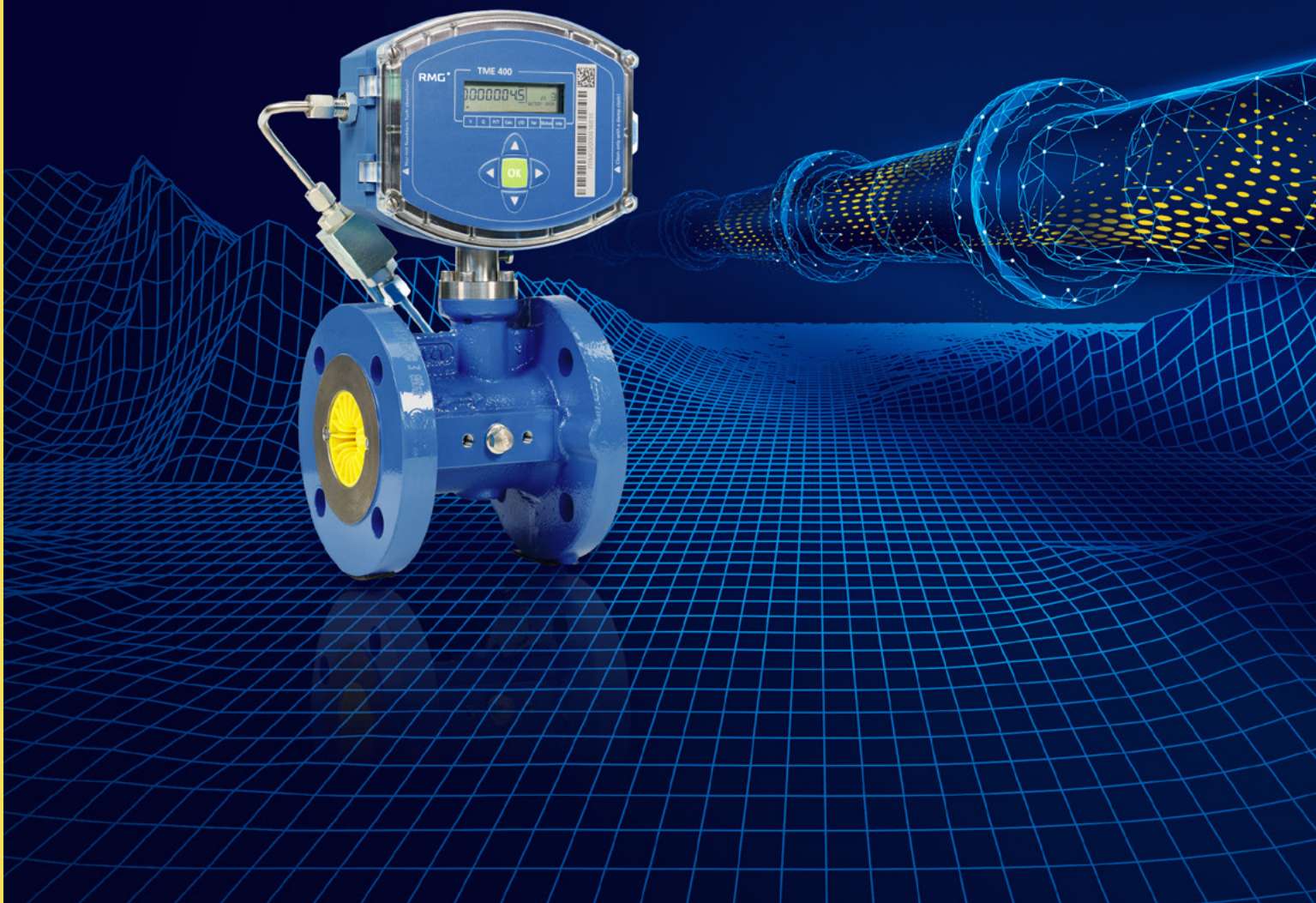
RMG

# ELECTRONIC VOLUMETERS
# TME 400-VM / VC

TME 400 (Turbine Meter Electronic) type volumeters offer a number of advantages over classical mechanical turbine meters like display of actual flow rate, data and parameter archiving, various interfaces and optionally integrated volume correction.



# METHOD OF OPERATION AND CONSTRUCTION

## Introduction

The new type TME 400 volumeters are turbines designed for secondary metering (non custody transfer operation) with purely electronical totalizers. In contrast to mechanical turbine meters, in the TME 400 the volume flow is converted in the mechanical meter body to electrical impulses, which are transmitted to the electronical meter head where they are processed.

In this way, the TME 400 can not only display and save the totalizer reading, but also, for example, the actual flow rate. In addition, several totalizers can be realized and the meter can transmit its measured values as well as additional signals directly via various interfaces (pulses, analog, digital). Furthermore, the version TME 400-VC offers a fully-fledged volume corrector integrated in the meter head, including pressure and temperature measurement.

It calculates the standard volume besides operating flow rate and operating volume. An external volume corrector is no longer needed. For all TME 400 versions, a long-lasting backup battery ensures continued reliable operation even in the case of a complete power failure.

TME 400-VM

TME 400-VC

## TME 400-VM

The TME 400-VM (Volume Meter) is the basic version of the TME 400 family. As the abbreviation VM indicates, it is a so-called volumeter, i.e. a pure operating volume meter for non-custody transfer applications.

## Features

- **Electronic totalizers**
  Main totalizer, additional start-stop or resettable totalizer for low flow (or slow down) cut-off by external signal.
- **Low-torque metering system with long-term stability**
  Turbine design with a minimum of moving parts.
- **Battery or mains operation** Autonomous operation with lithium cell for 6+ years or external power supply and backup battery to protect against power failures.
- **Explosion protection** The TME 400 is intrinsically safe and can be used in zones 1 and 2.
- **Outputs** Pulse outputs HF and LF (variable), alarm output, current output (4-20 mA, optional).
- **Flow display**
- **Digital interface**
  serial RS 485 interface for Modbus connection.
- **Storage of maximum value (Qm)**
- **Archive** Integrated fail-safe parameter, event and measured value archive.
- **RMGView**$^{TME}$ Provided software for convenient parameterization and management of device and stored data.

## TME 400-VC

The TME 400-VC (Volume Corrector) combines all features of the TME 400-VM with the benefits of a fully integrated non-custody transfer PTZ volume corrector. Pressure and temperature measurement are integrated directly into the meter.

## Additional Features (VC)

- **Volume corrector** Integrated fully-fledged compact volume corrector including digital pressure and temperature measurement.
- **Calculation of the K coefficient** according to SGERG88, AGA8 GROSS M1 and M2 as well as AGA NX19.
- **Display** Operating volume, standard volume, current and maximum flow can be displayed in measurement and standard condition.
- **Separate Terminal block** Inputs for pulses, pressure and temperature can be sealed separately from the rest. The lithium battery can be exchanged without opening the case.

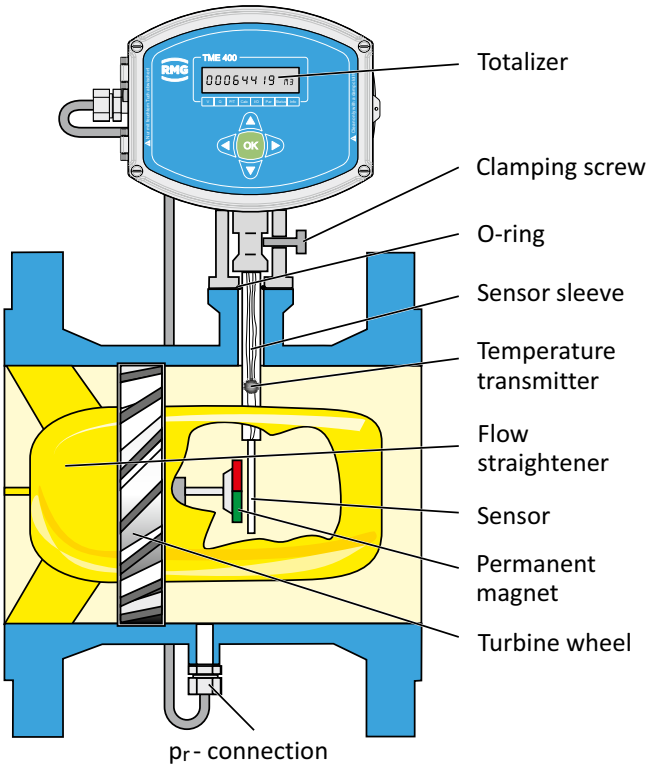
## Method of Operation

With turbine gas meters, the gas flow strikes a mechanically mounted turbine wheel and drives it. The rotational speed of the turbine wheel is proportional to the flow rate of the gas. Since the gas flows through an invariable cross section (annular gap of the turbine wheel), the flow velocity is also proportional to the volume flow.

TME 400-VM and TME 400-VC are based on the on the trusted RMG Volumeter series TRZ03-K. Dimensions and metrological performance are identical for both.

In the TME-400, a magnetic disk is mounted on the shaft of the turbine wheel, rotating at the same speed as the tur- bine wheel. A Wiegand sensor scans that disk and generates one electrical pulse per revolution which is transmitted to the electronic meter head. Each pulse is directly proportional to a certain volume flow. The meter can therefore display both the current flow ($Q_M$) and the total flowed volume ($V_M$).

Furthermore, the volume corrector integrated in the TME 400-VC allows the calculation of the standard volume ($V_B$). In order to do this, the meter measures operating pressure and operating temperature in addition to the operating volume flow. From this, the standard volume flow can be calculated using a suitable equation of state together with the corresponding standard conditions. Then this value is summed up in the standard volume totalizer and stored in the data logger.




## Electronic Totalizer

Possible connections for the electronic totalizer:

| Connection | Type | Umax | Umin | Imax | Tpulse | fmax |
|---|---|---|---|---|---|---|
| Pulse output<br>HF direct signal frequency | Transistor,<br>open collector | 30 V | 4.0 V | 30 mA | 1 ms | 250 Hz |
| Pulse output<br>LF reduction programmable | Transistor,<br>open collector | 30 V | 4.0 V | 30 mA | 20 ms<br>125 ms<br>250 ms | 25 Hz |
| Interface | RS 485 | 10.5 V | 6.0 V | 200 mA | – | – |
| Switch input for stopping the totalizer | Switching contact | potential-free | – | – | – | – |
| Current output (option)<br>Version with a current board | 4-20 mA,<br>2 wires | 30 V | 12 V | 23 mA | Imin<br>3.5 mA | Error < 0.5% of final value** |

# TECHNICAL DATA

| Nominal size | | Measuring range | Pulse value | Pressure loss |
|---|---|---|---|---|
| | | Qmin - Qmax | HF | Δp |
| mm | in. | m³/h | pulses/m³ | mbar |
| 25 | 1 | 2.5 - 25 | 13450 | 3 |
| 40 | 1½ | 6 - 70 | 7800 | 4 |
| 50 | 2 | 6 - 100 | 7800 | 6 |
| 80 | 3 | 13 - 160<br>16 - 250<br>25 - 400 | 2375<br>2375<br>1250 | 3<br>7<br>16 |
| 100 | 4 | 25 - 400<br>40 - 650 | 1060<br>600 | 4<br>11 |
| 150 | 6 | 40 - 650<br>65 - 1000<br>100 - 1600 | 330<br>330<br>190 | 3<br>6<br>14 |
| 200 | 8 | 100 - 1600<br>160 - 2500 | 135<br>80 | 4<br>9 |
| 250 | 10 | 160 - 2500<br>250 - 4000 | 75<br>44 | 4<br>8 |
| 300 | 12 | 250 - 4000<br>400 - 6500 | 48<br>28 | 4<br>9 |
| 400 | 16 | 400 - 6500<br>650 - 10000 | 24<br>14 | 4<br>9 |
| 500 | 20 | on request | | |
| 600 | 24 | on request | | |

The pulse value for LF pulses can be programmed from 0.01 to 100 pulses/m³ with a maximum output frequency of 25 Hz.

## Pressure Loss

The pressure loss Δp stated in the table applies to natural gas at $Q_{max}$ and 1 bar (a). From this, the pressure loss at measurement conditions can be calculated in accordance with the formula below.

Pressure loss as per the formula

$$\Delta p_m = \Delta p \cdot \frac{\rho_b}{0.83} \cdot p_m \cdot \left( \frac{Q_m}{Q_{max}} \right)^2$$

$\Delta p_m$ = Pressure loss at measurement conditions ($p_m$, $Q_m$) in mbar
$\Delta p$ = Pressure loss at Qmax with natural gas at 1 bar in mbar (see table)
$\rho_b$ = Standard density of the gas in kg/m³
$p_m$ = Pressure at meas. conditions in bar(a)
$Q_m$ = Flow rate at meas. conditions in m³/h
$Q_{max}$ = Maximum flow rate in m³/h (see table)

Example:
Air, nominal meter size DN 100,
measuring range 20 - 400 m³/h, $p_m$ = 1.01 bar (a),
$\rho_b$ = 1.29 kg/m³, $Q_m$ = 250 m³/h.
Take from the table: Δp = 4 mbar.
Hence the result using the above formula:
Δp = 2.5 mbar.

| Technical Data | |
|---|---|
| Explosion protection | II 2G Ex ia IIC T4 Gb |
| Degree of protection | IP 65 |
| Ambient temperature | -25°C - +55°C |
| Medium temperature range | -20°C - +60°C |
| Temperature transmitter | PT 1000 |
| Pressure ranges | 0.8 – 2.5 bar(a) 0.8 – 6.0 bar(a) 2.0 – 10 bar(a) 4.0 – 20 bar(a) |
| Power supply | Standard lithium battery with 3.6 V (service life 6+ years)<br>Service life of the standby battery with 24 V/DC external power supply via interface or current output 10+ years |
| Outputs | 3 transistor outputs:<br>- HF<br>- LF (puls width programmable)<br>- Fault<br>4 - 20 mA analog output (only with external power supply), electrically isolated |
| Interface | RS 485 (Modbus protocol) / external power supply |

# FACTS, APPROVALS, CONNECTION

## Types of Gas

The TME 400 standard design is suitable for all gases complying with DVGW Code of Practice G260. The materials used are appropriate for industrial gases and fuel gases, such as unmodified and modified natural gases, processed biogas and all non-corrosive gases. For corrosive gases, there are special designs available with PTFE lining, special material, special lubrication, etc.

## Maintenance

All turbine meters up to and including the nominal size of DN 150 are fitted with permanently lubricated bearings and require no maintenance. From the nominal size of DN 200, the meters are fitted with a lubricator. Lubrication has to be performed in compliance with the operating instruc- tions (see also lubrication instruction plate on the meter).

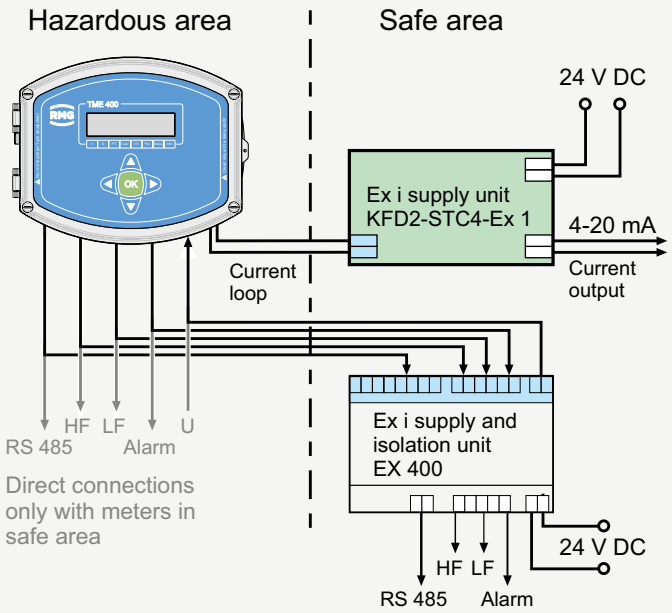
## Measuring Accuracy (Natural GAS)

| Measuring error | Qmin to 0.2 · Qmax | 0.2 · Qmax to Qmax |
|---|---|---|
| DN 25 | ± 6% | ± 2% |
| DN 40 | ± 6% | ± 1.5% |
| DN 50 | ± 3% | ± 1.5% |
| DN 80 | ± 3% | ± 1% |
| ≥ DN 100 | ± 2% | ± 1% |
| Reproducibility: ≤ ± 0.1% | | |

## Approvals

EU type examination according to

- Explosion protection directive 2014/34/EU
  as per certificate of conformity No.:
  TÜV 17 ATEX 207566 X
  Marking: II 2 G Ex ia IIC T4 Gb
- Pressure equipment directive 2014/68/EU
  as per certificate No.:
  ISG-22-12-1979_Rev. K




## Connection of Outputs

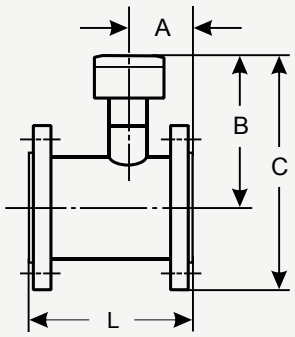
Example for installation in areas subject to explosion hazards

## Current output 4-20 mA possible:

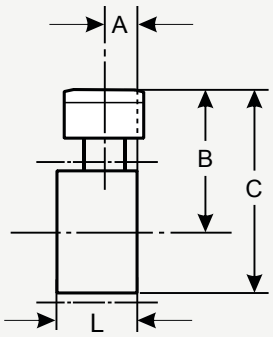
When installing in hazardous areas, a galvanic isolation of the outputs and the interface is required. The device EX 400, which can be delivered for this purpose as an accessory, can also serve as power supply.

Optionally, the TME 400 can be equipped with an externally drivencurrent output (4-20 mA).

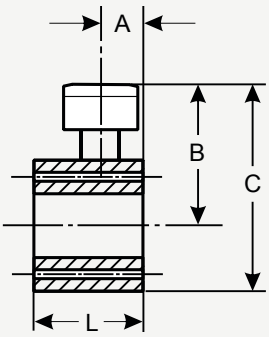
# TYPES OF CONSTRUCTION AND DIMENSIONS



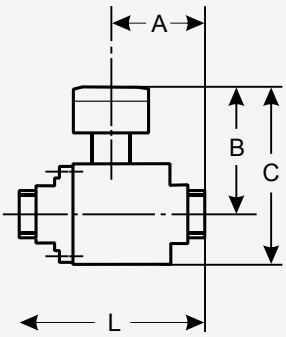

Flanged-end design




Sandwich design
(Adaptor-flange mounting)




Monoflange design




Threaded-end design

| | Weights and measures | | | | | | Pressure rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case design | Nominal size mm | L mm | A mm | B mm | C mm | Weight kg* | PN 10 PN 16 | PN 25 ANSI 150 | PN 40 | ANSI 300 | ANSI 600 |
| Threads | 25** | 185 | 80 | 145 | 195 | 4 | ○ | | | | |
| | 40*** | 140 | 80 | 145 | 195 | 12 | ▲ | | | | |
| Flanges | 50 | 150 | 60 | 180 | 265 | 10 | • | • | • | • | |
| | 80 | 120 | 35 | 180 | 315 | 14 | • | • | • | | |
| | 100 | 150 | 50 | 215 | 345 | 25 | • | • | • | | |
| | 150 | 175 | 70 | 225 | 410 | 40 | • | • | • | | |
| | 200 | 200 | 70 | 225 | 470 | 60 | • | • | • | | |
| | 250 | 300 | 135 | 280 | 540 | 70 | ■ | ■ | | | |
| | 300 | 300 | 95 | 320 | 580 | 100 | ■ | ■ | | | |
| | | 450 | 200 | 325 | 610 | 200 | | | ■ | ■ | ■ |
| | 400 | 600 | 145 | 325 | 650 | 180 | ■ | ■ | | | |
| | | 600 | 345 | 335 | 680 | 400 | | | ■ | ■ | ■ |
| Mono-flanges | 50 | 80 | 60 | 175 | 255 | 15 | | | | | • |
| | 80 | 120 | 35 | 200 | 300 | 35 | | | | • | • |
| | 100 | 150 | 50 | 225 | 335 | 50 | | | | • | • |
| | 150 | 175 | 70 | 270 | 445 | 100 | | | | • | • |
| | 200 | 200 | 70 | 305 | 510 | 130 | | | | • | • |
| | 250 | 250 | 85 | 345 | 590 | 200 | | | • | • | • |
| Sandwich | 50 | 80 | 30 | 145 | 195 | 12 | ▲ | • | | | |

Nominal sizes DN 500 / DN 600 and special designs on request.

▯ Steel/spheroidal cast iron ▯ Aluminium
▯ Steel, welded design ▯ Stainless steel

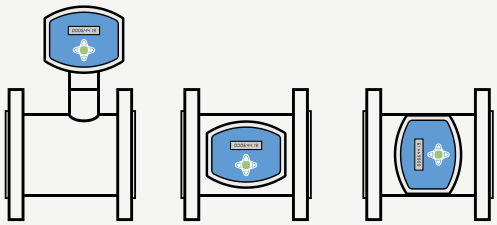
* The weights are approximate values, devices with a lower pressure rating can have a lower weight.
** External thread R 1½"; with coupling kit: internal thread Rp 1 ISO 7-1, overall length 243 mm, max. pressure for combustible gases: 5 bar
*** External thread R 2¼"; with coupling kit: internal thread Rp 1½ ISO 7-1, overall length 206 mm

# INSTALLATION OPTIONS, ARCHIVES, SOFTWARE

## Options for Installing the Totalizer

With the TME 400-VM the meter head can be mounted standing or lying as well as rotated about the vertical axis. For TME 400-VC the meter head is mounted standing in any case due to the pulse piping required.

For both the TME 400-VM and the TME 400-VC the remote totalizer option for a separated mounting of the meter head in a distance of max. 10 m from the meter body is available.



## Archives

Parameter changes, meter readings and events are stored in the archives and for the TME 400-VC additionally measured values.

The memory depth is in each case:

- Parameter archive (custody transfer) 300
- Parameter archive (secondary) 300
- Event archive 200
- Periodic archive 9000
- Daily archive 100
- Monthly archive 25

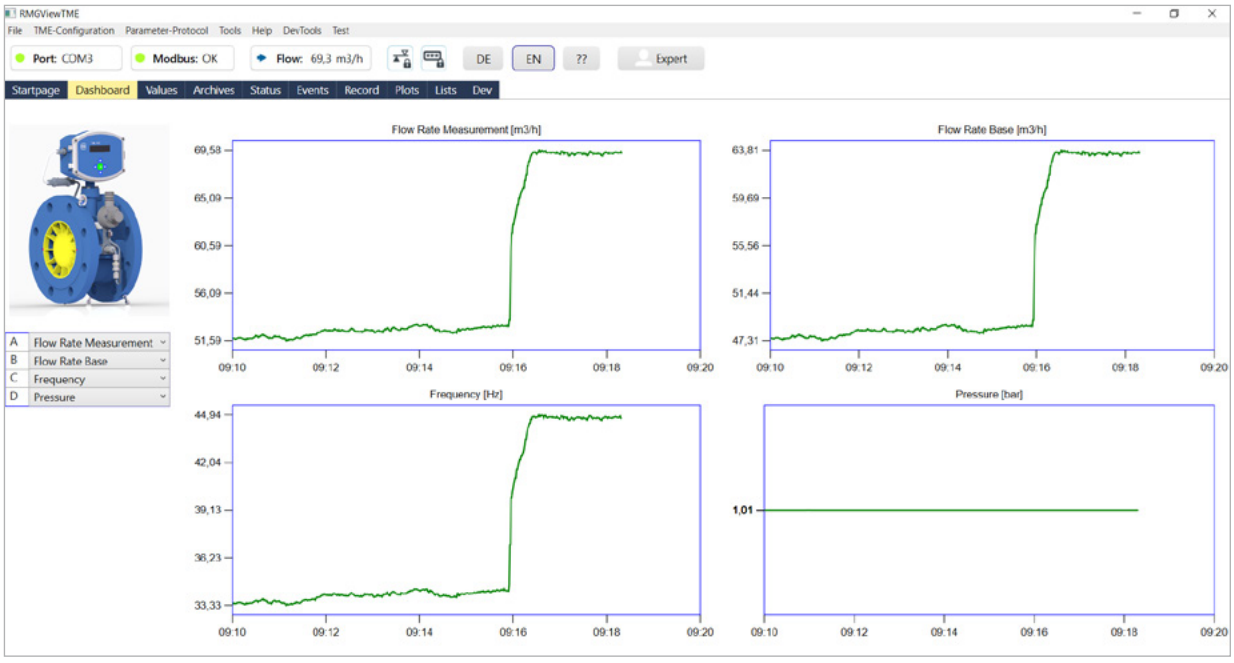
The measuring period can be set to 15, 30 or 60 minutes.

## Operating software RMGView$^{TME}$

The provided RMGView$^{TME}$ software allows direct access to the measuring electronics with a PC. The most important functions are:

- Readout of all parameters
- Change of parameters (with open calibration switch)
- Graphical display of measured values
- Creating test certificates and data sheets and their output in pdf format
- Reading out the archives
- Export of parameters and archive data in Excel readable format

The software is easy to use and all the data is displayed systematically in clearly arranged tables. It is also possible to combine selected measured values and parameters in user-defined tables.



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ONE STEP AHEAD

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