



Operating Manual

Turbine Meter TME400-VC (..-VCF)

Issued: July, 01st 2021
Version: 08
Firmware: 1.06

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Translation of the original document The manual **TME400VCF_manual_en_08** of 2021 July 1st for the TME400-VC and TME400-VCF turbine meter with volume converters is the original document. This document is a template for translations in other languages.

Note Unfortunately, paper is not updated automatically, whereas technical development continuously advances. Therefore, we reserve the right to make technical changes in regard to the representations and specifications of these operating instructions. The latest version of this manual (and other devices) can be downloaded at your convenience from our Internet page:

www.rmg.com.

| | | |
|--------------------------------|---------------|------|
| Created | June | 2018 |
| ... | | |
| 4th Revision | March | 2019 |
| 5th Revision | July | 2019 |
| 6th Revision | September | 2020 |
| 7th Revision | 2021 July 1st | |

| | | |
|--------------------------------------|-------------------------|---|
| Document version and language | Document version | TME400VCF_manual_en_08 2021 July 1st |
| | Language | EN |

TABLE OF CONTENTS

| | |
|---|----|
| 1. INTRODUCTION | 1 |
| 1.1. STRUCTURE OF THE MANUAL | 1 |
| 1.2. PURPOSE OF THE MANUAL | 2 |
| 1.2.1. ABBREVIATIONS..... | 2 |
| 1.2.2. SYMBOLS..... | 3 |
| 1.2.3. STRUCTURE OF NOTICES..... | 3 |
| 1.2.4. WORKING WITH THE DEVICE | 4 |
| 1.2.4.1. SAFETY NOTICES DANGER, WARNING, CAUTION AND NOTE..... | 4 |
| 1.2.4.2. DANGERS DURING COMMISSIONING | 6 |
| 1.2.4.3. DANGERS DURING MAINTENANCE AND REPAIR..... | 7 |
| 1.2.4.4. QUALIFICATION OF PERSONNEL | 9 |
| 1.2.5. RISK ASSESSMENT AND MINIMIZATION | 9 |
| 1.2.6. APPLICABILITY OF THE MANUAL..... | 12 |
| 1.2.6.1. DANGER DURING OPERATION..... | 12 |
| 1.2.6.2. DANGERS OF OPERATION IN EX AREAS | 12 |
| 1.2.6.3. RESPONSIBILITY OF THE OPERATOR..... | 13 |
| 1.2.7. TRANSPORT | 13 |
| 1.2.8. SCOPE OF DELIVERY | 14 |
| 1.2.9. DISPOSAL OF PACKAGING MATERIAL | 15 |
| 1.2.10. STORAGE | 15 |
| 1.3. OVERVIEW OF VERSIONS..... | 16 |
| 1.3.1. DESCRIPTION..... | 16 |
| 1.3.2. DEVICE FEATURES | 16 |
| 1.3.3. POWER SUPPLY | 17 |
| 1.3.4. AREA OF APPLICATION | 18 |
| 1.3.4.1. INSTALLATION AND MOUNTING POSITION | 18 |
| 1.3.4.2. TEMPERATURE RANGES | 18 |
| 1.3.5. USE OF GAS METERS FOR DIFFERENT GASES | 20 |
| 1.3.5.1. SUITABILITY AND SAFETY FOR NATURAL GAS CONTAINING H ₂ | 21 |
| 1.4. AREAS OF APPLICATION..... | 22 |
| 1.4.1. WORKING PRINCIPLE OF THE TME400 | 22 |



| | | |
|-----------|--|----|
| 1.4.2. | INTEGRATING THE TURBINE METER INTO THE PIPELINE..... | 24 |
| 1.4.2.1. | SEALS | 25 |
| 1.4.2.2. | SCREWS | 28 |
| 1.4.2.3. | METER HOUSING MATERIAL | 28 |
| 1.4.2.4. | INSTALLATION | 29 |
| 1.4.2.5. | THRESHOLD VALUES | 31 |
| 1.4.2.6. | TECHNICAL GUIDELINE G13..... | 32 |
| 1.4.2.7. | STANDARDS / GUIDELINES..... | 33 |
| 1.4.2.8. | MEASURING RANGES | 34 |
| 1.4.2.9. | MEASURING ACCURACY..... | 35 |
| 1.4.2.10. | PRESSURE LOSS | 36 |
| 1.4.2.11. | PUTTING THE DEVICE INTO OPERATION | 37 |
| 1.4.2.12. | MAINTENANCE / LUBRICATION..... | 37 |
| 2. | INSTALLATION | 39 |
| 2.1. | ELECTRICAL CONNECTIONS | 39 |
| 3. | TME400..... | 47 |
| 3.1. | DISPLAY FIELD | 47 |
| 3.1.1. | DISPLAY TEST..... | 48 |
| 3.1.2. | RESET..... | 48 |
| 3.1.3. | BOOTING UP..... | 48 |
| 3.1.4. | BATTERY REPLACEMENT | 51 |
| 4. | OPERATION..... | 54 |
| 4.1. | OPERATION CONCEPT..... | 54 |
| 4.1.1. | COORDINATE SYSTEM | 54 |
| 4.1.2. | DISPLAY AND COORDINATE SYSTEM..... | 56 |
| 4.1.3. | PARAMETER PROTECTION | 56 |
| 4.2. | PROGRAMMING..... | 58 |
| 4.2.1. | PROGRAMMING WITH THE PROGRAMMING BUTTONS | 58 |
| 4.3. | EQUATIONS IN THE TME400..... | 61 |
| 4.3.1. | VARIABLE DESCRIPTION | 61 |
| 4.3.2. | STANDARD FORMULA..... | 62 |
| 4.3.3. | COORDINATES IN CONTEXT | 62 |
| 4.3.3.1. | VOLUME / METERS | 63 |

| | | |
|-----------|---|-----|
| 4.3.3.2. | FLOW RATE | 65 |
| 4.3.3.3. | PRESSURE | 66 |
| 4.3.3.4. | TEMPERATURE | 68 |
| 4.3.3.5. | ANALYSIS..... | 70 |
| 4.3.3.6. | CURRENT OUTPUT | 73 |
| 4.3.3.7. | ERROR / TYPE PLATE | 74 |
| 4.3.3.8. | RS-485 INTERFACE..... | 75 |
| 4.3.3.9. | ARCHIVE..... | 76 |
| 4.3.3.10. | SETTINGS | 78 |
| 4.4. | SPECIAL SETTINGS | 81 |
| 4.4.1. | CONFIGURATION OF THE CURRENT OUTPUT | 81 |
| 4.5. | RMGVIEW ^{TME} | 82 |
| 5. | TECHNICAL DATA..... | 83 |
| 5.1.1. | DEVICE TYPES | 83 |
| 5.1.2. | INPUTS..... | 83 |
| 5.1.2.1. | POWER SUPPLY..... | 83 |
| 5.1.2.2. | PULSE IN MEASURING INPUTS (SENSOR 1 / 2)..... | 84 |
| 5.1.2.3. | TEMPERATURE INPUT | 84 |
| 5.1.2.4. | PRESSURE TRANSDUCER | 84 |
| 5.1.3. | OUTPUTS | 85 |
| 5.1.4. | DIGITAL INTERFACE | 85 |
| 5.1.5. | CURRENT LOOP CONNECTION..... | 85 |
| 5.1.6. | CABLE | 87 |
| 5.1.7. | CABLE CONNECTION | 87 |
| 5.1.8. | GROUND..... | 89 |
| 5.2. | OVERVIEW OF MATERIALS IN USE..... | 91 |
| 6. | ERROR MESSAGES | 92 |
| | APPENDIX..... | 94 |
| A | MODBUS | 94 |
| B | STRUCTURE OF THE ARCHIVES | 103 |
| B1 | ARCHIVE SIZE | 103 |
| B2 | ARCHIVE TYPES | 103 |
| B2.1 | PARAMETER ARCHIVES..... | 104 |



| | | | |
|-----------|----------|--|------------|
| | B2.2 | EVENT ARCHIVES..... | 104 |
| | B2.3 | MEASURED VALUES ARCHIVES..... | 105 |
| | B3 | CALCULATION OF THE STORAGE SIZE | 106 |
| | B4 | ARCHIVE HEADER | 106 |
| | B5 | READING THE ARCHIVE DATA VIA MODBUS..... | 109 |
| IV | C | DIMENSIONS | 111 |
| | D | MEASURING RANGES FOR TME 400-VMF/ TME 400-VCF | 116 |
| | E | TYPE PLATE..... | 117 |
| | F | SEAL DIAGRAMS..... | 119 |
| | G | LATER INSTALLATION OF THE POWER MODULE | 120 |
| | H | SPARE PARTS AND ACCESSORIES | 122 |
| | I | CERTIFICATES AND APPROVALS..... | 123 |

1. Introduction

1.1. Structure of the manual

The introduction of this manual comprises two parts. The first part lists general specifications; the symbols used in the manual and the structure of notices are presented and a risk assessment is provided. The differences between the TME400-VC and TME400-VCF turbine meters with volume converters are explained. If there is no explicit reference to differences, the TME400 is superordinate for both versions.

Note

The unit of the turbine meter is always identified with an electric converter with TME400-VC and TME400-VCF in this manual.

In addition, the first part includes specifications for the transport and storage of the TME400. The second part of the introduction describes the features and areas of application of the TME400; basic standards are listed and the pressure and temperature ranges in which the TME400 can and may be used are pre-adjusted.

The second chapter describes the electrical and mechanical commissioning of the TME400. An explanation of how to achieve the reliable commissioning of the meter and high precision is provided.

The third chapter explains the displays of the TME400. It explains resetting, booting and replacement of the battery.

The settings of the TME400 are explained in chapter four. In particular, all adjustable parameters are provided there with some explanations.

The fifth chapter summarizes the technical data and the sixth chapter provides a list of error messages.

The appendix provides details about the Modbus, measurements, type plate and seal plans. Then the certificates and approvals are listed.

1.2. Purpose of the manual

This manual provides information that is necessary for fault-free and safe operation.

The TME400 was designed and produced according to the state of the art and generally recognized safety standards and directives. However, its use can entail dangers that are avoidable by complying with this manual. The device must only be used as intended and in technically sound condition.

Warning

Unintended use voids all warranty claims and the TME400 can also lose its approvals.

1.2.1. Abbreviations

The following abbreviations are used:

| | |
|------------|--|
| TME400-VM | The TME400-VM is a turbine meter which is used for non-custody-transfer volume measurement (V olume M easurement) of the operating volume of non-aggressive gases and combustion fuels is used. |
| TME400-VMF | The TME400-VMF is a turbine meter that is used in custody-transfer applications (F iscally). The designation TME400-VMF comprises all turbine meters. |
| TME400-VC | The TME400-VC also enables calculation of the standard volume flow (V olume C orrector) from the operating volume flow in non-custody-transfer applications. |
| TME400-VCF | The TME400-VCF is used in custody-transfer applications (F iscally). In addition to the turbine meter, the TME400-VCF designation also includes the volume corrector. |

Note

This manual only describes the TME400-VC and TME400-VCF.

| | |
|---------|---|
| MessEG | Measurement and Calibration Act Law on the marketing and provision of measuring devices in the market, their use and calibration, valid since 1/1/2015 |
| MessEV | Measurement and Calibration Regulation Regulation on the marketing and provision of measuring devices in the market and on their use and calibration; 12/11/2014 |
| MID | Measurement Instruments Directive |
| PTB | Physikalisch-Technische Bundesanstalt [German National Test Authority] |
| Vo | <u>o</u> riginal meter reading (<u>V</u> olume) of a mechanical counter |
| approx. | approximately |
| max. | maximum |
| min. | minimum |

3


1.2.2. Symbols

The following symbols are used:

| | |
|-----------|---------------------------------|
| 1, 2, ... | Identifies steps for work tasks |
| .. | |

1.2.3. Structure of notices

The following notices are used:

 **Danger**

This warning notice informs you of imminently threatening dangers that can arise due to misuse/operator error. If these situations are not avoided, death or severe injuries can occur.

⚠ Warning

This warning notice informs you of potentially dangerous situations that can arise due to misuse/operator error. If these situations are not avoided, minor injuries can occur.

⚠ Caution

This notice informs you of potentially dangerous situations that can arise due to misuse/operator error. If these situations are not avoided, damage to the device or nearby property can occur.

Note

This notice informs you of potentially dangerous situations that can arise due to misuse/operator error. If these situations are not avoided, damage to the device or nearby property can occur.

This notice can provide you with helpful tips to make your work easier. This notice also provides you with further information about the device or the work process in order to prevent operator error.

1.2.4. Working with the device

1.2.4.1. Safety notices Danger, Warning, Caution and Note

⚠ Danger

All of the following safety notices must be observed!

Disregard of the safety notices can result in danger to the life and limb or environmental and property damage.

Bear in mind that the safety warnings in this manual and on the device cannot cover all potentially dangerous situations, because the interaction of various conditions can be impossible to foresee. Merely following the instructions may not suffice for correct operation. Always remain attentive and consider potential consequences.

- Read this operating manual and especially the following safety notices carefully before working with the device for the first time.
- Warnings are provided in the operating manual for unavoidable residual risks for users, third parties, equipment or other property. The safety instructions used in this manual do not refer to unavoidable residual risks.
- Only operate the device in fault-free condition and in observance of the operating manual.
- Compliance with local statutory accident prevention, installation and assembly regulations is also mandatory.

⚠ Caution

All notices in the manual must be observed. Use of the TME400 is only permitted in accordance with the specifications in the operating manual. RMG assumes no liability for damages arising due to disregard of the operating manual.

⚠ Danger

Service and maintenance tasks or repairs that are not described in the operating manual must not be carried out without prior consultation with the manufacturer. The device must not be opened forcefully.

⚠ Caution

The TME400 is approved for custody-transfer applications. For this purpose, it is sealed before deliver and settings specified by the approval authority are locked. These seals, software or hardware locks must not be damaged, destroyed or removed!

In this case, the TME400 loses its official certification!

The TME400 can only be approved for officially certified operation after a renewed inspection by an officially recognized inspection authority or calibration officials and an additional inspection of additional settings. The calibration official must re-apply the seals after the inspection.

Observe the following, in particular:

- Changes to the TME400 are not permitted.
- The technical specifications must be observed and followed for safe operation. Performance limits must not be exceeded (*chapter 5 Technical data*).
- For safe operation, the TME400 must only be used in the scope of the intended use (*chapter 1.3 Overview of versions*).
- The TME400 complies with current standards and regulations. However, danger can arise with misuse.

1.2.4.2. Dangers during commissioning

Initial commissioning

The initial commissioning must only be carried out by specially trained personnel (training by RMG) or RMG service personnel.

Note

An acceptance test certificate must be created during the commissioning. This, the operating manual and the EU Declaration of Conformity must be stored so that they are always readily available.

All sharp edges on the device were removed, insofar as possible. However, personal protective equipment provided by the operator must be worn during all work.

Danger

Install the device as specified in the operating manual. If the device is not installed as specified in the operating manual, there may be a risk that adequate explosion protection is not provided.

The explosion protection is lost!

⚠ Danger

Inadequately qualified persons working on the equipment are unable to correctly estimate dangers. Explosions can be triggered. Only work on the equipment if you have the appropriate qualifications.

Components can be damaged if you do not use suitable tools and materials. Use tools that are recommended for the respective work in the operating manual.

7

| | |
|---|---|
| Mechanical installation | Mechanical installation must only be performed by appropriately qualified technicians. |
| Electrical installation | Installation on electrical components must only be carried out by qualified electricians. |
| Mechanical and/or electrical installation | These qualified personnel require training specifically for work in hazardous areas. Qualified personnel are persons who have training / education in accordance with DIN VDE 0105, IEC 364 or comparable standards . |

⚠ Danger

Installation and removal of the TME400 must only take place in an explosion-free, pressure-free atmosphere. The descriptions in the operating manual must be observed. In general, it is recommended that the replacement should only be carried out by RMG Service.

A leak test must be carried out after work on pressurized components.

All of the above points also apply to repair and maintenance tasks and in general when opening the meter is necessary.

Flange fastening elements, fastening screws, screw couplings and check valves, the oil supply, pressure relief connections, valves, HF pulse generators, protective pipes and swivel adapters must not be loosened during operation.

1.2.4.3. Dangers during maintenance and repair

| | |
|---------------------|--|
| Operating personnel | The operating personnel use and operate the device in the scope of the intended use. |
|---------------------|--|

Maintenance personnel

Work on the device must only be carried out by qualified personnel who can carry out the respective tasks on the basis of their technical training, experience and familiarity with the applicable standards and requirements. These qualified personnel are familiar with the applicable statutory regulations for accident prevention and can independently recognize and avoid potential dangers.

Maintenance and cleaning

Maintenance and cleaning must only be performed by appropriately qualified technicians.

 **Danger**

Inadequately qualified persons working on the equipment are unable to correctly estimate dangers. Explosions can be triggered. If work on live equipment must be conducted in hazardous areas, sparks that are created can trigger an explosion.

 **Danger**

The device can be damaged if it is not cleaned as specified in the operating manual. Only clean the device as specified in the operating manual.

Components can be damaged if you do not use suitable tools. The explosion protection is lost.

- **Only clean the device with a damp cloth!**

 **Danger**

The TME400 must only be used as intended! (*Chapter 1.3 Fehler! Verweisquelle konnte nicht gefunden werden. Overview of versions*). Prevent use of the TME400 as a potential climbing aid or use of attachments of the TME400 as potential handles!

1.2.4.4. Qualification of personnel

Note

In general, the following is recommended for all persons working with or on the TME400:

- Training / education for work in hazardous areas.
- The capacity to be able to correctly estimate dangers and risks when working with the TME400 and all connected devices. Possible dangers include components that are under pressure and consequences of incorrect installation.
- Recognition of dangers that can arise from the flow medium that is used.
- Training / education by RMG for work with gas measuring devices.
- Education / instruction in all national standards and directives to be complied with for the work to be carried out on the device.

1.2.5. Risk assessment and minimization

According to assessment by qualified employees of RMG, the TME400 is subject to risks during its use. Risks can arise, for example, due to high pressures and occasionally due to pressures that are too low. Work outside of the permissible temperature range can also lead to dangers. Impermissible current and voltage values can trigger explosions in hazardous areas. The risk assessment requires an emptying and ventilation of the pipeline for connection with installation and removal of a turbine. Then and only then is it assured that there is not a hazardous gas mixture in the pipeline. Naturally, work must only be carried out by trained personnel (see *chapter 1.2.4.4 Qualification of personnel*), who are also trained to recognize suitable tools and use them exclusively. The risks were summarized alongside development and measures were taken to minimize these risks.

Measures for risk minimization:

- All pressurized parts are designed in accordance with AD 2000 rules and regulations, Pressure Equipment Directive, Annex 1
- The complete pressure design has been inspected by TÜV Hessen
- All pressurized parts have been manufactured with a material certificate; there is an uninterrupted change of batch tracing of pressurized components
- The mechanical properties of all relevant pressurized components have been subjected to tension tests, notch impact bending tests and hardness tests

- Non-destructive testing was also carried out: X-ray and ultrasonic inspection of the meter housing for defective points in material, surface crack testing with magnetic powder and a color penetration process
- Strength tests for components were conducted at 1.5 times the nominal pressure for the pressure testing; the leak testing for the assembly was conducted at 1.1 times the nominal pressure. Certificates were issued for successfully passed tests
- The maximum operating pressure and the permissible temperature range are specified on the type plate of the device. Operation of the device is only permitted within these specified ranges.
- A maximal temperature difference of $\Delta T \leq 100^{\circ}\text{K}$ between the inside and outside of the TME400 must be respected.
- Additional external forces and torques were not taken into account in the pressure dimensioning.
- In the event that the pressure equipment is to be marketed and put into operation as an assembly within the meaning of the Pressure Equipment-Directive, an examination of the assembly must be provided at the latest during the final and pressure tests.
Otherwise, the commissioning inspector must explicitly point out that a test of the equipment location with safety function still has to be performed at the installation site.

⚠ Danger

The following applies for work in hazardous areas (all zones):

- The pulse generators of the turbine meter must be connected to intrinsically safe power circuit only.
- Only tools that are approved for Ex Zone 1 are permitted for maintenance and repair tasks.
- Otherwise, work must only be carried out when there is not an explosive atmosphere.
- The risk of ignition due to impact or friction must be avoided.
- Work on devices which are used in hazardous areas must be carried out by qualified electrical engineers with special capabilities for work in hazardous areas.
- The wiring / installation in hazardous areas must only be carried out by trained personnel in accordance with EN60079-14 and in observance of national regulations.
- Qualified persons must satisfy the definitions in accordance with DIN EN 0105 or IEC 364 or directly comparable standards.
- If one or more power circuits are used, it must be ensured that the permissible limit values according to the EC type approval certificate are not exceeded when choosing the cables.
- Every Ex signal circuit must be routed with a dedicated cable which must be guided through the appropriate PG screw coupling.
- Permanent installation of the intrinsically safe cable is mandatory.

11

⚠ Danger

In addition, the following applies for work in hazardous areas (all zones):

- Only trained and instructed personnel are permitted. Work on the measuring system must only be carried out from qualified persons and inspected by responsible qualified supervisors.
- Qualified persons have been authorized by the person responsible for safety of personnel to carrying out such work on the basis of their training, experience or instruction and familiarity with applicable standards, provisions, accident prevention regulations and system conditions. It is essential that these persons are able to recognize and avoid potential dangers in good time.

1.2.6. Applicability of the manual

This manual describes the TME400. TME400 is generally only part of a complete system. The manuals of the other components of the system must be observed. If you find contradictory instructions, contact RMG and/or the manufacturers of the other components.

Note

Ensure that the power data of the current connection matches the specifications on the type plate. Ensure that the limit values specified in the conformity certificate (see appendix) for the devices to be connected are not exceeded.

Observe any applicable national regulations in the country of use. Use cable that is appropriate for the cable fittings.

Danger

Only work on the equipment if you have the appropriate training and qualifications.

Attention: Risk of destruction due to body electricity, e.g. due to the rubbing of clothing.

1.2.6.1. Danger during operation

Observe the specifications of the system manufacturer and/or system operator.

1.2.6.2. Dangers of operation in EX areas

Only operate the device in fault-free and complete condition.

If you make technical changes to the device, safe operation can no longer be guaranteed.

Danger

Only use the device in its original condition. The TME400 is permitted for operation in Ex Protection Zone 1, but only within the permissible temperature range (*chapter 1.3.4.2 Temperature ranges*).

1.2.6.3. Responsibility of the operator

As the operator, you must ensure that only adequately qualified personnel work on the device. Ensure that all employees who work with the device have read and understood this manual. You are also obligated to train personnel regularly and inform them of the dangers. Ensure that all work on the device is carried out exclusively by qualified persons and inspected by responsible qualified supervisors. The responsibilities for installation, operation, fault rectification, maintenance and cleaning must be clearly regulated. Instruct your personnel with regard to the risks involved with working with the device.

1.2.7. Transport

The device is packaged specific to the transport requirements for each customer. Ensure safe packaging that absorbs light impact and vibrations is used for any further transport. Nevertheless, inform the transport company that all types of impact and vibrations should be avoided during transport.

Warning

Risk of injury during transport

Any foot screws must be mounted if they are provided as a transport safeguard to prevent rolling and tipping. Additional measures must be taken to ensure that impermissible rolling and tipping are prevented.

Only use the provided lifting eyes / ring screws to lift the meter. Please observe the relevant permissible loads for the lifting equipment. Prior to lifting, ensure that the load is securely fastened. Do not stand under suspended loads.

The device can slip, topple over or fall down when being lifted and set down. The device can fall over if the bearing capacity of the lifting equipment is disregarded. There is a risk of severe injury for nearby persons.

If the device is delivered on a Euro pallet, the device can be transported on the pallet using a pallet truck or forklift.

The gas meters and accessories must be protected from jarring and vibrations during transport.

The gas meters or any inlet/outlet pieces have a flange as an end piece. The flanges are sealed with a protective sticker or fitted with a plastic dummy plug. The protective stickers and/or dummy plugs must be removed without leaving any residue prior to installation in the pipeline. Residue from this film changes the flow and causes measuring errors!

This protection must be re-applied to the flanges for transport or storage of the device.

1.2.8. Scope of delivery

The scope of delivery can differ depending on the optional orders. The following is "normally" included in the scope of delivery:

| Part | Quantity |
|---|----------|
| TME400-VC (or TME400-VCF) turbine meter with integrated electronic volume corrector | 1 |
| 1 Lubricating oil bottle | Optional |
| Lubricating instructions | 1 |
| Manual | 1 |

| | |
|--------------------------------|---------------|
| Test log | 1 |
| Calibration certificate | 1 |
| Material test certificate | 1 |
| Strength test certificate 3.1. | Op- tional |

1.2.9. Disposal of packaging material

Dispose of the material in an environmentally friendly manner in accordance with national standards and directives.

1.2.10. Storage

Avoid extended periods of storage. After storage, inspect the device for damage and test for correct function. Contact the RMG service department to arrange for inspection of the device after a storage period of longer than one year. For this purpose, return the device to RMG.

Note

Storage must take place in a dry and protected room.

It must be ensured that all open pipes are sealed.

1.3. Overview of versions

1.3.1. Description

The **TME400-VC** is a turbine meter which is used for volume measurement of the operating volume of non-aggressive gases and burnable gas. The operating volume flow is determined based on the turbine speed, which is scanned by means of a Wiegand or Reed sensor element and then added together. An optional 2-channel measuring head version can be implemented for inspection purposes, particularly for use in custody-transfer applications. The result is registered in an electronic meter. This operating volume flow is determined for the present pressure and temperature conditions, with are also detected. The integrated volume corrector of the TME400-VC enables calculation of the standard volume flow from the operating volume flow with the pressure and temperature data (**V**olume **C**orrector). Special gas properties can be factored in using different gas models for correct gas status determination. The measured operating volume and / or the calculated standard volume are added up in internal archives.

There are a high-frequency (HF) and a low-frequency (LF) output, where the HF output is preferably used as a flow sensor for control tasks and remote transmission. In addition to these outputs, the TME400 VC has a serial RS-485 interface for digital data readings and parameterization. The TME400-VC is used in **non-custody-transfer** applications.

The **TME400-VCF** (MID) is the version of the TME400-VC for **custody-transfer** applications. The device can be activated via the same outputs.

The **TME400-VCF** (MID) is the turbine meter with volume corrector for custody-transfer applications and has an equivalent function and operating method to the TME400-VC. It is used in **custody-transfer applications**.

1.3.2. Device features

TME400-VC

- Non-custody-transfer measurements
- Electronic meter
- Flow rate display
- Measurement and display of pressure
- Measurement and display of temperature
- Peak value display for the flow value
- Determination and display of the standard volume flow
- Alarm output

- Optionally available in a version with remote meter (distance from meter head to meter: 10 m; see *appendix C Dimensions*)
- 2x pulse inputs selectable for Reed, Wiegand and external pulse transmitters (remote meters)
- 1x contact input
- 1x HF output (input pulse of pulse input 1 is output with defined pulse width of 1 ms)
- 1x LF output with defined pulse width (20 ms, 125 ms or 250 ms)
- 1x input for digital pressure sensors (see below)
- 1x temperature input Pt1000 (see below)
- 1x RS-485 with external power supply
- 1x optional power module
- Power supply via 3.6V lithium cell or an external power supply which is assigned to the RS-485 interface (supply via power module alone is not adequate and a battery is required for support)
- Archive memory for events, parameters, measurements

TME400-VCF

- In addition to the features of the TME400-VC, this version can be used for custody-transfer applications.

1.3.3. Power supply

Battery-operated device

The TME400 is equipped with a replaceable 3.6 V lithium battery. The device is designed for continuous operation for approximately 10 years. To achieve this, the devices may be operated for a maximum of 15 minutes per day with input pulses of 1 Hz.

Battery-operated device with additional external power supply

An electric supply of the TME400 via the 4-20mA current loop reduces the power consumption from the batterie and typically extends the service life of the battery to more than 12 years.

If the TME400 is additionally electrical powered by the RS-485 interface, the service life of the battery is typically extended to clearly more than 12 years.

Battery replacement indicator

The remaining battery life is determined by means of an internal calculation. An indicator in the display appears when it is time to replace the battery. Battery replacement is described in *chapter 3.1.4 Battery replacement*. In parameter G20 *Date of last battery change* the date of the last battery change is displayed (see *chapter 4.3.3 Coordinates in context*).

Note

In case of a loss of the external power supply, the TME400 is supplied by the buffer battery. The battery symbol is blinking in this case.

1.3.4. Area of application

The TME400 is approved for use in hazardous areas with the following mark:



II 2G Ex ia IIC T4 Gb

The EC type approval certificate is:

**TÜV 17 ATEX 207566 X
IECEX TUN 18.0009 X**

The corresponding conformity certificates are provided in the annex. The RMG contact information is provided on the second and last page.

1.3.4.1. Installation and mounting position

The TME400-VC and TME400-VCF can be supplied with DIN and ANSI connections. Up to nominal diameter DN 200, the installation position of the turbine meter with permanent lubrication can be selected as required. From nominal diameter DN 250, the meter must be installed in the ordered installation position. It must also be ensured that the filling opening of the lubrication faces upwards.

1.3.4.2. Temperature ranges

The following temperature ranges are approved for the TME400 volume corrector and the turbine meter in standard version.

| | |
|---|---|
| Temperature ranges | |
| Medium temperature | -25°C to +55°C |
| According to ATEX (T _{amb}) | -25°C to +55°C (II 2G Ex ia IIC T4) |
| According to PED 2014/68/EU | -20°C to +80°C (spheroidal graphite iron) -40°C to +80°C (cast steel) -40°C to +80°C (stainless steel) -10°C to +80°C (welded version and round steel material) |
| Pressure safety for DN25 according to sound engineering practice, see PED 2014/68/EU, sec. 4, subsec. 3 | -40°C to +60°C (aluminum) |
| Lower temperature limits are available on request with the welded version and round steel material. | |

Note

If different temperature ranges apply simultaneously, the smallest specified range applies for the overall system. This is also marked on the type plate.

⚠ Caution

Direct solar radiation must be avoided.

⚠ Danger

The temperature sensor must not be connected via the housing plug on the meter in hazardous areas; a dedicated cable must be routed for the temperature sensor!

1.3.5. Use of gas meters for different gases

| Gas | Symbol | Tightness at 0°C and 1.013 bar | Meter housing | Comments |
|---------------------------|--------------------------------|--------------------------------|---------------|--|
| Natural gas | | 0.8 | Standard | |
| City gas | | | Standard | |
| Methane | CH ₄ | 0.72 | Standard | |
| Ethane | C ₂ H ₆ | 1.36 | Standard | |
| Propane | C ₃ H ₈ | 2.02 | Standard | |
| Butane | C ₄ H ₁₀ | 2.70 | Standard | |
| Air | | 1.29 | Standard | |
| Argon | Ar | 1.78 | Standard | |
| Helium | He | 0.18 | Standard | |
| Carbon dioxide (dry) | CO ₂ | 1.98 | Standard | |
| Nitrogen | N ₂ | 1.25 | Standard | |
| Hydrogen | H ₂ | 0.09 | Standard | up to 20% Generally, a reduced measuring range |
| Ethylene (gaseous) | C ₂ H ₄ | 1.26 | Special | Special version (also for humid gases): Teflon coating, special lubrication, special material, etc. |
| Biogas | | | Special | |
| Sour gas | | | Special | |
| Digester gas / sewage gas | | | Special | |
| Sulfur dioxide | SO ₂ | 2.93 | Special | |

The components of the gases must be within the concentration limits according to EN 437:2009 for test gases. Safe operation is guaranteed with these specified gases.

Other gases on request.

1.3.5.1. Suitability and safety for natural gas containing H₂

The TME400 can be used in hydrogen-containing natural gas. There are no safety-related concerns for this use.

Notice

In accordance with the German TR-G19 – the TME400 is suitable and approved for use in custody transfer applications – in natural gases with a maximum hydrogen content of 10 mol-%, with the accuracy specified in *chapter 1.4.2.9 Measuring accuracy*.

21

Since there are currently no certified test rigs in Germany to calibrate meters with higher hydrogen-containing gases, an accuracy above 10 mol-% cannot be tested or certified.

Not custody transfer measurements are of course possible in natural gases with a hydrogen content above 10 mol%. However, a reduced measuring range must be taken into account if applicable. Please contact RMG for further information.

1.4. Areas of application

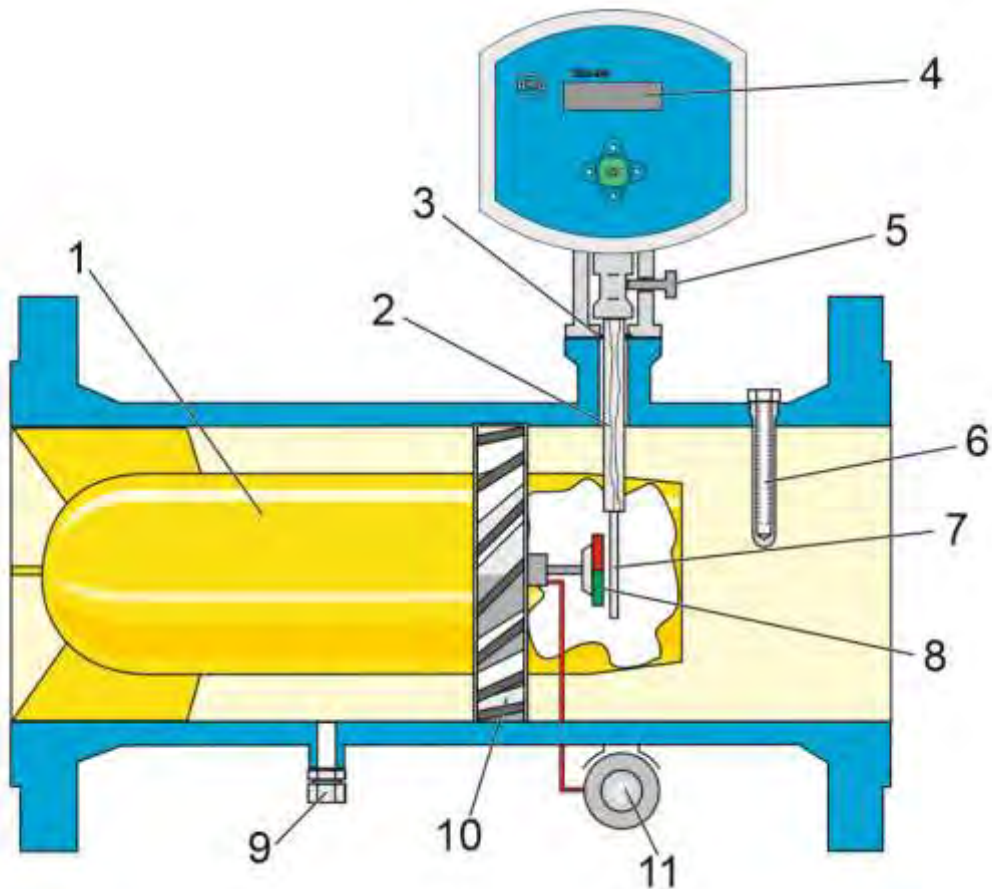
The following chapter provides handling instructions for the TME400 turbine meter for the purpose of safe and reliable operation of the device.

Note

Some of the settings described below must not be made until you have read the explanations in *chapter4 Operation*.

1.4.1. Working principle of the TME400

The working principle of a mechanical turbine meter is based on the measurement of the gas velocity of the flowing gas which powers a turbine wheel. The speed of the turbine within the measuring range (Q_{\min} - Q_{\max}) is approximately proportional to the mean gas velocity and thus the flow rate. The number of rotations, therefore, is a measurement for the gas volume flowing through.



- | | | | |
|---|--|----|---------------------|
| 1 | Flow straightener | 7 | Sensor |
| 2 | Sensor sleeve | 8 | Permanent magnet |
| 3 | O-ring | 9 | Pressure connection |
| 4 | Counter | 10 | Turbine wheel |
| 5 | Clamp screw | 11 | Oil pump |
| 6 | Thermowell for temperature comparison (fiscal) | | |

Figure 1: Turbine meter sectional drawing

There is a permanent magnet on the end disc of the turbine shaft which induces a voltage pulse in the Wiegand sensor with every rotation. This pulse is supplied to the counter of the meter head, which detects the operating volume flow directly as a main totalizer and determines the gas volume flowing through the meter by adding up the pulses and division by the meter factor (number of pulses per m³). This operating volume is shown in the display of the TME400.

Note

The unchanged signal frequency of the sensor element is output at the HF output.

The LF output transmits this HF frequency with a variable scaling factor (*chapter 4.3.3.1 Volume / Meters*).

1.4.2. Integrating the turbine meter into the pipeline

Turbine meters from RMG are equipped with connecting flanges. For a secure connection, the connection dimensions of the flanges of the pipelines to be connected must match the connection dimensions of the flanges of the device.

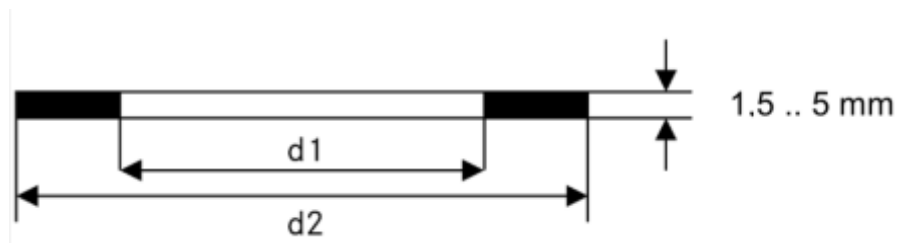
- ANSI pressure levels: flange connection dimensions correspond to the standard ASME B 16.5.
- DIN pressure levels: flange connection dimensions correspond to the standard DIN EN 1092.

1.4.2.1. Seals

- Flat seals: $k_0 \times K_D = 20 \times b_D \mid k_1 = 1.3 \times b_D$ [N/mm]
- Grooved seals: $k_0 \times K_D = 15 \times b_D \mid k_1 = 1.1 \times b_D$ [N/mm]
- Spiral seals: $k_0 \times K_D = 50 \times b_D \mid k_1 = 1.4 \times b_D$ [N/mm]
- Octagonal ring-joint seal: $K_D = 480$ N/mm²

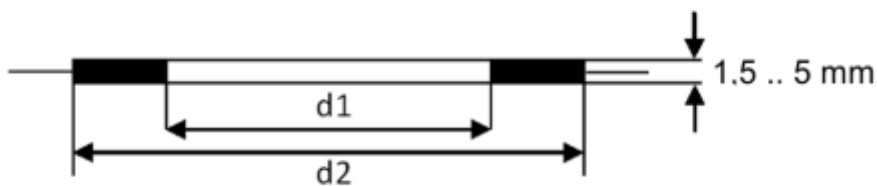
Refer to the tables below for the recommended dimensions.

Flat seals (DIN 2690 / EN 12560-1 Form IBC)



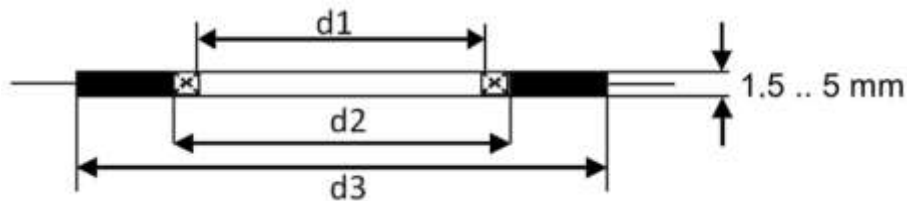
| DN | | d1 | PN 10 | PN 16 | ANSI 150 | PN 25 | PN 40 |
|-----|-----|-----|-------|-------|----------|-------|-------|
| 50 | 2" | 77 | 107 | 107 | 105 | 107 | 107 |
| 80 | 3" | 90 | 142 | 142 | 137 | 142 | 142 |
| 100 | 4" | 115 | 162 | 162 | 175 | 168 | 168 |
| 150 | 6" | 169 | 218 | 218 | 222 | 225 | 225 |
| 200 | 8" | 220 | 273 | 273 | 279 | 285 | 292 |
| 250 | 10" | 274 | 328 | 330 | 340 | 342 | 353 |
| 300 | 12" | 325 | 378 | 385 | 410 | 402 | 418 |
| 400 | 16" | 420 | 490 | 497 | 514 | 515 | 547 |
| 500 | 20" | 520 | 595 | 618 | 607 | 625 | 628 |
| 600 | 24" | 620 | 695 | 735 | 718 | 730 | 745 |

Grooved (EN 12560-6 with centering ring)



| | | ANSI 300 / ANSI 600 | | PN 64 | |
|-----|-----|---------------------|-------|-------|-----|
| DN | | d1 | d2 | d1 | d2 |
| 50 | 2" | 69.8 | 88.9 | 65 | 87 |
| 80 | 3" | 98.4 | 123.8 | 95 | 121 |
| 100 | 4" | 123.8 | 154.0 | 118 | 144 |
| 150 | 6" | 177.8 | 212.7 | 170 | 204 |
| 200 | 8" | 228.6 | 266.7 | 220 | 258 |
| 250 | 10" | 282.6 | 320.7 | 270 | 315 |
| 300 | 12" | 339.7 | 377.8 | 320 | 365 |
| 400 | 16" | 422.3 | 466.7 | 426 | 474 |
| 500 | 20" | 530.2 | 581.0 | 530 | 578 |
| 600 | 24" | 631.8 | 682.6 | 630 | 680 |

Spiral seals (EN 12560-2 with centering ring)



| | | ANSI 300 | | | PN 64 | | | ANSI 600 | | |
|-----|-----|----------|-------|-------|-------|-----|-----|----------|-------|--|
| DN | | d1 | d2 | d3 | d1 | d2 | d3 | d1 | d2 | |
| 50 | 2" | 51 | 69.9 | 85.9 | 54 | 66 | 84 | 51 | 69.9 | |
| 80 | 3" | 81 | 101.6 | 120.7 | 86 | 95 | 119 | 81 | 101.6 | |
| 100 | 4" | 106,4 | 127.0 | 149.4 | 108 | 120 | 144 | 106,4 | 120.7 | |
| 150 | 6" | 157,2 | 182.6 | 209.6 | 162 | 174 | 200 | 157,2 | 174.8 | |
| 200 | 8" | 215,9 | 233.4 | 263.7 | 213 | 225 | 257 | 215,9 | 225.6 | |
| 250 | 10" | 268,3 | 287.3 | 317.5 | 267 | 279 | 315 | 268,3 | 274.6 | |
| 300 | 12" | 317,5 | 339.9 | 374.7 | 318 | 330 | 366 | 317,5 | 327.2 | |
| 400 | 16" | 400 | 422.4 | 463.6 | 414 | 426 | 466 | 400 | 412.8 | |
| 500 | 20" | 500 | 525.5 | 577.9 | 518 | 530 | 574 | 500 | 520.7 | |
| 600 | 24" | 603,3 | 628.7 | 685.8 | 618 | 630 | 674 | 603.3 | 628.7 | |

For flanges according to ASME to be observed:

- Gasket type: flat gasket tanged sheet metal/graphite or similar
- Gasket dimensions: according to ASME B16.21
- Seal data: design seat tension
 $Y_{\max} = 45 \text{ MPa}$, sealing factor $m_{\max} = 2.5$

Note

When flange seals which protrude into the pipeline are used for turbine meters, the measuring accuracy can be influenced negatively. Ensure that the flange seals do not protrude beyond the seal surfaces into the pipeline.

Danger

Gas escape due to incorrect seal

If incorrect flange seals are used for the assembly of turbines, an explosive gas mixture can form due to leaks.

Danger of poisoning and explosion!

In addition, the stress on the flange is increased to an impermissible level when tightening the thread bolts.

Ensure secure fastening/attachment of the TME400 during assembly in order to avoid crushing. Ensure that you keep your fingers (or other body parts) away from these openings and gaps when pulling the flanges together.

1.4.2.2. Screws

| | Temperature ranges for screws and nuts | | | |
|----------------------------|--|---|--|---|
| | -10°C to +80°C | -40°C to +80°C | | |
| Pressure levels | | Option 1 | Option 2 | Option 3 |
| up to and including 40 bar | Screws according to DIN EN ISO 4014 in material 5.6 Nuts according to DIN EN ISO 4032 in material 5-2 | Screws according to DIN EN ISO 4014 in material 25CrMo4, Nuts according to DIN EN ISO 4032 in material 25CrMo4 | | |
| 40 bar or higher | Threaded bolts according to ANSI B1.1 material ASTM A 193 degree B7, Nuts according to ANSI B1.1 material ASTM A 194 degree 2H, | Threaded bolts according to ANSI B1.1 material ASTM A 320 degree L7, Nuts according to ANSI B1.1 material ASTM A 320 degree L7 | Threaded bolts according to ANSI B1.1 material 42CrMo4 Nuts according to ANSI B1.1 material 42CrMo4 | Reduced shaft screws according to DIN 2510 material 25CrMo4, Nuts according to DIN 2510 material 25CrMo4 |

For flanges according to ASME to be observed > -10°C:

Screw material SA.193 B7/B7M according to ASTM A193 Grade B7 or comparable materials.

Note

Reduced shaft screws must only be used for devices in the area of application of the Pressure Equipment Directive.

The durability of the flange connection was verified using the screws listed in this chapter in combination with the seals listed in the previous chapter with the following maximum material characteristic data according to AD200 rules and regulations. Other screw/flange variants were not tested.

Malfunctions can occur with incorrect seals.

1.4.2.3. Meter housing material

Cast steel or round steel material, depending on the pressure level and nominal diameter. Aluminum or stainless steel for the screw-type versions.

1.4.2.4. Installation

Note

Installations disturbing the gas flow directly upstream of the turbine meter must be avoided (see DVGW guideline G 492 II and PTGB guideline G 13).

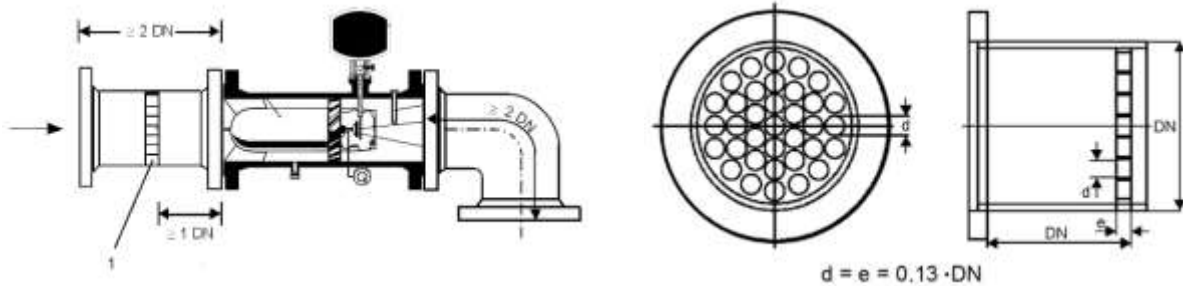
An inlet pipe of at least 2 x DN is required upstream from the turbine meter TME400. The inlet pipe must be designed as a straight pipe section with the same nominal diameter as the meter. With heavy upstream perturbations, installation of straighteners is recommended (refer to the table on the next page). A pipe or bend with the nominal diameter of the meter having a total length of 2 x DN must be arranged downstream from the meter.

Temperature measuring devices must be installed at a distance of at least 1 x DN or at least 300 mm with nominal diameters \geq DN 300.

If there is perturbation (e.g. a gas pressure control device) upstream from the inlet pipe, a perforated plate straightener is also necessary. Perforated plate straighteners according to ISO 5167-1 or the type RMG LP-35, which cause a pressure loss by a factor of 2.5 in comparison with the standard straightener, can be used.

Recommended installation with straightener

Perforated plate straightener LP 35



1 Perforated plate straightener

- The opening angle of the reducing or expansion pieces which are installed upstream from the TME400 turbine meter must not be more than 30°.

Note

If necessary, a screen must be installed before the inlet pipe of the meter for protection of the turbine meter from foreign objects which may be present in the gas flow. The screen can be, for example, a perforated plate/filter of \varnothing 0.15 mm.

⚠ Danger

Protect the turbine meter from damage caused by high pressure fluctuations in the flow, e.g. if the downstream pipeline system is filled or blown off.

⚠ Danger

Welding on the line must only take place at a safe distance from the meter. Extreme temperatures in the line near the meter can cause permanent damage to the meter.

⚠ Danger

Establish all electrical connections between meters and amplifiers or flow computers as specified in the installation manual. Ensure that the connections are intrinsically safe.

⚠ Caution

Liquids remaining in the line after hydrostatic testing can damage internal parts of the meter.

If hydrostatic testing is not possible, the turbine meter must be replaced with a pipe section. Ensure that there is no liquid remaining in the line above the meter after the hydrostatic testing.

1.4.2.5. Threshold values

The following threshold values are recommended for maximum durability and the highest measuring accuracy:

| Note | |
|--|--|
| Maximum overload | < 20% above Q_{max} , short-term (< 30 sec) |
| Maximum flow rate changes and/or impact loads | < $0.01 \cdot Q_{max}/sec \hat{=} 1\%$ of Q_{max}/sec e.g. start-up 0 - 100%: > 100 sec |
| Maximum pressure change: | < 0.1 bar/sec |
| Maximum flow pulsation: | < 5% |
| Particle size in the gas flow: | < 5 μm |
| Lubrication: | Refer to lubrication chapter Intervals depend on the status of the gas (condensate, rust, dust) |
| Vibration / mech. vibration: | < 1 mm/sec (vibration speed) |

31

These measures must be determined and checked during commissioning, before filling, during the start-up and run-in phase of the meter and evaluated, in particularly with simultaneous occurrence of multiple of these threshold values. Intervention in the system for improvement of measuring conditions must be carried out when the aforementioned threshold values are reached.

| Note | |
|---|--|
| <p>The operator should record the overall measurement data (meter and operating data) during the entire operation in order to be able to recognize causes of potential damage at an early stage and to intervene in good time.</p> <p>Remedy and/or relief of critical operating statuses can be achieved, for example, with the following measures:</p> <ul style="list-style-type: none"> • Start-up screen (MW < 0.15 mm) • Filter • Meter protection perforated plates (\varnothing 3 - 4 mm) • Valves with control drive (flow change) • Check valves (pulsation, backflow) | |

1.4.2.6. Technical guideline G13

The installation conditions for new systems according to TRG G13 and the facilitated installation conditions for RMG turbine meters are compared in the table below.

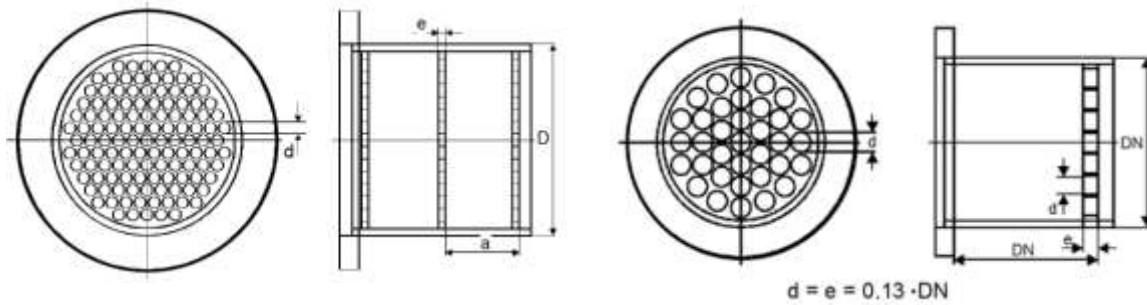
| Type of upstream perturbation | Installation conditions according to TR G13 | Installation conditions for RMG type TME400 meters | Comments |
|--|--|--|---|
| none | Inlet \geq 5 DN Outlet \geq 2 DN | Inlet \geq 2 DN Outlet \geq 2 DN | The outlet pipe can also be designed as a bend. |
| | Inlet \geq 10 DN | | Perturbation upstream from this inlet pipe does not have to be factored in when the requirements for an alternating and pulsing flow are fulfilled. |
| Bend | Inlet \geq 5 DN | Inlet \geq 2 DN | |
| Bends in 2 planes | Inlet \geq 5 DN plus 2 perforated plate straighteners or a bend straightener | Inlet \geq 2 DN | |
| Gas pressure regulating device with an attenuator | Inlet \geq 5 DN | Inlet \geq 2 DN plus 1 perforated plate straightener | |
| Gas pressure regulating device without an attenuator | Inlet \geq 5 DN plus 2 perforated plate straighteners | Inlet \geq 2 DN plus 1 perforated plate straightener | |
| Diffuser | Inlet \geq 5 DN plus 1 perforated plate straighteners | Inlet \geq 2 DN | |
| Diffuser with swirling flow | Inlet \geq 5 DN plus 2 perforated plate straighteners | Inlet \geq 2 DN | |

Perforated plate straightener

The following options are available for the straighteners:

Perforated plate straightener RMG L1 - L3 according to ISO 5167-1 and DIN 1952

Perforate plate straightener RMG LP-35



| Characteristics | ISO/DIN | L1-L3 | RMG LP-35 |
|----------------------------------|-------------------------|---------------------------|---------------------------|
| Hole diameter d | $d \leq 0.05 D$ | 0.04 D | 0.13 D |
| Plate thickness e | $e \geq d$ | $e = d$ | 0.13 D |
| Plate clearance a | $0.5 D \leq a \leq 1 D$ | 0.5 D | - |
| Opening ratio m | $0.2 \leq m \leq 0.4$ | 0.3 | 0.6 |
| Dynamic pressure loss Δp | | 5 - 15 ($c^2 \rho / 2$) | 2 - 15 ($c^2 \rho / 2$) |

With the RMG turbine meters, these straighteners fulfill the requirements of technical guideline G 13 and are approved with approval number D 81 / 7.211.10 for turbine meters.

1.4.2.7. Standards / guidelines

All RMG turbine meters have passed upstream perturbation measurements according to OIML recommendation IR-32/89, Annex A, with slight and heavy upstream perturbation. Therefore, this meter design fulfills the installation conditions according to technical guideline G 13, section 1. The PTB testing vol. 29 and 30, Testing of volume gas meters with air at atmospheric pressure and high-pressure testing rules apply as a testing requirement. The RMG turbine meter TME400 conforms to EN12261. The measuring accuracy in the range of 0.2 Q_{max} to Q_{max} is between $\pm 1.0 \%$ to 1.5% (see *chapter 1.4.2.9 Measuring accuracy*). The TME400 has an electronic suppression by external shut down of the totalizer of the slow down cutoff of the turbine wheel after the flow is stopped.

1.4.2.8. Measuring ranges

Type TME400 turbine meters have measuring ranges of at least 1:20 at atmospheric pressure (see *chapter 1.4.2.9 Measuring accuracy*). At a higher pressure, the measuring range can be expanded to 1:50. The measuring ranges are between 2.5 and 25,000 m³/h (operating conditions), depending on meter size.

The turbine meters with nominal diameter of DN25 and DN40 can be used up to a maximum of 16 bar. However, there may be restrictions for threaded connections that are subsequently used.

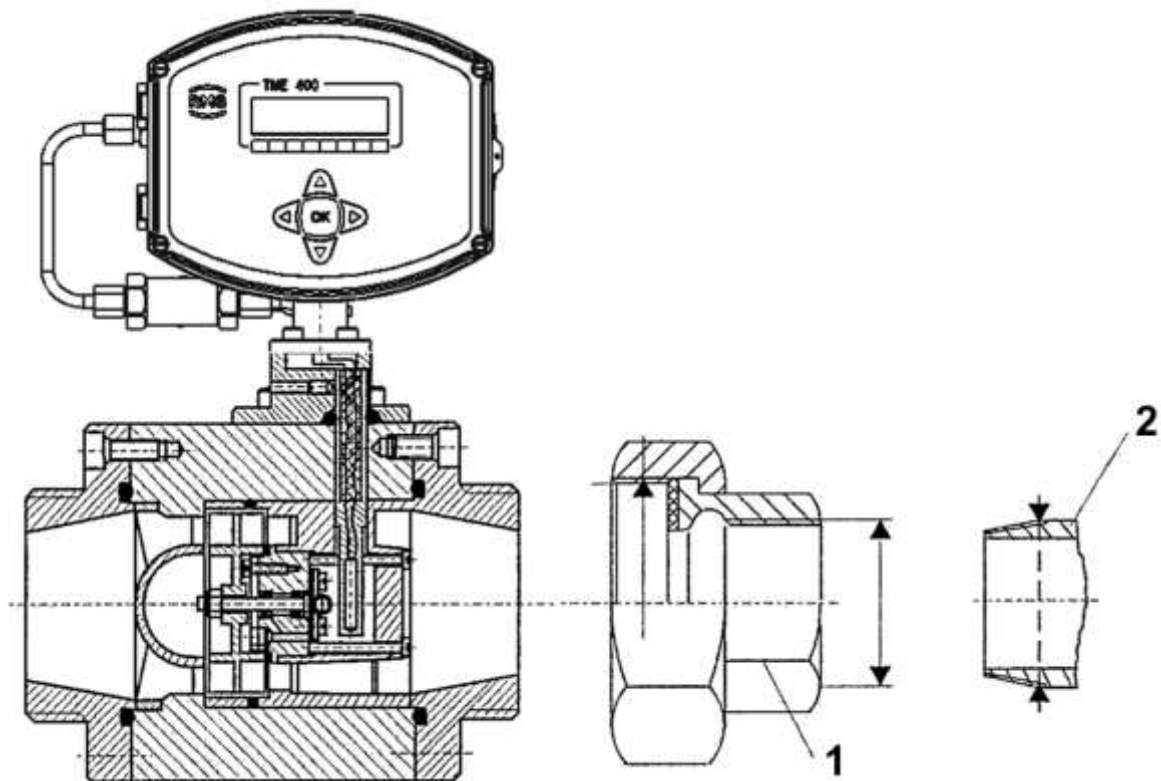


Figure 2: Threaded connection for DN25 and DN40

- 1 – Pipe fitting DIN2950
 - DN25 thread G 1 ½ ISO 228-1
 - DN40 thread G 2 ¼ ISO 228-1
 - DN25 / thread Rp 1 ISO 7-1
 - DN40 / thread Pp 1 ½ ISO 7-1

- 2 – Gas pipe
 - DN25 / thread R1 ISO 7-1
 - DN40 / thread R1 ½ ISO 7-1

According to DIN30690-1, the maximum operating pressure for non-flammable gases may not exceed 16 bar; for flammable gases, EN746-2 defines a maximum pressure of 5 bar for DN25 and 2 bar for DN40. Usually these pressure restrictions are specified on a plate on the pipe fittings.

1.4.2.9. Measuring accuracy

The following error limits apply within the permissible measuring range:

| DN | Qmin [m ³ /h] | Qmax [m ³ /h] | MR | Measurement deviation in the range of | |
|-----|-----------------------------|-----------------------------|------|---------------------------------------|------------------------|
| | | | | Qmin-0.2 x Qmax [%] | 0.2 x Qmax-Qmax [%] |
| 25 | 2.5 | 25 | 1:10 | 3 | 2 |
| 40 | 6 | 70 | 1:12 | 3 | 1.5 |
| 80 | 13 | 160 | 1:12 | 3 | 1.0 |
| 50 | 6 | 100 | 1:16 | 3 | 1.5 |
| 80 | 16 | 250 | 1:16 | 3 | 1.0 |
| | 25 | 400 | 1:16 | 3 | 1.0 |
| 100 | 25 | 400 | 1:16 | 2 | 1.0 |
| | 40 | 650 | 1:16 | 2 | 1.0 |
| 80 | 13 | 250 | 1:20 | 3 | 1.5 |
| | 20 | 400 | 1:20 | 3 | 1.5 |
| 100 | 20 | 400 | 1:20 | 3 | 1.5 |
| | 32 | 650 | 1:20 | 3 | 1.5 |

Note

With a slightly smaller measuring range of 1:16, turbine meters are also available in nominal diameters 80 and 100, which have an increased accuracy with a deviation of max. $\pm 1\%$ in the range of $0.2 \times Q_{\max} - Q_{\max}$.

| | | | | | |
|-----|-----|------|------|---|---|
| 150 | 32 | 650 | 1:20 | 2 | 1 |
| | 50 | 1000 | 1:20 | 2 | 1 |
| | 80 | 1600 | 1:20 | 2 | 1 |
| 200 | 80 | 1600 | 1:20 | 2 | 1 |
| | 125 | 2500 | 1:20 | 2 | 1 |
| 250 | 125 | 2500 | 1:20 | 2 | 1 |

| | | | | | |
|-----|------|-------|------|---|---|
| | 200 | 4000 | 1:20 | 2 | 1 |
| 300 | 200 | 4000 | 1:20 | 2 | 1 |
| | 325 | 6500 | 1:20 | 2 | 1 |
| 400 | 325 | 6500 | 1:20 | 2 | 1 |
| | 500 | 10000 | 1:20 | 2 | 1 |
| 500 | 500 | 10000 | 1:20 | 2 | 1 |
| | 800 | 16000 | 1:20 | 2 | 1 |
| 600 | 800 | 16000 | 1:20 | 2 | 1 |
| | 1250 | 25000 | 1:20 | 2 | 1 |

1.4.2.10. Pressure loss

The measuring points for determining pressure loss are 1 x DN upstream and downstream of the meter. The pressure loss is calculated according to the following formula:

$$\Delta p = Z_p \cdot \rho \cdot \frac{Q_m^2}{DN^4}$$

| | | | |
|--------|------------|---------------------------------------|----------------------|
| where: | Δp | pressure loss | [mbar] |
| | Z_p | coefficient of pressure loss | [-] |
| | ρ | operating density | [kg/m ³] |
| | Q_m | volume flow at measurement conditions | [m ³ /h] |
| | DN | nominal meter diameter | [mm] |

| Device type | Z_p |
|---|-------|
| Turbine meter TME400 | 5040 |
| Perforated plate straightener L1 according to ISO/DIN | 3150 |
| Perforated plate straightener L2 according to ISO/DIN | 6300 |
| Perforated plate straightener L3 according to ISO/DIN | 9450 |
| Perforated plate straightener LP-35 RMG standard | 1260 |
| Bend straightener RB 19 according to ISO/DIN | 1260 |

The values for Z_p are rough averages. The exact value is calculated from the pressure loss, which is determined when testing the meter.

Example calculation for the pressure loss of a turbine meter:

TME400 in DN 150:

$Q_m = 650 \text{ m}^3/\text{h}$
 $\rho = 1.3 \text{ kg}/\text{m}^3$ (natural gas at 600 mbar overpressure)
 $Z_p(\text{TME400}) = 5040$ (see the table above)

Calculation:

$$\begin{aligned} \Rightarrow \Delta p &= 5040 \cdot 1,3 \cdot \frac{650^2}{150^4} \text{ mbar} \\ &= \underline{\underline{5.5 \text{ mbar}}} \end{aligned}$$

1.4.2.11. Putting the device into operation

Note

You receive the TME400 parameterized and calibrated according to your specifications, so that no additionally settings are generally required.

However, check whether these settings match your specifications; check the settings of the pulse width, the frequency reducer and the settings of the current output (for versions with current output).

Set up all totalizers to the meter status which you desire. (see *chapter 4.2 Programming*).

Note

Parameters can be changed exclusively with the device open.

1.4.2.12. Maintenance / lubrication

The TME 400 turbine gas meter is maintenance-free (apart from the lubrication for meters with an oil pump).

Meters in custody transfer operation must be calibrated at the prescribed intervals (according to national law). For meters in secondary operation, we recommend from a metrological point of view a check at the manufacturer every 5 to 8 years.

The TME400 is equipped with permanently lubricated bearings up to a nominal diameter of DN150 as standard. Nominal diameter of DN200 or higher are provided with an integrated lubricating device. Optionally, the TME400 can also be equipped with the "small oil pump" lubricating devices for DN25 to DN150 versions.

The type of lubricating device and the lubricant requirement depend on the nominal diameter and the pressure level:

| Nominal diameter | Pressure classes | Lubricating device | Lubricant requirement |
|------------------|-------------------------------------|---|-----------------------------|
| DN25-DN150 | All pressure classes | As necessary (see below) optional small oil pump (push-button operated) | Every 3 months 6 strokes |
| DN200 | All pressure classes | Small oil pump (push-button operated) | Every 3 months 6 strokes |
| DN250 | PN10 to PN16 ANSI 150 | | |
| DN250 | PN25 to PN100 ANSI300 to ANSI600 | Large oil pump (lever operated) | Every 3 months 2 strokes |
| > DN300 | All pressure classes | | |

Also observe the notice plate on the housing.

In unfavorable conditions, e.g. with an accumulation of water and hydrocarbon condensate, as well as dust-laden gases, more frequent lubrication is recommended, even daily in extreme cases (e.g. with continuous condensate formation).

Note

Recommended lubricating oil:

Shell Tellus S2 MA 10 or another oil with 2 to 4°E at 25°C.

2. Installation

2.1. Electrical connections

Open the cover of the meter in order to reach the electrical connections.



Figure 3: Unscrewing the screws to open the cover

Remove – if necessary – the printed circuit board for sealing of the calibration button.

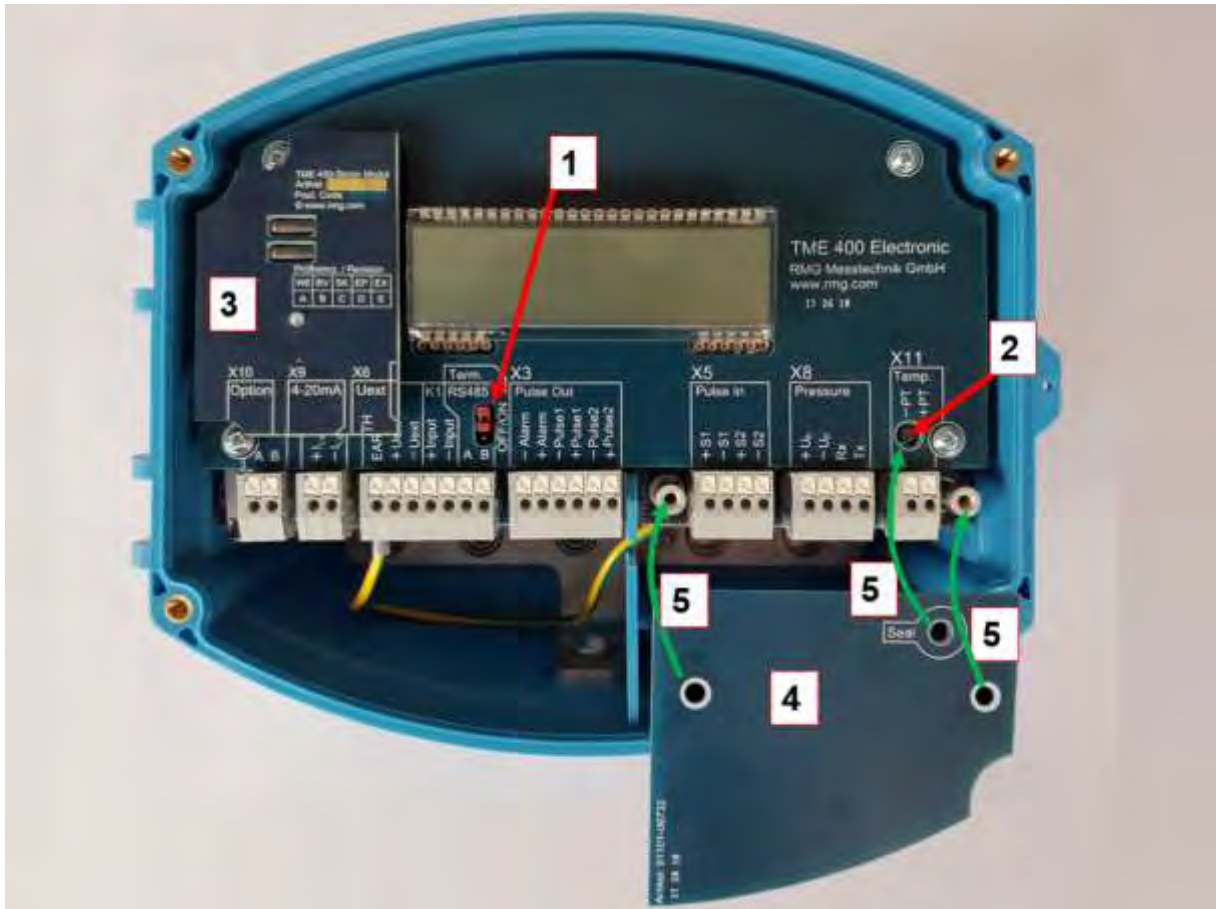


Figure 4: Unscrew the screws to remove the cover

- 1 Jumper for RS 485 terminating resistor. Bridged: with 120 Ω ; open: $\infty \Omega$
- 2 Calibration switch
- 3 Current module board
- 4 Cover plate for pressure and temperature sensor and calibration switch
- 5 Normal position, indicated by green arrows

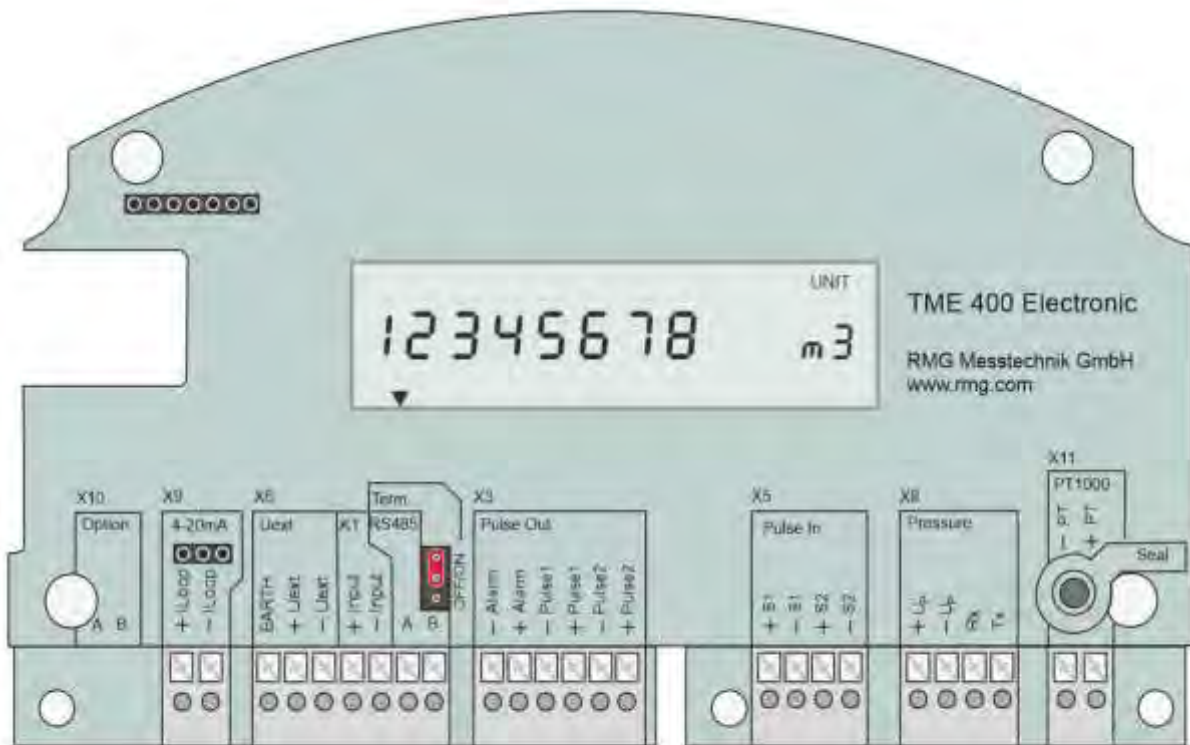


Figure 5: Connection assignment of the TME400

Refer to *Figure 5: Connection assignment of the TME400* for the assignment. The connection of internal sensors is carried out in accordance with the current standards, this applies in particular to the earthing of the pressure sensor.

If, for example, the TME400 is to be used as a "flow sensor", the current must be connected to 4..20 mA (**terminal block X9**). The 4..20 mA current is then connected to the two terminals. For this function, the optional current module must be plugged in at the top left (see *Figure 4 Unscrew the screws to remove the cover*).

The "sensor" TME400 is passive, it is fed and limits the current to the corresponding value. With this use, the current serves as an additional current supply (see *chapter 1.3.3 Power supply*). Here, care must be taken to ensure that this power supply is galvanically isolated.

If digital communication with the TME400 is required, it can be connected to the RS485. The differential signals are obtained via data lines A and B under RS485 (**terminal block X6**). Please pay attention to crossed signal lines and change the connections if appropriate. If necessary, the data interface can be conditioned using a jumper. Normally, the resistance is infinitely large ($\infty \Omega$); for a point-to-point

connection or if the terminal device is part of a bus system, the resistance must be set to 120 Ω.

Via "+ Uext" (external voltage supply, positive potential) and "- Uext" (external voltage supply, negative potential) the TME400 can be fed with 6-30 VDC in addition to the internal battery (in non-Ex areas). "Earth" is used for internal voltage balance. The power supply can be independent or in combination with the RS485 interface. Anyhow, this supply voltage is required for communication via the RS485 interface.

Terminal block X6 also contains a digital input K1, which can be used to start, stop and reset the totalizer; "+Input" is the contact input for positive potential, "-Input" the contact input for negative potential.

Caution

In the Ex version, refer to the EC type approval certificate for the maximum values for the current output and the RS-485!

Via "Pulse In" (**terminal block X5**), pulses proportional to the flow rate at measurement conditions can be read from an encoder with 1 or 2 frequency outputs (main encoder and second redundant encoder if required).

Encoder (sensor) 1 is connected to the terminals via "+S1" (positive potential) and "-S1" (negative potential), encoder (sensor) 2 is connected to "+S2" and "-S2". This is especially necessary for the TME400-VMF version operated at custody-transfer applications. The sensor types can be selected in coordinates Z26/27 (see chapter 4.3.3.7 Settings). Pulse input 2 is only active if a 2-channel counting mode is selected (coordinate Z25).

Via "Pulse Out2" (**terminal block X3**) pulses and redundant pulses can be output. An alarm output can also be connected here. These six terminals combine the three digital outputs:

-Alarm: Alarm output negative potential

+Alarm: Alarm output positive potential

The alarm output works according to the closed-circuit current principle. The switching contact is closed in undisturbed condition.

-Pulse 1: HF output negative potential

+Pulse 1: HF output positive potential

At this output, the arriving pulses at pulse input 1 are synchronously with a pulse width of 1 ms.

-Pulse 2: LF output negative potential

+Pulse 2: LF output positive potential

Output pulses are output at these terminals depending on the change in the volume flow rate. The pulse output factor can be used to weight the number of output pulses in relation to the increase in volume.

For the device types TME400-VC and TME400-VCF, the dependence of the pulse output on the standard volume can also be selected (see coordinates A11 and A21). In coordinate A23 the possible pulse width can be 20ms, 125ms or 250ms.

A pressure sensor can be connected to the four connections of **terminal block X8**: "+Up" positive and "-Up" negative voltage supply for pressure sensor; "RX" or "TX" are the serial data received from the pressure sensor or sent to the pressure sensor.

The temperature sensor, a Pt1000, is connected to the terminals of **terminal block X11** in two-wire connection. Pressure and temperature sensors are generally only in use with the TME400-VC and TME400-VCF versions.

The terminals of the **terminal block X10** are connections for an optional module which is not yet supported by the firmware.

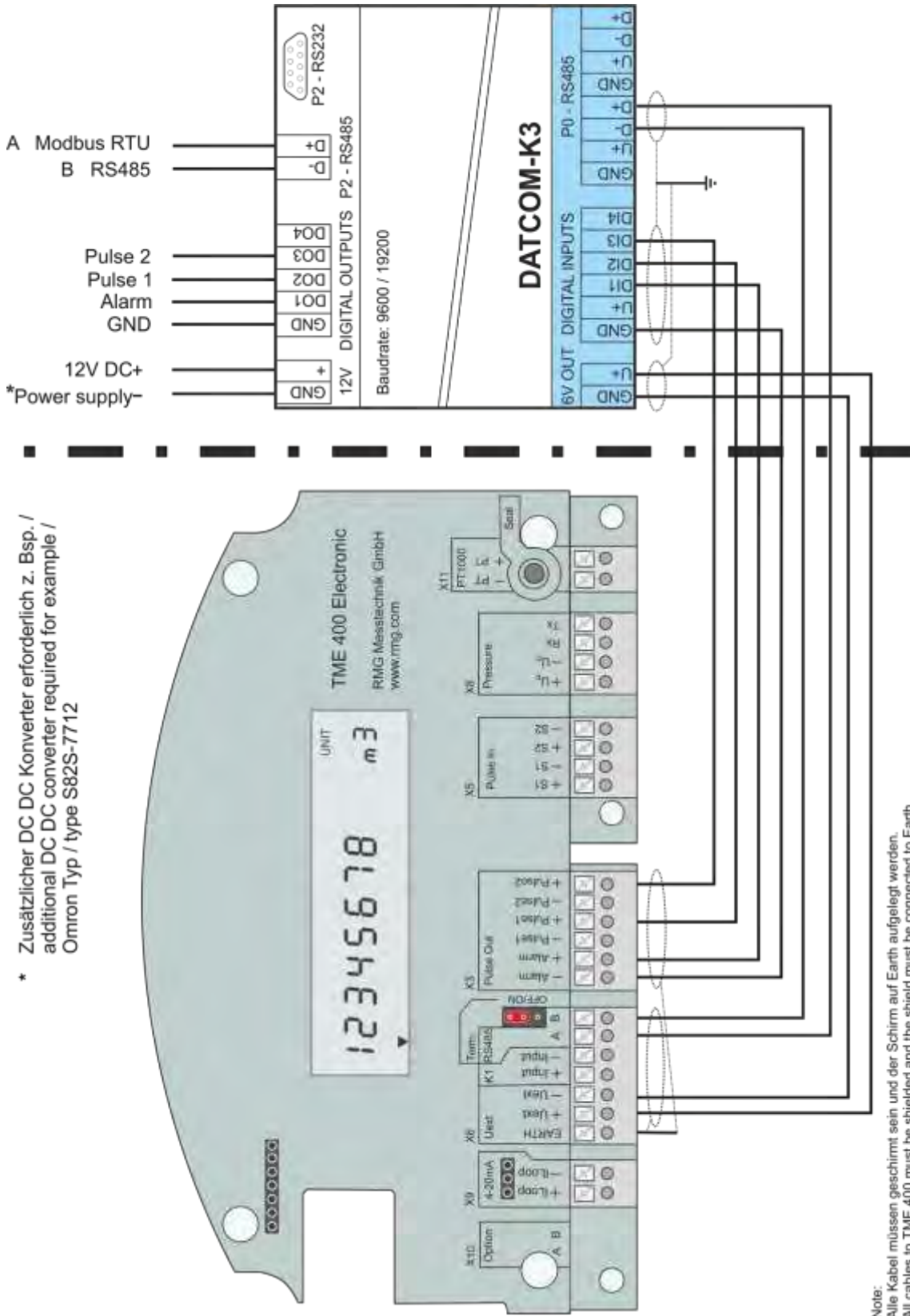
Use the wire end ferrules for the connecting cable and route them in from below; a seal holds the cable. To be able to pull a cable out again, press the small white square (marked with the X) down using a small screwdriver (at the bottom in *Figure 4: Unscrew the screws to remove the cover* and *Figure 5: Connection assignment of the TME400*; top of the plug strip) in order to open the locking device. Hold down the square and pull the cable out of the connector strip.

Some connection examples are given on the following pages. Anyhow, please check for further connections the data and limitations of the connected devices in the documentations of these devices.

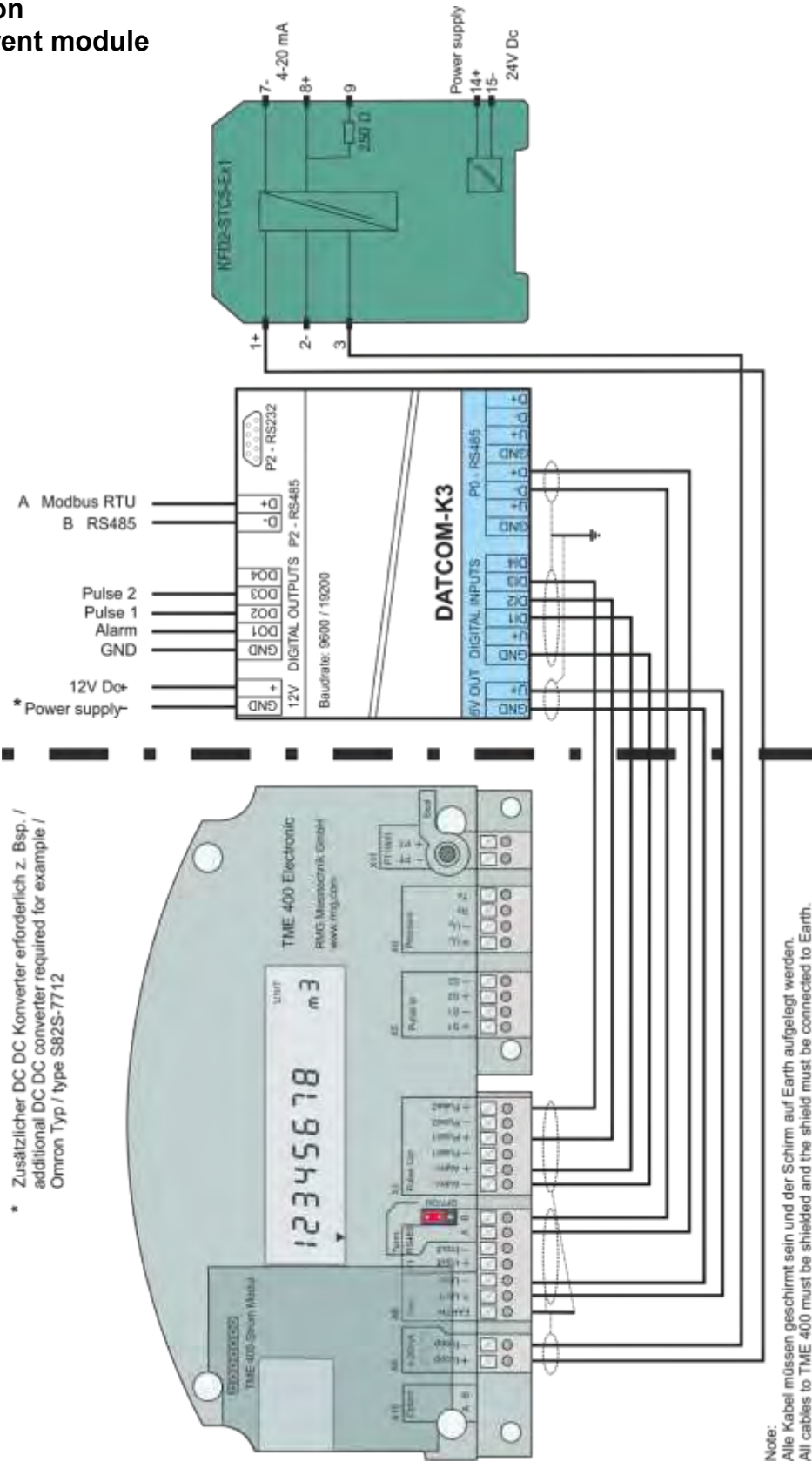
⚠ Caution

The TME400 and connected devices do not have any plugs that have a to prevent polarity reversal. Pay careful attention to the correct connections!

Ex version

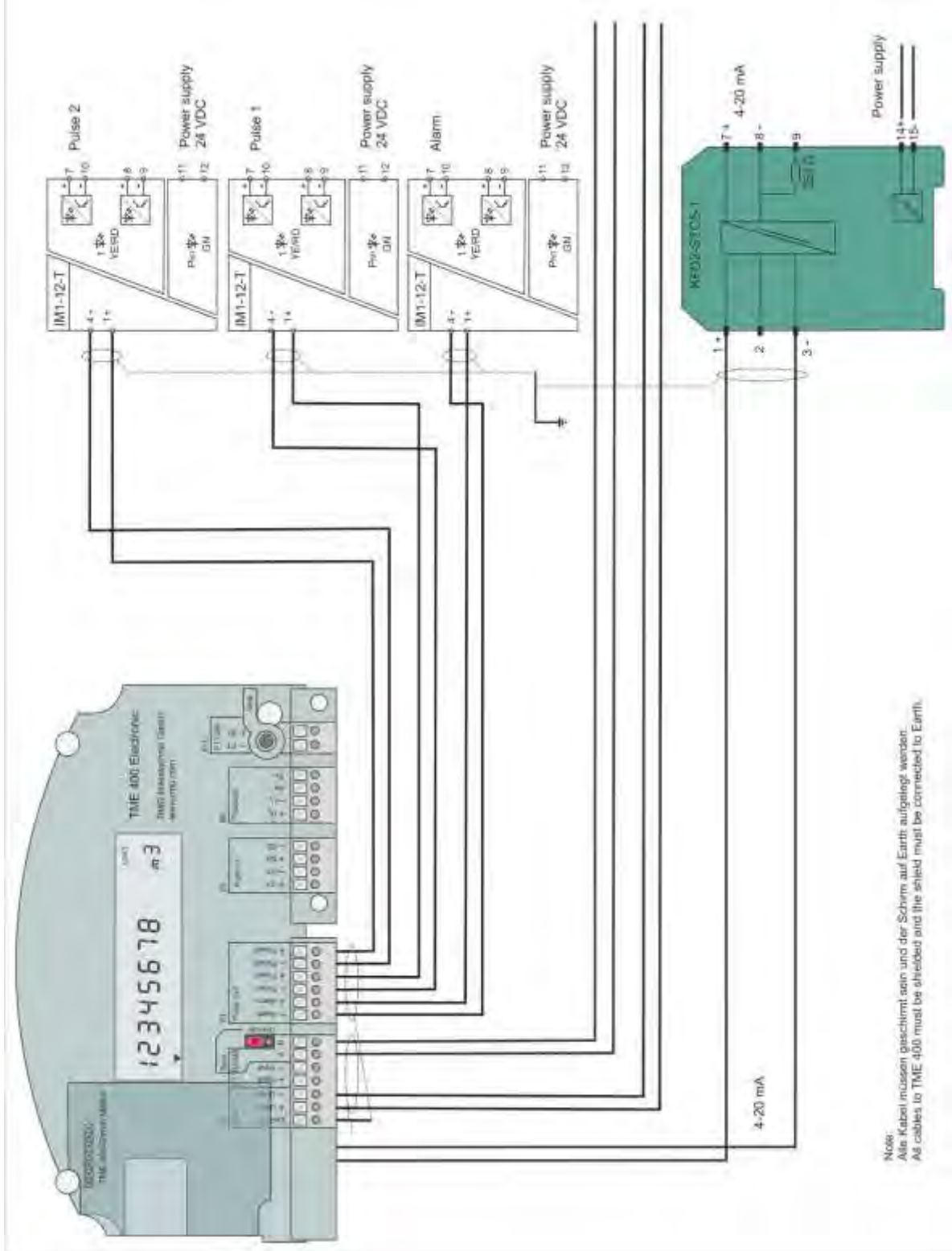


Ex version
with current module



* Zusätzlicher DC DC Konverter erforderlich z. Bsp. /
additional DC DC converter required for example /
Omron Typ / type S82S-7712

Non-Ex version



3. TME400

3.1. Display field

A single-line alphanumeric display with 12 characters enables representation of the data and measurements together with the short description or the unit.

Total flow volume

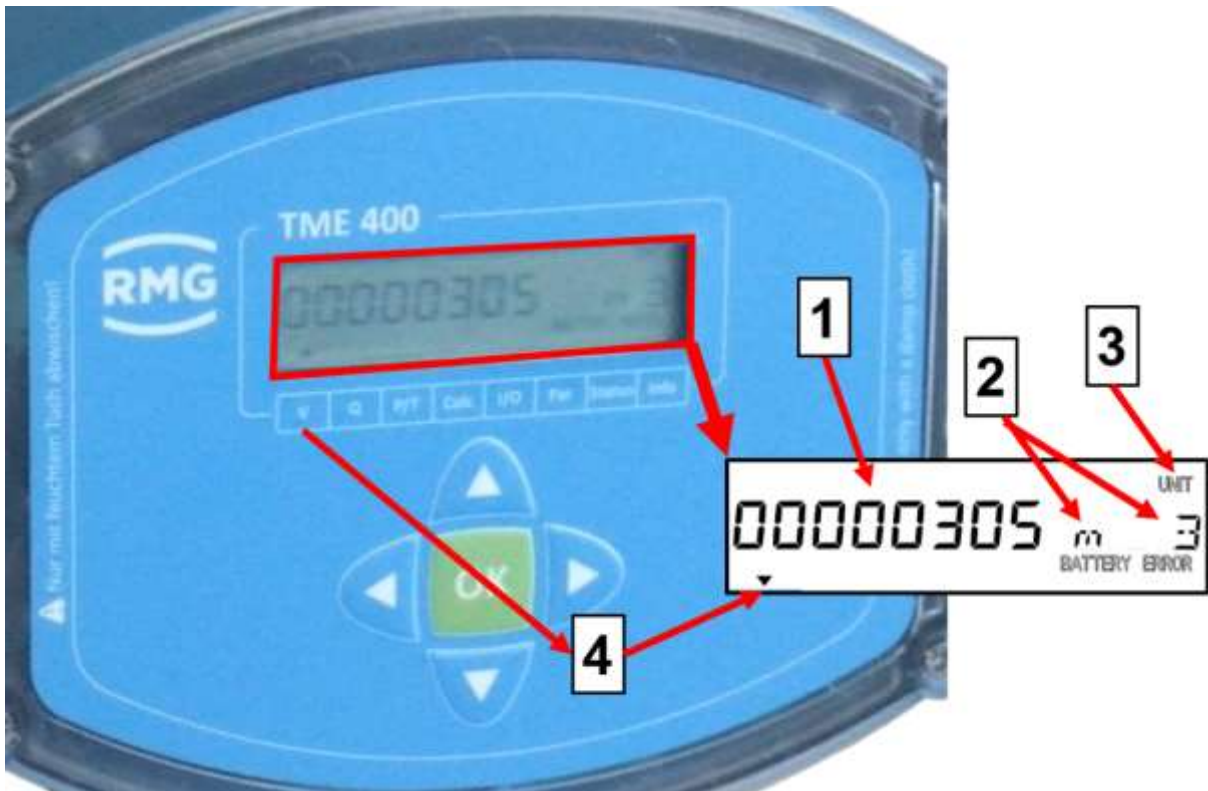


Figure 6: Display field

- | | | | |
|---|----------------------------|---|--------------------------|
| 1 | 8 characters for the value | 3 | Text: UNIT |
| 2 | Unit [m³] | 4 | Display arrow for volume |

The LCD display and its operation are designed to save energy in order to enable battery-powered operation. The display can be impaired at temperatures below -25°C or above +60°C.

3.1.1. Display test

The display test is provided to ensure that all fields of the display function properly. For this purpose, please press and hold the up arrow and down arrow buttons (▲ and ▼) for more than 2 seconds. The following display appears while these buttons are held.

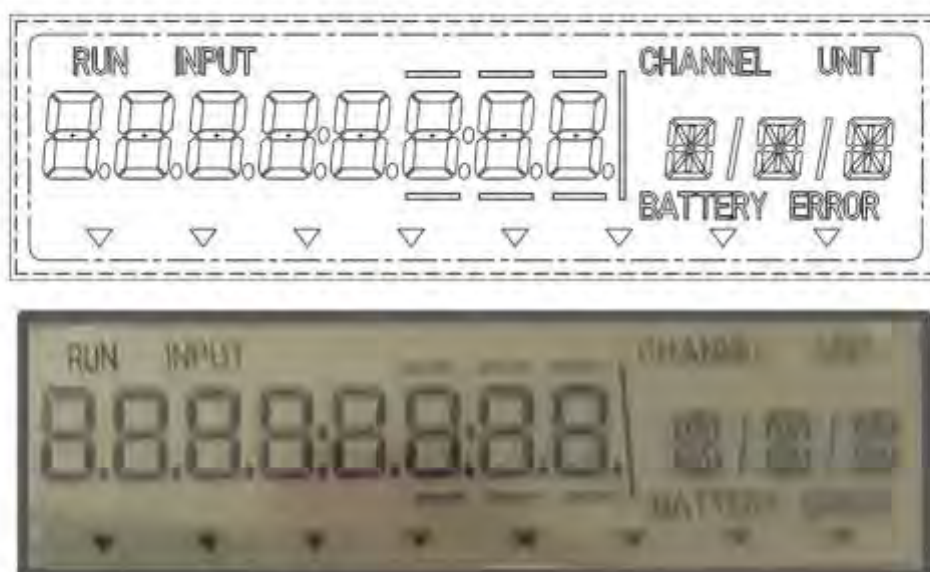


Figure 7: Display at display test

3.1.2. Reset

To reset the system, the voltage supply is interrupted and the TME400 is switched off for this period. For this purpose, the battery and any existing external voltage supply are disconnected. The program and operating parameters are not lost in the process and the meter statuses are saved.

3.1.3. Booting up

It may be necessary to re-boot the device in case of severe faults.

⚠ Caution

It is necessary to remove the seals, particularly the seal over the calibration button in order to boot up (see *Figure 8: Position of the calibration button*).

The TME400 must only be used for custody transfer with unbroken seal. Removal or damage to seals normally entails considerable expenses!

Re-application of seals must only be carried out by an officially recognized inspection authority or calibration officials!

49



Figure 8: Position of the calibration button

Note

**The current parameter settings and meter statuses are lost when re-booting!
They are reset to standard values.
Therefore, prior to booting up, read all parameters of the TME400.**

50

Proceed as follows to re-boot:

- Switch off the devices
- Press the "left ◀" and "right ▶" buttons simultaneously
- Switch on the voltage again
- Then, the text "del All" appears in the display.
- Release the depressed buttons.
- Press the calibration button with a thin pencil or small screwdriver.
- Now the device is booted up and the display shows "Boot".
- Then, "done" appears in the display and the totalizer status of the main totalizer is displayed.

Then, re-transmit all device parameters to the TME400 or enter the values from the test certificated.

Note

**The serial interface is set to 38400 Bps, 8N1, Modbus RTU after booting.
These are also the default values of RMGView^{TME}
(see *chapter 4.5 RMGViewTME*).**

3.1.4. Battery replacement

Note

The coordinate G24 (see *chapter 4.3.3.7 Error / type plate*) indicates the remaining battery capacity. If the remaining capacity falls below 10 %, a warning is generated.

In order to replace the battery, unscrew the large screw on the right side of the electronics with a large screwdriver or a coin.



Figure 9: Position of the battery housing

The meter is rotated in the next figure, showing the rear area in this figure below. Now, you can pull out the battery holder with battery on a handle.

The battery can be removed vertically in relation to the battery holder by pulling slightly. When installing the new battery, ensure that the polarity is retained for the new battery.

⚠ Danger

The battery must only be replaced in a non-explosive atmosphere. Ensure that the electronics are supplied with adequate ventilation with fresh air.

52

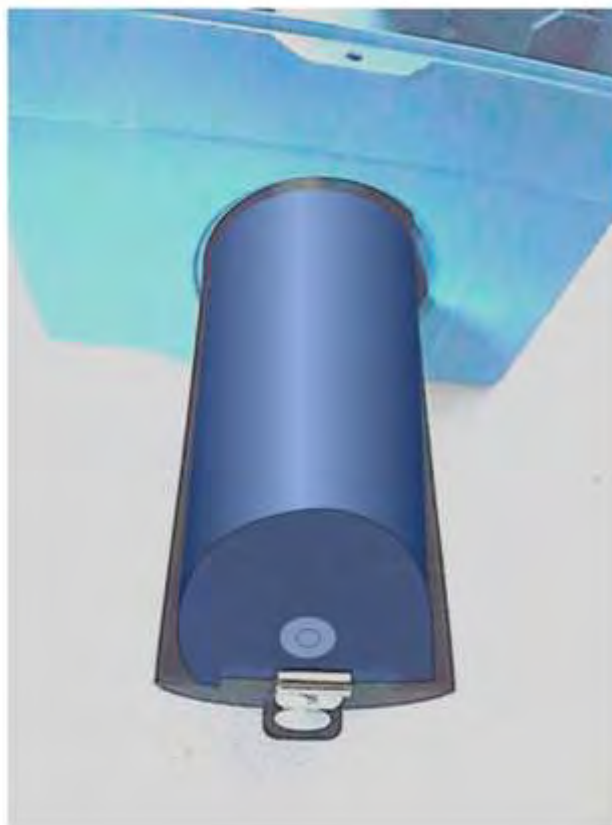


Figure 10: Battery holder

Note

The battery can be changed during operation.

- All readings of the counter(s) and all counting parameters are retained.
- After changing the battery, the current time and date must be entered again (coordinates X01 and X02; see *chapter 4.3.3.9 Archive*). In addition, the battery change must be indicated in coordinate G25. This updates the battery change date and sets the operating hours G26 to 0 and the battery capacity G24 to 100 %.
- The current flow rate value is not stored during the change because there is no additional battery buffering.

⚠ Danger

According to the type examination certificate, only the following battery types may be used in potentially explosive areas:

- Saft, type LS33600, 17 Ah or
- XENO, type XL 205-F, 19 Ah

53

Note

You can also have the battery replaced by the RMG Service department; please contact RMG for this purpose (see page 2).

Please only use the battery types intended by RMG. They are available as spare parts.

4. Operation

4.1. Operation concept

54



Figure 11: Front panel

The concept of the operation is simple and easy to implement with knowledge of the coordinates.

4.1.1. Coordinate system

All configuration data, measurements and computed values are sorted in a table in a coordinate system which enables easy access. The coordinate system is divided into several columns, as shown on, in part, on the front panel (see *top* and *bottom*).








Figure 12: 8 columns of the coordinate system

With the cursor buttons (arrows)



you can reach each value by gently pressing the desired button in this coordinate system.

| Keypad | Description | Effect |
|---|-------------|---|
|  | Left arrow | Switches the column of the table from right to left |
|  | Up arrow | Upward movement within the column of the table: You move from the last value of the list towards the first value. This is also used to adjust numbers (counting up). |
|  | Down arrow | Downward movement within the column of the table: You move from the first value of the list towards the last value. This is used to adjust numbers (counting down). |
|  | Right arrow | Switches the column of the table from left to right |
|  | Function | The following functions are triggered by pressing: pressed < 2 seconds = display of the coordinate pressed > 2 seconds = switch to settings mode (see below) |

4.1.2. Display and coordinate system

The main totalizer is displayed in normal operating mode. The other display values can be selected with the operating buttons. After approx. 1 minute, the TME400 switches back to the main totalizer.

56

If the display is dark, the TME400 is in energy-saving mode, where the display is completely switched off. The incoming pulses are processed and the outputs are actuated.

The display value is shown again by pressing any operating button.

Any arbitrary position in the coordinate system, which is identified by letters and numbers, can be reached with the arrow keys.

| | A | B | C | D | E | F | G | H | X | Y | Z |
|-----|---|---|---|---|-----|---|---|---|---|---|---|
| 01 | | | | | | | | | | | |
| 02 | | | | | E02 | | | | | | |
| 03 | | | | | | | | | | | |
| 04 | | | | | | | | | | | |
| 05 | | | | | | | | | | | |
| 06 | | | | | | | | | | | |
| 07 | | | | | | | | | | | |
| ... | | | | | | | | | | | |

Example

Example:

E02, for example, stands for the compression factor. This value is calculated after entry of relevant gas parameters via different gas models, which are listed below.

4.1.3. Parameter protection

Note

All custody-transfer parameters are protected by the (sealed) calibration button.

There are different access authorizations for the parameters with which unauthorized changes are suppressed. The different access rights are assigned to the coordinates

by a letter. They are shown in the coordinate list. The following access levels are used:

| Access level | Access right |
|--------------|---|
| A | Display values, change not possible |
| N | Parameter for which no password is necessary for use |
| C | Code word Entry of a code word is necessary to change the parameter |
| E | Calibration button Custody-transfer variant TME400-VCF: Custody-transfer display values / parameters, use of the calibration button is necessary Non-custody-transfer variant TME400-VC: Entry of the code word is adequate <div style="border: 2px solid black; padding: 5px;"> <p>Note</p> <p>Enabling or disabling the code word or opening the calibration button creates an entry in the event archive (see below).</p> </div> |

57

4.2. Programming

There are five buttons available on the front foil for programming of the TME400. Alternatively, you can carry out programming via the RMGView^{TME} operating software (see *chapter 4.5 RMGViewTME*).

58

4.2.1. Programming with the programming buttons

Basically, you proceed as follows for the programming:

- First check the protection status of the coordinate. When parameters are not protected, you can carry out changes, as described below without additional measures.
- With parameters protected by code word, you must enter it first in coordinate Z15. Please read how to make the entry as below.
- With parameters protected for custody-transfer applications, you must press the calibration button first.






Caution










It is necessary to remove the seals, particularly the seal over the calibration button in order to press the calibration button (see *Figure 8: Position of the calibration button*).

The TME400 must only be used for custody transfer with unbroken seal. Removal or damage to seals normally entails considerable expenses!

Re-application of seals must only be carried out by an officially recognized inspection authority or calibration officials!

The principle of the programming is shown based on the example of changing the output pulse factor:

- I. Move with the arrows (   ) to the position: A11
- II. Activate the calibration button (see *Figure 8: Position of the calibration button*)
- III. The blinking "INPUT" text appears above the displayed value in the display view.
- IV. Press  for more than 2 seconds
- V. The value begins to blink at a position

- VI. With the  and  arrows, you can now increase or decrease the value at this position. For the values, after the "0", you also have "-1" available in order to enter negative values, if necessary.
- VII. With the  and  arrows, you can move to a different position of the value and change it – as described in the point above.
- VIII. An additional position is added when you move with the  and  before the displayed number.
For example, only the units digit is displayed. If you move in front of it, you will also have the tens position available as an entry.
- IX. By pressing and holding the "right" button , the position of the decimal point is changed. After pressing and holding, the decimal point is inserted after the blinking digit.
- X. By pressing and holding the "left" button , the entry can be canceled. If a change and/or entry is necessary, the entry must be restarted.
- XI. When you have finished making an entry, you confirm it by briefly pressing .
- XII. A plausibility check takes place and the result is displayed immediately.
- XIII. If this check shows an implausible entry, "rAnGE" will be shown briefly in the display and the display jumps back to the original value.
- XIV. If this check shows an plausible entry, "Good" will be shown briefly in the display and the value is adopted as a new value.
- XV. Now you can – if necessary – change other parameters.
- XVI. After about 1 minute without additional entries, the display returns to the display of the main totalizer.
- XVII. By pressing the calibration, you close the further entry of custody-transfer parameters.
- XVIII. After another minute without an entry, the change possibility is closed automatically.

Note

Some of the coordinates permit other settings as purely numerical values. However, these other entries are assigned numbers so that the adjustment can be carried out as described.




Example:

Current mode F02 can be deactivated or activated on various settings. This is adjusted as follows:

| | |
|---|---------------|
| 0 | Off (default) |
| 1 | No errors |
| 2 | Error 3.5 mA |
| 3 | Error 21.8 mA |
| 4 | 0 - 20mA |

If F02 = "0" is selected for the coordinate, the current output is switched off.

Note

With some coordinates, a number is assigned fixed values. Instead of an adjustment with 0, 1, ..., these numerical values are shown directly. Changes are possible with the arrows  and , then the next higher or lower value is shown and can be adopted with .

Example:

Digital output 2 pulse width (coordinate A22) can adjust the pulse width to 3 different widths. The following values can be directly as an assignment:

| |
|--------|
| 20 ms |
| 125 ms |
| 250 ms |

4.3. Equations in the TME400

The TME400 enables calculation of different values from the measured data and in the data entered in the TME400. For a better understanding, some variables and formula in this chapter are presented in advance; other equations and definitions of parameters are found in the *chapter 4.3.3. Coordinates in context*.

4.3.1. Variable description

| Formula symbol | Units | Name |
|----------------|-----------------------------------|--|
| q_m | m ³ /h | Operating volume flow at measurement conditions |
| f_v | Hz | Frequency of the volume transmitter |
| K_V | l/m ³ | Meter factor |
| V_m | m ³ | Operating volume at measurement conditions |
| P_V | Nondimensional (1) | Volume pulse |
| K_{Z1} | m ³ /l | Meter factor (only for output contacts) |
| q_n | m ³ /h | Standard volume flow at normalized condition |
| V_n | m ³ | Standard volume at normalized condition |
| $Z_u(p, T)$ | Nondimensional (1) | Conversion factor |
| K_{Z2} | m ³ /l | Meter factor (only for output contacts) |
| p | bara, (barg, kg/cm ²) | Measured pressure (absolute) |
| p_n | bara, (barg, kg/cm ²) | Pressure in standard state (=1.01325 bar absolute) |
| T | °C | Measuring temperature |
| T_K | K | Measuring temperature in Kelvin |
| T_n | K | Temperature in standard state (= 273.15 K) |
| K | Nondimensional (1) | Compression factor |
| Z | Nondimensional (1) | Real gas factor |
| Z_n | Nondimensional (1) | Real gas factor in standard state (calculation for Z and Z_n takes place according to GERG-88 in accordance with G9) |

4.3.2. Standard formula

| Formula name | Formula | Reference chapter |
|-----------------------|---|-------------------------|
| Operating volume flow | $q_m = \frac{f_V}{K_V} * 3600 [\frac{m^3}{h}]$ | 4.3.3.2 Flow rate |
| Operating volume | $V_m = \frac{P_V}{K_V} \frac{1}{K_{Z1}}$ | 4.3.3.1 Volume / Meters |
| Compression factor | $K = \frac{Z}{Z_n}$ | 4.3.3.5 Analysis |
| Conversion factor | $Zu(p,T) = \frac{p \cdot T_n}{p_n \cdot T_K \cdot K}$ | 4.3.3.5 Analysis |
| Standard volume flow | $q_n = \frac{f_V}{K_V} \cdot 3600 \cdot Zu(p,T)$ | 4.3.3.2 Flow rate |
| Standard volume | $V_n = V_b \cdot Zu(p,T) \cdot \frac{1}{K_{Z2}}$ | 4.3.3.1 Volume / Meters |

Measuring and standard pressure are calculated as absolute pressure in the specified equations.

4.3.3. Coordinates in context

In the following, the coordinates which can be addressed with the TME400-VC and TME400-VCF turbine meters are shown. In the tables, the parameters which can be addressed with the TME400-VC are shown in light blue and the values which are additionally available with the version for custody-transfer applications, TME400-VCF, are shown in orange.

| | |
|------------|-----------------------------------|
| TME400-VC | Non-custody-transfer applications |
| TME400-VCF | Custody-transfer applications |

4.3.3.1. Volume / Meters

| Coordinate | Name | Description |
|------------|------------------------------|---|
| A01 | Standard volume | Volumes added up, corrected according to the equation above, plus the status and compression factor (see above). |
| A02 | Operating volume | Volumes added up at the current (temperature and pressure) conditions. |
| A03 | Standard volume error | Volumes added up under standard conditions; in these conditions a parameter was faulty or could not be determined (e.g. temporary failure of the temperature sensor, etc.) |
| A04 | Operating volume error | Volumes added up under the present conditions; in these conditions a parameter was faulty or could not be determined (e.g. flow rates below or above the flow rate range, etc.) |
| A05 | Uncorrected operating volume | Z26: If the characteristic correction is deactivated, A05 is not visible and cannot be adjusted. If a characteristic correction is activated, this characteristic curve correction is deactivated from 0 up to this value A05. |
| A06 | Volume Start/Stop | Starts and stops a volume flow measurement |
| A07 | Volume Reset | Sets the volume flow rate to 0 |
| A10 | Meter factor | <p>With the meter factor (pulse value), the corresponding operating value flow is calculated from the signal frequency of the sensor element in the meter electronics.</p> $q_m = \frac{f_V}{K_V} * 3600 \left[\frac{m^3}{h} \right]$ <p>The meter factor must be calibrated at the factory so that a direct meter display in cubic meters.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Note</p> <p>A change of this adjustment takes place in the area of responsibility of the operator.</p> </div> <p>After any change to the meter factor, calculation takes place with the new value immediately.</p> <p>The uninfluenced signal frequency of the sensor element is available at the HF output. The frequency range can be determined from the meter factor K and the minimum and maximum operating volume flow of the meter according to the formula:</p> $f_{V \min} = \frac{q_{m \min}}{3600} * K_V \quad f_{V \max} = \frac{q_{m \max}}{3600} * K_V$ |

| | | | | | | | | | | | | |
|------|--|---|------|-------------------------------|-----|------------------------------|---|--|----|--------------------------------|-----|--------------------------------|
| | | <p>$q_{m \min}$: minimum operating volume flow</p> <p>$q_{m \max}$: maximum operating volume flow</p> <p>Example:</p> <p>$q_{m \min} = 16 \text{ m}^3/\text{h}$</p> <p>$q_{m \max} = 250 \text{ m}^3/\text{h}$</p> <p>$K_V = 2362 \text{ pulses/m}^3$</p> $f_{V \min} = \frac{16 \text{ m}^3}{3600 \text{ s}} \cdot 2362 \frac{\text{Impulse}}{\text{m}^3} = 10,5 \text{ Hz}$ $f_{V \max} = \frac{250 \text{ m}^3}{3600 \text{ s}} \cdot 2362 \frac{\text{Impulse}}{\text{m}^3} = 164 \text{ Hz}$ | | | | | | | | | | |
| A11 | Output pulse factor | The output pulse value indicates how many LF output pulses correspond to one m^3 (1 m^3). | | | | | | | | | | |
| A12 | Meter factor corrected | The meter can be adjusted by the operator, e.g. during calibration. As a display value, this value cannot be changed. This value is only visible if the Z27 characteristic correction is activated. | | | | | | | | | | |
| A20 | Display factor | <p>A20: Display factor for meters, including decimal places</p> <table border="1"> <tr> <td>0.01</td> <td>Display with 2 decimal places</td> </tr> <tr> <td>0.1</td> <td>Display with 1 decimal place</td> </tr> <tr> <td>1</td> <td>Display without decimal places (default)</td> </tr> <tr> <td>10</td> <td>Display without decimal places</td> </tr> <tr> <td>100</td> <td>Display without decimal places</td> </tr> </table> <p>Example:</p> <p>If the factor is adjusted to 0.1, the meter status is displayed with a decimal place.</p> <div style="border: 1px solid black; padding: 5px;"> <p>Note</p> <p>If the factor is adjusted, for instance, to 10, the display value is displayed without a decimal place.</p> <p>You get the <u>actual</u> meter status by multiplying the display value by 10.</p> <p>This setting is marked with a "x 10" sticker (or it must be marked).</p> </div> | 0.01 | Display with 2 decimal places | 0.1 | Display with 1 decimal place | 1 | Display without decimal places (default) | 10 | Display without decimal places | 100 | Display without decimal places |
| 0.01 | Display with 2 decimal places | | | | | | | | | | | |
| 0.1 | Display with 1 decimal place | | | | | | | | | | | |
| 1 | Display without decimal places (default) | | | | | | | | | | | |
| 10 | Display without decimal places | | | | | | | | | | | |
| 100 | Display without decimal places | | | | | | | | | | | |
| A21 | Digital output 2 mode | <p>A21: Digital output 2 mode</p> <table border="1"> <tr> <td>0</td> <td>Operating volume (default)</td> </tr> <tr> <td>1</td> <td>Standard volume</td> </tr> </table> | 0 | Operating volume (default) | 1 | Standard volume | | | | | | |
| 0 | Operating volume (default) | | | | | | | | | | | |
| 1 | Standard volume | | | | | | | | | | | |

| | | |
|-----|------------------------------|---|
| A22 | Digital output 2 pulse width | A22 digital output 2 pulse width |
| | | 20 ms |
| | | 125 ms (default) |
| | | 250 ms |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|------------------------------|-----------------|---------------|------------|-----------|------|----------|---------|------------------|
| A01 | Standard volume | 300 | W | E | uint32 | 0 | 99999999 | 0 | m ³ |
| A02 | Operating volume | 302 | W | E | uint32 | 0 | 99999999 | 0 | m ³ |
| A03 | Standard volume error | 304 | W | E | uint32 | 0 | 99999999 | 0 | m ³ |
| A04 | Operating volume error | 306 | W | E | uint32 | 0 | 99999999 | 0 | m ³ |
| A05 | Uncorrected operating volume | 308 | W | E | uint32 | 0 | 99999999 | 0 | m ³ |
| A06 | Volume Start/Stop | 310 | W | N | uint32 | 0 | 99999999 | 0 | m ³ |
| A07 | Volume Reset | 312 | W | N | uint32 | 0 | 99999999 | 0 | m ³ |
| A10 | Meter factor | 500 | W | E | string12 | * | * | 1000.0 | l/m ³ |
| A11 | Output pulse factor | 506 | W | E | float | 0.01 | 100 | 1.0 | l/m ³ |
| A12 | Meter factor corrected | 508 | R | A | float | - | - | 1.0 | l/m ³ |
| A20 | Display factor | 510 | W | E | menü16 | 0 | 4 | 2 | |
| A21 | Digital output 2 mode | 511 | W | E | menü16 | 0 | 1 | 0 | |
| A22 | Digit. output 2 pulse width | 512 | W | N | menü16 | 0 | 2 | 1 | ms |

65


4.3.3.2. Flow rate


| Coordinate | Name | Description |
|--------------------------|------------------------------------|---|
| B01 | Standard flow rate | Flow value under standard conditions (see above) |
| B02 | Operating flow rate | Flow rate under current operating conditions |
| B03 | Frequency | Unchanged output value, frequency of Sensor 1. |
| B05 | Min. flow rate | An alarm is generated below this flow rate |
| B06 | Max. flow rate | An alarm is generated above this flow rate |
| B10, B11, B12, B13, B14, | Coefficients: A-2, A-1, A0, A1, A2 | Z26: If the characteristic correction is deactivated, the additional parameters are not visible and cannot be adjusted. If a characteristic correction is activated (see Z26 below), a correction takes place with the factors in: B10: Factor for the characteristic correction B11: Factor for the characteristic correction B12: Factor for the characteristic correction B13: Factor for the characteristic correction B14: Factor for the characteristic correction |
| B15 | Max. operating point deviation | B15: If the deviation of the corrected from the uncorrected characteristic at an operating point (or a range) is more than |

| | | |
|-----|----------------------------------|--|
| | | the adjusted value (2% here), the correction, is set to "0" for this operating point or operating range, which means a correction takes place. |
| B08 | Leak flow volume limit | The flow rate is disregarded below this limit - i.e. it is set to 0 |
| B09 | Maximum time > Q _{ug} + | Indicates the maximum time until the flow rate (e.g. on start-up) reaches the measuring range (Q _{min}) after reaching the lower measuring limit (Q _{ug}). The flow rate measurement applies as defective during this time, but no error message is generated. |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|----------------------------------|-----------------|---------------|------------|-----------|------|-------|---------|---------------------|
| B01 | Standard flow rate | 318 | R | A | float | - | - | * | m ³ /h |
| B02 | Operating flow rate | 320 | R | A | float | - | - | * | m ³ /h |
| B03 | Frequency | 322 | R | A | float | - | - | * | Hz |
| B05 | Min. flow rate | 521 | W | E | float | * | * | 0.0 | m ³ /h |
| B06 | Max. flow rate | 523 | W | E | float | * | * | 1000.0 | m ³ /h |
| B10 | Coefficient A-2 | 530 | W | E | float | * | * | 0 | Am2 |
| B11 | Coefficient A-1 | 532 | W | E | float | * | * | 0 | Am1 |
| B12 | Coefficient A0 | 534 | W | E | float | * | * | 0 | A0 |
| B13 | Coefficient A1 | 536 | W | E | float | * | * | 0 | A1x10 ⁻⁴ |
| B14 | Coefficient A2 | 538 | W | E | float | * | * | 0 | A2x10 ⁻⁸ |
| B15 | Max. dev. operating point | 540 | W | E | float | 0.0 | 100.0 | 2.0 | kkp |
| B08 | Leak flow volume limit | 527 | W | E | float | * | * | * | m ³ /h |
| B09 | Maximum time > Q _{ug} + | 529 | W | E | uint16 | 0 | 10000 | 10 | s |


4.3.3.3. Pressure

| Coordinate | Name | Description |
|------------|---------------|--|
| C01 | Pressure | Currently available pressure |
| C02 | Pressure mode | Pressure measurement transmitter (source of the pressure measurement) |
| | | 0 Specification (default, fixed value) |
| | | 1 Wika TI-1  |

| | | | | | |
|-----|----------------------------------|--|------------------|--|--|
| | | 2 | Endress + Hauser |  | |
| C03 | Pressure Default | Default value of the pressure | | | |
| C04 | Pressure Minimum | This value presents the lowest pressure value of the individual pressure transducer. An error is displayed if the pressure is below this limit. | | | |
| C05 | Pressure Maximum | This value presents the highest pressure value of the individual pressure transducer. An error is displayed if the pressure is above this limit. | | | |
| C08 | Pressure offset | The measured pressure value can be corrected. The offset enables a constant increase over the entire pressure measuring range, based on 1 bar of pressure (atmospheric pressure) | | | |
| C09 | Pressure increase | The increase can be changed by the pressure increase factor based on the offset value. | | | |
| C10 | Pressure sensor temperature | Display of the temperature of the pressure sensor. | | | |
| C11 | Min. pressure sensor temperature | Temperature range (lower limit) within which the pressure sensor works "precisely". | | | |
| C12 | Max. pressure sensor temperature | Temperature range (upper limit) within which the pressure sensor works "precisely". Outside of this range, the pressure value is interpreted as "incorrectly" measured. | | | |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|----------------------------------|-----------------|---------------|------------|-----------|------|-------|---------|------|
| C01 | Pressure | 326 | R | A | float | - | - | - | bar |
| C02 | Pressure mode | 555 | W | E | menü16 | 0 | 2 | 0 | |
| C03 | Pressure specification | 556 | W | E | float | 0.0 | 100.0 | 1.0 | bar |
| C04 | Pressure Minimum | 558 | W | E | float | 0.8 | 100.0 | 0.8 | bar |
| C05 | Pressure Maximum | 560 | W | E | float | 0.8 | 100.0 | 2.5 | bar |
| C07 | Pressure offset | 562 | W | E | float | -0.5 | 0.5 | 0.0 | |
| C08 | Pressure increase | 564 | W | E | float | 0.8 | 1.2 | 1.0 | |
| C10 | Pressure sensor temperature | 566 | R | E | float | - | - | - | °C |
| C11 | Min. pressure sensor temperature | 568 | R | E | float | - | - | - | °C |
| C12 | Max. pressure sensor temperature | 570 | R | E | float | - | - | - | °C |

4.3.3.4. Temperature

| Coordinate | Name | Description | | | | |
|------------|--------------------------------------|---|---|--------------------------------------|---|--------|
| D01 | Temperature | Current temperature | | | | |
| D02 | Temperature mode | <p>Temperature measurement transmitter (source of the temperature measurement)</p> <table border="1"> <tr> <td>0</td> <td>Specification (default, fixed value)</td> </tr> <tr> <td>1</td> <td>Pt1000</td> </tr> </table>  | 0 | Specification (default, fixed value) | 1 | Pt1000 |
| 0 | Specification (default, fixed value) | | | | | |
| 1 | Pt1000 | | | | | |
| D03 | Temperature default | Default value of the temperature | | | | |
| D04 | Temperature Minimum | This value represents the lowest temperature value of the temperature sensor at which the functionality of the TME400 is still guaranteed. An error is displayed if the temperature is below this limit. | | | | |
| D05 | Temperature Maximum | This value represents the highest temperature value of the temperature sensor at which the functionality of the TME400 is still guaranteed. An error is displayed if the temperature is above this limit. | | | | |
| D06 | Temperature moderation | The temperature value is moderated by means of averaging. A value of 0 corresponds to no moderation. A value of 0.99 causes heavy moderation. | | | | |
| D11 | PT1000 resistance | Corrected resistance value of the Pt1000 | | | | |
| D12 | PT1000 resistance uncorr. | Uncorrected resistance value of the Pt1000 | | | | |
| D30 | Temperature (uncorrected) | Display of the uncorrected temperature measurement | | | | |
| D35 | Temperature setpoint 1 | Set point 1 (lower value) for temperature adjustment | | | | |
| D36 | Temperature setpoint 2 | Set point 2 (upper value) for temperature adjustment | | | | |
| D37 | Temp. actual value 1 | Measured value at temperature set point 1 | | | | |
| D38 | Temp. actual value 2 | Measured value at temperature set point 2 | | | | |
| D41 | Write temperature corr. | Correction values with are adopted with "Yes" are calculated internally. | | | | |

⚠ Caution

Adoption of the correction changes the temperature characteristic measured in the factory and stored. Only perform this change if you are certain that you have detected a deviating temperature measurement.

Of course, this correction is subject to the mandatory calibration.

| | |
|---|--------------|
| 0 | No (default) |
| 1 | Yes |

Note

Correction values displayed in the coordinates D08 (f0) and D09 (f1) are calculated internally. These correction values may only change within the scope of 0.9 to 1.1; otherwise there is a defect which must be corrected by RMG.

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|---------------------------|-----------------|---------------|------------|-----------|-------|------|---------|------|
| D01 | Temperature | 324 | R | A | float | - | - | - | °C |
| D02 | Temperature mode | 587 | W | E | menü16 | 0 | 1 | 0 | |
| D03 | Temperature default | 588 | W | E | float | -40.0 | 80.0 | 10.0 | T-V |
| D04 | Temperature Minimum | 590 | W | E | float | -40.0 | 80.0 | -25.0 | °C |
| D05 | Temperature Maximum | 592 | W | E | float | -40.0 | 80.0 | 60.0 | °C |
| D06 | Temperature moderation | 594 | | E | float | 0.1 | 1.0 | 1.0 | T-D |
| D11 | PT1000 resistance | 602 | R | A | float | - | - | - | Ohm |
| D12 | PT1000 resistance uncorr. | 604 | R | A | float | - | - | - | Ohm |
| D30 | Temperature (uncorrected) | 606 | R | A | float | - | - | - | °C |
| D35 | Temperature setpoint 1 | 616 | W | N | float | -40.0 | 80.0 | -10.0 | °C |
| D36 | Temperature setpoint 2 | 618 | W | N | float | -40.0 | 80.0 | 50.0 | °C |
| D37 | Temp. actual value 1 | 620 | W | N | float | -40.0 | 80.0 | -10.0 | °C |
| D38 | Temp. actual value 2 | 622 | W | N | float | -40.0 | 80.0 | 50.0 | °C |
| D41 | Write temperature corr. | 628 | W | E | menü16 | | | | |

4.3.3.5. Analysis

70

| Coordinate | Name | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|--|--|---|---------------------------------------|---|---------|---|---------------------|---|---------------------|---|----------------------------------|---|----------------------------------|---|-------------|-----|-------------------------------|--------------------|-----|------------------------|-------------------|-----|---------------------|--|-----|--|-------|-----|---------------------------------------|-------|-----|---------------------------------------|-------|
| E01 | Conversion factor | Conversion factor; see above | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E02 | Compression factor | Compressibility (from AGA8, etc.); see above. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E05 | Calculation method | <p>The TME400 enables calculation of gas parameters, particularly the compression factor according to various methods. These methods must be adjusted in coordinate E05 with the corresponding number. Available for selection:</p> <table border="1"> <tr><td>0</td><td>Constant compression factor (default)</td></tr> <tr><td>1</td><td>Gerg88S</td></tr> <tr><td>2</td><td>AGA8 GROSS method 1</td></tr> <tr><td>3</td><td>AGA8 GROSS method 2</td></tr> <tr><td>4</td><td>AGA NX19-mod. (relative density)</td></tr> <tr><td>5</td><td>AGA NX19-mod. (standard density)</td></tr> <tr><td>6</td><td>GOST30319-2</td></tr> </table> <p>The application of these calculations have been verified in the range of: Temperature: -25°C to +60°C Pressure: 0 bar to 40 bar (absolute)</p> <p>The calculation method also carries out checks on the approved input variables (e.g. temperature, pressure, standard calorific value, etc.). If the limits are exceeded, the calculation is performed with the default value of the compression factor. In this case, the device displays an error. The volumes are then summarized in the error totalizer.</p> <p>Compression factor constant The simplest option is to set to the compressibility to constant. This is correct if you always work with the same measuring gas and know the compression factor. Enter this compression factor in E02. The compression factor is set to "1" for an ideal gas (e.g. gases at low pressure).</p> <p>Complete gas analyses are not necessary for any other gas models, but knowledge of additional gas parameters is necessary. Depending on the model, this must be entered in coordinates E07 to E12:</p> <table border="1"> <tr><td>E07</td><td>Standard calorific value Ho n</td><td>kWh/m³</td></tr> <tr><td>E08</td><td>Standard density Rho n</td><td>kg/m³</td></tr> <tr><td>E09</td><td>Relative density DV</td><td></td></tr> <tr><td>E10</td><td>Percentage of carbon dioxide CO₂</td><td>mol-%</td></tr> <tr><td>E11</td><td>Percentage of nitrogen N₂</td><td>mol-%</td></tr> <tr><td>E12</td><td>Percentage of hydrogen H₂</td><td>mol-%</td></tr> </table> | 0 | Constant compression factor (default) | 1 | Gerg88S | 2 | AGA8 GROSS method 1 | 3 | AGA8 GROSS method 2 | 4 | AGA NX19-mod. (relative density) | 5 | AGA NX19-mod. (standard density) | 6 | GOST30319-2 | E07 | Standard calorific value Ho n | kWh/m ³ | E08 | Standard density Rho n | kg/m ³ | E09 | Relative density DV | | E10 | Percentage of carbon dioxide CO ₂ | mol-% | E11 | Percentage of nitrogen N ₂ | mol-% | E12 | Percentage of hydrogen H ₂ | mol-% |
| 0 | Constant compression factor (default) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Gerg88S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | AGA8 GROSS method 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | AGA8 GROSS method 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | AGA NX19-mod. (relative density) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | AGA NX19-mod. (standard density) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | GOST30319-2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E07 | Standard calorific value Ho n | kWh/m ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E08 | Standard density Rho n | kg/m ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E09 | Relative density DV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E10 | Percentage of carbon dioxide CO ₂ | mol-% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E11 | Percentage of nitrogen N ₂ | mol-% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E12 | Percentage of hydrogen H ₂ | mol-% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | |
|-----|--------------------------------|---|---|-----------------------|---|---------|
| | | <p>GERG 88 S This equation requires the following fixed input variables: standard calorific value (E07), standard density (E08), and the gas fractions (in mol%) of carbon dioxide (E10) and hydrogen (E12).</p> <p>AGA 8 Gross Method 1 This calculation method corresponds to GERG 88 S taking into account the absence of hydrogen; E12, the percentage of H₂ = 0 -mol-%.</p> <p>AGA 8 Gross Method 2 This equation requires the following fixed input variables: standard density (E08), as well as the gas fraction (in mol-%) of carbon dioxide (E10) and nitrogen (E11). The hydrogen fraction is assumed to be 0 mol-% in analogy to AGA8 Gross method 1.</p> <p>AGA NX19-mod. (relative density) This equation requires the following fixed input variables: Relative density (E09), standard calorific value (E07), and the gas fractions (in mol-%) of carbon dioxide (E10) and nitrogen (E11).</p> <p>AGA NX19-mod. (standard density) The input variables of this equation are: standard density (E08), standard calorific value (E07), and the gas fractions (in mol%) of carbon dioxide (E10) and nitrogen (E11).</p> <p>GOST30319-2 This is a Russian standard to calculate the gas parameters. More details can be found in the Russian manual.</p> | | | | |
| E06 | Default compr. factor | Default value for compression factor | | | | |
| E07 | Standard calorific value | Standard calorific value | | | | |
| E08 | Standard density | Standard density | | | | |
| E09 | Relative density | Relative density | | | | |
| E10 | Carbon dioxide | Fraction of carbon dioxide | | | | |
| E11 | Nitrogen | Fraction of nitrogen | | | | |
| E12 | Hydrogen | Fraction of hydrogen | | | | |
| E20 | Standard pressure selection | <p>Standard conditions In Germany, standard conditions at which gas parameters must be determined are defined. These standard conditions are for the pressure (E20) 1.01325 bar and the temperature (E21) 0°C. In addition, 25°C applies as a standard combustion temperature for determining the calorific value (E22).</p> <p>Selection of standard pressure</p> <table border="1"> <tr> <td>0</td> <td>1.01325 bar (default)</td> </tr> <tr> <td>1</td> <td>1.0 bar</td> </tr> </table> | 0 | 1.01325 bar (default) | 1 | 1.0 bar |
| 0 | 1.01325 bar (default) | | | | | |
| 1 | 1.0 bar | | | | | |
| E21 | Standard temperature selection | <p>Selection of standard temperature</p> <table border="1"> <tr> <td>0</td> <td>0° C (default)</td> </tr> </table> | 0 | 0° C (default) | | |
| 0 | 0° C (default) | | | | | |

72

| | | | |
|---|-------------------------------------|--|-----------------|
| | | 1 | 15° C |
| | | 2 | 15.56° C |
| | | 3 | 20° C |
| E22 | Standard combustion temp. selection | Selection of the standard combustion temperature | |
| | | 0 | 0° C |
| | | 1 | 15° C |
| | | 2 | 20° C |
| | | 3 | 25° C (default) |
| Note | | | |
| <p>For the European area of application, the standard conditions are not uniform with respect to various pressure / temperature values. In the United States, conversions to the units "psi" and "°F" apply.</p> <p>In general, care should be taken, because the pressure / temperature values for the respective standard conditions may deviate from the German standard values. Disregard can result in significant conversion errors.</p> | | | |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|----------------------------------|-----------------|---------------|------------|-----------|------|-------|---------|--------|
| E01 | Status coefficient | 328 | R | A | float | - | - | - | Supply |
| E02 | Compressibility | 633 | R | A | float | - | - | 1.0 | K |
| E05 | Calculation method | 639 | W | E | menü16 | 0 | 5 | 0 | |
| E06 | Compressibility default | 640 | W | E | float | 0.1 | 10.0 | 1.0 | K-V |
| E07 | Calorific value | 642 | W | E | float | 0.0 | 100.0 | 10.0 | Hon |
| E08 | Standard density | 644 | W | E | float | 0.0 | 100.0 | 0.8 | rhñ |
| E09 | Relative density | 646 | W | E | float | 0.0 | 100.0 | 25.0 | dv |
| E10 | Fraction of carbon dioxide | 648 | W | E | float | 0.0 | 100.0 | 1.0 | CO2 |
| E11 | Nitrogen | 650 | W | E | float | 0.0 | 100.0 | 25.0 | N2 |
| E12 | Hydrogen | 652 | W | E | float | 0.0 | 100.0 | 0.0 | H2 |
| E20 | Selection standard pressure | 654 | W | E | menü16 | 0 | 1 | 0 | |
| E21 | Selection standard temperature | 655 | W | E | menü16 | 0 | 3 | 0 | |
| E22 | Selection combustion temperature | 656 | W | E | menü16 | 0 | 3 | 0 | |

4.3.3.6. Current output

| Coordinate | Name | Description | | | | | | | | | | | | | | | | |
|------------|-------------------------|---|---|-------------------------|---|---------------------|---|--------------|---|-----------------|---|------------------|---|--------------------|---|-------------|---|----------|
| F01 | Current | Current to be output | | | | | | | | | | | | | | | | |
| F02 | Current mode | Mode of the current output <table border="1" data-bbox="622 548 1439 750"> <tr><td>0</td><td>Off (default)</td></tr> <tr><td>1</td><td>No errors</td></tr> <tr><td>2</td><td>Error 3.5 mA</td></tr> <tr><td>3</td><td>Error 21.8 mA</td></tr> <tr><td>4</td><td>0 - 20mA</td></tr> </table> <p>If the current mode is set to "0", i.e. "Off", no parameters of the output other than parameter F02: current mode are visible and adjustable.</p> | 0 | Off (default) | 1 | No errors | 2 | Error 3.5 mA | 3 | Error 21.8 mA | 4 | 0 - 20mA | | | | | | |
| 0 | Off (default) | | | | | | | | | | | | | | | | | |
| 1 | No errors | | | | | | | | | | | | | | | | | |
| 2 | Error 3.5 mA | | | | | | | | | | | | | | | | | |
| 3 | Error 21.8 mA | | | | | | | | | | | | | | | | | |
| 4 | 0 - 20mA | | | | | | | | | | | | | | | | | |
| F03 | Current source | Source of the current output <table border="1" data-bbox="622 963 1439 1276"> <tr><td>0</td><td>Specification (default)</td></tr> <tr><td>1</td><td>Operating flow rate</td></tr> <tr><td>2</td><td>Frequency</td></tr> <tr><td>3</td><td>Calibration 4mA</td></tr> <tr><td>4</td><td>Calibration 20mA</td></tr> <tr><td>5</td><td>Standard flow rate</td></tr> <tr><td>6</td><td>Temperature</td></tr> <tr><td>7</td><td>Pressure</td></tr> </table> | 0 | Specification (default) | 1 | Operating flow rate | 2 | Frequency | 3 | Calibration 4mA | 4 | Calibration 20mA | 5 | Standard flow rate | 6 | Temperature | 7 | Pressure |
| 0 | Specification (default) | | | | | | | | | | | | | | | | | |
| 1 | Operating flow rate | | | | | | | | | | | | | | | | | |
| 2 | Frequency | | | | | | | | | | | | | | | | | |
| 3 | Calibration 4mA | | | | | | | | | | | | | | | | | |
| 4 | Calibration 20mA | | | | | | | | | | | | | | | | | |
| 5 | Standard flow rate | | | | | | | | | | | | | | | | | |
| 6 | Temperature | | | | | | | | | | | | | | | | | |
| 7 | Pressure | | | | | | | | | | | | | | | | | |
| F04 | Phys. Minimum value | Current output phys. Minimum value (required for display in RMGView ^{TME}) | | | | | | | | | | | | | | | | |
| F05 | Phys. Maximum value | Current output phys. Maximum value (required for display in RMGView ^{TME}) | | | | | | | | | | | | | | | | |
| F06 | Current specification | Specification value for the current output (for testing purposes) | | | | | | | | | | | | | | | | |
| F07 | Current moderation | The current output is damped by averaging. A value of 0 corresponds to no damping. A value of 0.99 causes strong averaging. | | | | | | | | | | | | | | | | |
| F10 | Calibration value 4mA | Calibration: Current value 4mA (after activation of current source) | | | | | | | | | | | | | | | | |
| F11 | Calibration value 20mA | Calibration: Current value 20mA (after activation of current source) | | | | | | | | | | | | | | | | |
| F12 | Module serial number | Serial number of the current module | | | | | | | | | | | | | | | | |

73

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|----------------|-----------------|---------------|------------|-----------|------|------|---------|------|
| F01 | Current | 330 | R | A | float | - | - | - | mA |
| F02 | Current mode | 657 | W | N | menü16 | 0 | 4 | 0 | |
| F03 | Current source | 658 | W | N | menü16 | 0 | 7 | 0 | |

| | | | | | | | | | |
|-----|------------------------|-----|---|---|---------|-----|------|--------------|-----|
| F04 | Figure below | 659 | W | N | float | - | - | 0.0 | |
| F05 | Figure above | 661 | W | N | float | - | - | 1000.0 | |
| F06 | Current specification | 663 | W | N | float | 0.0 | 25.0 | 12.0 | mA |
| F07 | Current moderation | 665 | W | N | float | 0.0 | 0.99 | 0.7 | I-D |
| F10 | Calibration value 4mA | 667 | W | N | float | 0.0 | 25.0 | 4.0 | mA |
| F11 | Calibration value 20mA | 669 | W | N | float | 0.0 | 25.0 | 20.0 | mA |
| F12 | Module serial number | 671 | W | N | string8 | - | - | 0000 0000 | SN |

4.3.3.7. Error / type plate

| Coordinate | Name | Description | | | | |
|------------|----------------------------------|--|---|--------------|---|-----|
| G01 | Current error | Identifies the current error | | | | |
| G02 | Software version | Shows the version number of the firmware in the TME400. | | | | |
| G04 | Serial number | Serial number of the TME400 | | | | |
| G05 | Firmware checksum | Shows the checksum of the firmware (important for TME400-VMF and TME400-VCF in custody-transfer applications) | | | | |
| G06 | Measuring point | Possibility of numerical identification for the measuring point | | | | |
| G10 | Standard pressure | Display of the standard pressure setting | | | | |
| G11 | Pressure range min. | Display of the minimum of the pressure range Value range of the pressure sensor (chapter 5.1.2.4 Pressure transducer) or customer setting C04) | | | | |
| G12 | Pressure range max. | Display of the maximum of the pressure range (chapter 5.1.2.4 Pressure transducer) or customer setting C05) | | | | |
| G13 | Pressure sensor serial number | Serial number of the pressure sensor | | | | |
| G14 | Standard temperature | Display of the standard pressure setting | | | | |
| G17 | Temperature sensor serial number | Serial number of the temperature sensor | | | | |
| G18 | Meter number | Number of the turbine meter | | | | |
| G21 | CRC metrological Param. EEPROM | CRC of metrological parameters EEPROM | | | | |
| G23 | Date of Battery Exchange | Date of battery exchange | | | | |
| G24 | Remaining Battery Capacity | Remaining capacity of the battery | | | | |
| G25 | Battery Change | <table border="1"> <tr> <td>0</td> <td>No (default)</td> </tr> <tr> <td>1</td> <td>Yes</td> </tr> </table> | 0 | No (default) | 1 | Yes |
| 0 | No (default) | | | | | |
| 1 | Yes | | | | | |
| G26 | Operating Hours | Operating hours | | | | |
| G19 | Meter size | Meter size (G ..) | | | | |
| G20 | Date of last battery replacement | Shows the date of the last battery replacement | | | | |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|----------------------------------|-----------------|---------------|------------|-----------|------|----------|--------------|------|
| G01 | Current error | 675 | R | A | uint16 | - | - | 0 | ERR |
| G02 | Software version | 676 | R | A | float | - | - | * | Rev |
| G04 | Serial number | 680 | W | E | int32 | 0 | 99999999 | 0l | SNo |
| G05 | Firmware checksum | 682 | R | A | int16 | - | - | * | CRC |
| G06 | Measuring point | 314 | W | A | uint32 | * | * | 0 | Rev |
| G10 | Standard pressure | 683 | R | A | float | - | - | 1.0 | bar |
| G11 | Pressure range min. | 685 | R | A | float | - | - | 0.7 | bar |
| G12 | Pressure range max. | 687 | R | A | float | - | - | 2.0 | bar |
| G13 | Pressure sensor serial number | 689 | R | A | string12 | - | - | * | --- |
| G14 | Standard temperature | 695 | R | A | float | - | - | 273.15 | TN |
| G17 | Temperature sensor serial number | 697 | W | E | int32 | * | * | 9999 9999 | TNo |
| G18 | Meter number | 699 | W | E | int32 | * | * | 9999 9999 | MNo |
| G21 | CRC metrological Param. EEPROM | 804 | R | A | string8 | - | - | CALC | Hex |
| G23 | Date of Battery Exchange | 705 | W | C | string8 | - | - | 010117 | Bat |
| G24 | Remaining Battery Capacity | 790 | R | A | uint16 | - | - | 100 | % |
| G25 | Battery Change | 791 | W | C | menü16 | 0 | 1 | 0 | - |
| G26 | Operating Hours | 792 | R | A | uint32 | - | - | 0 | h |
| G19 | Meter size | 701 | W | E | string8 | * | * | 4-16000 | G |
| G20 | Batter replacement date | 705 | W | C | int32 | * | * | 0101 2014 | Bat |

75

4.3.3.8. RS-485 interface

| Coordinate | Name | Description |
|------------|------------------|---------------------|
| H01 | RS-485 Baud rate | 2400 Bps |
| | | 9600 Bps |
| | | 19200 Bps |
| | | 38400 Bps (default) |
| H02 | RS-485 parameter | 0 8N1 (default) |
| | | 1 8E1 |
| | | 2 8O1 |

| | | | |
|-----|------------------------|--------------------------------------|----------------------|
| | | 3 | 7N1 |
| | | 4 | 7E1 |
| | | 5 | 7O1 |
| H03 | RS-485 protocol | 0 | Off |
| | | 1 | Modbus RTU (default) |
| | | 2 | Modbus ASCII |
| H04 | Modbus ID | Modbus device address (default = 1). | |
| H05 | Modbus register offset | The offset is defined as 1 by RMG. | |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|------------------------|-----------------|---------------|------------|-----------|------|-------|---------|------|
| H01 | RS-485 Baud rate | 709 | W | N | menu16 | 0 | 3 | 3 | Bps |
| H02 | RS485 parameter | 710 | W | N | menu16 | 0 | 5 | 0 | |
| H03 | RS485 protocol | 711 | W | N | menu16 | 0 | 2 | 1 | |
| H04 | Modbus ID | 712 | W | N | uint16 | 1 | 250 | 1 | MID |
| H05 | Modbus register offset | 713 | W | N | uint16 | 0 | 10000 | 1 | Mof |

4.3.3.9. Archive

| Coordinate | Name | Description | | | | | | | | | | | | | |
|--|---------------------------|---|---|---------------|---|-----|--------------|---|----------------------|--|---|------------|--|---|------------|
| X01 | Time | Direct entry of the current time as described above. | | | | | | | | | | | | | |
| X02 | Date | Direct entry of the current date as described above. | | | | | | | | | | | | | |
| X10 | Delete parameter archive | <table border="1"> <tr> <td>0</td> <td>No (default)</td> </tr> <tr> <td>1</td> <td>Yes</td> </tr> </table> | 0 | No (default) | 1 | Yes | | | | | | | | | |
| 0 | No (default) | | | | | | | | | | | | | | |
| 1 | Yes | | | | | | | | | | | | | | |
| X11 | Param. archive fill level | Display value | | | | | | | | | | | | | |
| X14 | Delete event archive | <table border="1"> <tr> <td>0</td> <td>No (default)</td> </tr> <tr> <td>1</td> <td>Yes</td> </tr> </table> | 0 | No (default) | 1 | Yes | | | | | | | | | |
| 0 | No (default) | | | | | | | | | | | | | | |
| 1 | Yes | | | | | | | | | | | | | | |
| X15 | Event archive fill level | Display value | | | | | | | | | | | | | |
| X16, X17, X18, X19, X20, X21, X22, X23 | Measurement archive mode | <table border="1"> <tr> <td>0</td> <td>Off (default)</td> </tr> <tr> <td>1</td> <td>On</td> </tr> </table> <p>If measurement archive mode is activated, the following archives are visible and can be adjusted and deleted as necessary.</p> <p>Minutes archive</p> <table border="1"> <tr> <td>X17 interval</td> <td>0</td> <td>15 minutes (default)</td> </tr> <tr> <td></td> <td>1</td> <td>30 minutes</td> </tr> <tr> <td></td> <td>2</td> <td>60 minutes</td> </tr> </table> | 0 | Off (default) | 1 | On | X17 interval | 0 | 15 minutes (default) | | 1 | 30 minutes | | 2 | 60 minutes |
| 0 | Off (default) | | | | | | | | | | | | | | |
| 1 | On | | | | | | | | | | | | | | |
| X17 interval | 0 | 15 minutes (default) | | | | | | | | | | | | | |
| | 1 | 30 minutes | | | | | | | | | | | | | |
| | 2 | 60 minutes | | | | | | | | | | | | | |

| | | | | |
|-----|----------------------------------|----------------|---------------|--------------|
| | | X18 delete | 0 | No (default) |
| | | | 1 | Yes |
| | | X19 fill level | Display value | |
| | | Day archive | | |
| | | X20 delete | 0 | No (default) |
| | | | 1 | Yes |
| | | X21 fill level | Display value | |
| | | Month archive | | |
| | | X22 delete | 0 | No (default) |
| | | | 1 | Yes |
| | | X23 fill level | Display value | |
| X24 | Delete all Archives | All archives | | |
| | | X24 delete | 0 | No (default) |
| | | | 1 | Yes |
| X12 | Delete parameter archive (E) | 0 | No (default) | |
| | | 1 | Yes | |
| X13 | Parameter archive (E) fill level | Display value | | |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|------------------------------|-----------------|---------------|------------|-----------|------|------|---------|------|
| X01 | Time | 714 | W | E | string8 | | | | T |
| X02 | Date | 717 | W | E | string8 | | | | D |
| X10 | Delete parameter archive | 722 | W | E | menu16 | 0 | 1 | 0 | |
| X11 | Parameter archive fill level | 723 | R | A | uint16 | - | - | 0 | % |
| X14 | Delete event archive | 726 | W | E | menu16 | 0 | 1 | 0 | |
| X15 | Event archive fill level | 727 | R | A | uint16 | - | - | 0 | % |
| X16 | Measurement archive mode | 728 | W | E | menu16 | 0 | 1 | 0 | |
| X17 | Minute archive interval | 729 | W | E | menu16 | 0 | 2 | 0 | |
| X18 | Delete minute archive | 730 | W | E | menu16 | 0 | 1 | 0 | |
| X19 | Minute archive fill level | 731 | R | A | uint16 | - | - | 0 | % |
| X20 | Delete day archive | 732 | W | E | menu16 | 0 | 1 | 0 | |
| X21 | Day archive fill level | 733 | R | A | uint16 | - | - | 0 | % |
| X22 | Delete month archive | 734 | W | E | menu16 | 0 | 1 | 0 | |
| X23 | Month archive fill level | 735 | R | A | uint16 | - | - | 0 | % |
| X24 | Delete all archives | 812 | W | E | menu16 | 0 | 1 | 0 | |

| | | | | | | | | | |
|-----|----------------------------------|-----|---|---|--------|---|---|---|---|
| X12 | Delete parameter archive (E) | 724 | W | E | menu16 | 0 | 1 | 0 | |
| X13 | Parameter archive (E) fill level | 725 | R | A | uint16 | - | - | 0 | % |

78

Further information about the archives can be found in *Appendix B Structure of the archives*.

4.3.3.10. Settings

| Coordinate | Name | Description | | | | | | | | |
|------------|-------------------------|--|---|---------------------|---|-----------|---|------------------|---|------------------|
| Z04 | X:Y maximum pulse error | A differential circuit compares the metered pulse of measuring and comparison channels alternately. Every deviation is counted internally. An alarm is generated if the adjusted limit value is exceeded. The failure counter is reset to 0 for each new measurement or after the maximum number of pulses (Z05) is reached. | | | | | | | | |
| Z05 | X:Y maximum pulse | see above | | | | | | | | |
| Z10 | Error register 1 | Display value | | | | | | | | |
| Z11 | Error register 2 | Display value | | | | | | | | |
| Z12 | Status register 1 | Display value | | | | | | | | |
| Z13 | Status register 2 | Display value | | | | | | | | |
| Z15 | Code word release | <div style="border: 2px solid black; padding: 5px;"> <p>Note</p> <p>The code word for the TME400 is: 1 2 3 4</p> <p>This is always displayed as " **** " in the parameter archive.</p> </div> <p>With entry of this code word, the protected parameters can be changed.</p> | | | | | | | | |
| Z16 | Change code word | A new password can be defined here. | | | | | | | | |
| Z17 | Device type | <table border="1"> <tr><td>0</td><td>TME400-VM (default)</td></tr> <tr><td>1</td><td>TME400-VC</td></tr> <tr><td>2</td><td>TME400-VMF (MID)</td></tr> <tr><td>3</td><td>TME400-VCF (MID)</td></tr> </table> | 0 | TME400-VM (default) | 1 | TME400-VC | 2 | TME400-VMF (MID) | 3 | TME400-VCF (MID) |
| 0 | TME400-VM (default) | | | | | | | | | |
| 1 | TME400-VC | | | | | | | | | |
| 2 | TME400-VMF (MID) | | | | | | | | | |
| 3 | TME400-VCF (MID) | | | | | | | | | |
| Z24 | Display active max. | <table border="1"> <tr><td>0</td><td>1 minute (default)</td></tr> <tr><td>1</td><td>5 minutes</td></tr> <tr><td>2</td><td>60 minute test</td></tr> </table> | 0 | 1 minute (default) | 1 | 5 minutes | 2 | 60 minute test | | |
| 0 | 1 minute (default) | | | | | | | | | |
| 1 | 5 minutes | | | | | | | | | |
| 2 | 60 minute test | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|-----|------------------------------------|--|---|------------------------------------|---|-------------------------|---|------------------------|---|------------------------|---|-----------------|---|-------------------------|---|------------------------|---|-----------------------------|---|-----------------------------|
| | | <p>The time during which the display is active for tests is selected as 60 minutes. In general, however, it must be observed that higher energy consumption is associated with this time, so this time should be selected as short as possible, if possible.</p> | | | | | | | | | | | | | | | | | | |
| Z25 | Volume metering mode | <table border="1"> <tr><td>0</td><td>1-channel without errors (default)</td></tr> <tr><td>1</td><td>1-channel stop on error</td></tr> <tr><td>2</td><td>1-channel run on error</td></tr> <tr><td>3</td><td>1-channel start / stop</td></tr> <tr><td>4</td><td>1-channel reset</td></tr> <tr><td>5</td><td>2-channel stop on error</td></tr> <tr><td>6</td><td>2-channel run on error</td></tr> <tr><td>7</td><td>2-channel without X:Y error</td></tr> <tr><td>8</td><td>1 Channel Start/Stop Mode 2</td></tr> </table> <p>With 1-channel measurements (0, 1, 2, 3, 4), the Z04 and Z05 pulse comparison is not activated. An entry for sensor type 2 is superfluous and has <u>no</u> further significance.</p> <p>Volume metering mode 8: 1 Channel Start/Stop Mode 2 If the external contact input 3 is closed (or opened), this additional mode 2 triggers a start (or stop) for the start/stop totalizer during this time. The LF output and the current output are deactivated for this period (4 mA) and no pulses are output (main totalizers stop). In case of an error, the pulses are counted in the error totalizers and current and pulses are output.</p> | 0 | 1-channel without errors (default) | 1 | 1-channel stop on error | 2 | 1-channel run on error | 3 | 1-channel start / stop | 4 | 1-channel reset | 5 | 2-channel stop on error | 6 | 2-channel run on error | 7 | 2-channel without X:Y error | 8 | 1 Channel Start/Stop Mode 2 |
| 0 | 1-channel without errors (default) | | | | | | | | | | | | | | | | | | | |
| 1 | 1-channel stop on error | | | | | | | | | | | | | | | | | | | |
| 2 | 1-channel run on error | | | | | | | | | | | | | | | | | | | |
| 3 | 1-channel start / stop | | | | | | | | | | | | | | | | | | | |
| 4 | 1-channel reset | | | | | | | | | | | | | | | | | | | |
| 5 | 2-channel stop on error | | | | | | | | | | | | | | | | | | | |
| 6 | 2-channel run on error | | | | | | | | | | | | | | | | | | | |
| 7 | 2-channel without X:Y error | | | | | | | | | | | | | | | | | | | |
| 8 | 1 Channel Start/Stop Mode 2 | | | | | | | | | | | | | | | | | | | |
| Z26 | Characteristic correction | <p>If the TME400 is supplied with a current supply, the TME400 enables a characteristic correction via a polynomial. This correction must be activated with coordinate Z26. With this polynomial correction, the corresponding percentage deviations of the turbine meter from a reference standard are determined for fixed percentage flow rate values. From these deviations, a polynomial function which ideally reflects the curve running through these points is calculated. The coefficients of the polynomial A-2, A-1, A0, A1 and A2 are adjusted by the manufacturer in the coordinates B10 to B14 or can be entered there when the manufacturer of the turbine meter provides these values.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>Note</p> <p>The HF output pulses (X3 pulse 1) are always uncorrected! With an active characteristic curve correction, no HF pulses are output.</p> </div> | | | | | | | | | | | | | | | | | | |

80

| | | | |
|-----|---------------|---|--------------------------|
| | | 0 | Off (default) |
| | | 1 | On |
| Z27 | Sensor type 1 | 0 | Reed sensor |
| | | 1 | Wiegand sensor (default) |
| | | 2 | External |
| Z28 | Sensor type 2 | Settings are possible, but only make sense in 2-channel operation. Settings changed here have no effect in 1-channel operation, | |
| | | 0 | Reed sensor |
| | | 1 | Wiegand sensor (default) |
| | | 2 | External |
| Z29 | Volume unit | 0 | m ³ (Default) |
| | | 1 | cf |

| Coordinate | Name | Modbus register | Modbus access | Protection | Data type | Min. | Max. | Default | Unit |
|------------|---------------------------|-----------------|---------------|------------|-----------|------|-------|---------|------|
| Z04 | X:Y maximum pulse error | 775 | W | E | uint16 | 1 | 10000 | 10 | X |
| Z05 | X:Y maximum pulse | 776 | W | E | uint16 | 1 | 10000 | 10000 | Y |
| Z10 | Error register 1 | 332 | R | A | int16 | - | - | * | Err |
| Z11 | Error register 2 | 333 | R | A | int16 | - | - | * | Err |
| Z12 | Status register 1 | 334 | R | A | int16 | - | - | * | Sta |
| Z13 | Status register 2 | 335 | R | A | int16 | - | - | * | Sta |
| Z15 | Code word release | 777 | W | N | uint16 | 1 | 9999 | 0 | COD |
| Z16 | Change code word | 778 | W | C | int16 | 1 | 9999 | 1234 | C-V |
| Z17 | Device type | 779 | W | E | menu16 | 0 | 3 | 0 | |
| Z24 | Display active max. | 780 | W | N | menu16 | 0 | 2 | 0 | |
| Z25 | Volume metering mode | 781 | W | E | menu16 | 0 | 7 | 0 | |
| Z26 | Characteristic correction | 782 | W | E | menu16 | 0 | 1 | 0 | |
| Z27 | Sensor type 1 | 783 | W | E | menu16 | 0 | 2 | 1 | |
| Z28 | Sensor type 2 | 784 | W | E | menu16 | 0 | 2 | 1 | |
| Z29 | Volume unit | 785 | W | E | menu16 | 0 | 1 | 0 | |

Note

If the parameter is not dimensioned, the text in the "Unit" column is shown in the display of the TME400 to the right under UNIT.

4.4. Special settings

4.4.1. Configuration of the current output

The connection of external devices to the current output of the meter is to be carried out as described in chapter 2.1 *Electrical connections*.

The parameters are then set in column 'F Current output' of the coordinate matrix as follows:

1. In coordinate **F-02** (current mode) select the operating mode of the current output:
 - 0: Off (default)
 - 1: 4-20mA - current is always calculated from the physical value
 - 2: 4-20mA - below the minimum value output of 3.5 mA
 - 3: 4-20mA - above the maximum value output of 21.8 mA.
 - 4: 0-20mA
2. In coordinate **F-03** (current source) select the value for output:
 - 0: Fixed value (default)
 - 1: Operating flow rate
 - 2: Sensor frequency
 - 3: Fixed value of 4mA for calibration
 - 4: Fixed value of 20mA for calibration
 - 5: Standard flow rate
 - 6: Temperature
 - 7: Pressure
3. In coordinate **F-04** (physical minimum) enter the lower limit for the physical value at which 0 or 4 mA should be output.
4. In coordinate **F-05** (physical maximum) enter the upper limit for the physical value eintragen, at which 20 mA should be output.
5. In **F-06** (current specification) a fixed value can be entered for the current which is output with the entry 0 in coordinate F-02.
6. In **F-07** (damping) the inertia of the output can be set with values from 0 (minimum) to 0.99 (maximum).

4.5. RMGView^{TME}

The RMGView^{TME} software also provides an additional possibility of parameter input. This software offers you additional options in combination with the TME400.

82



Figure 13: RMGView^{TME} software

For further details, please read the corresponding manual, which can be downloaded from our home page (see page 2).

5. Technical data

5.1.1. Device types

| Reed or transistor (with connected turbine meter) | |
|---|--|
| Pulse input | Reed or transistor |
| Current output | Current loop connection (current supply via this current output possible) |
| Wiegand (with connected turbine meter) | |
| Use | Direct installation on the TME400 turbine meter instead of the meter head |
| Pulse input | Wiegand |
| Current output | Current loop connection (current supply via this current output possible) |

83

5.1.2. Inputs

| Volume | |
|-----------------|---|
| Reed | |
| Pulse frequency | 0 Hz ... 4 Hz |
| Pulse width | ≥ 20 ms |
| Voltage | low: ≤ 0.9 V high: ≥ 2.2 V |
| Wiegand | |
| Pulse frequency | 0 Hz ... 400 Hz; with battery operation |
| Pulse width | ≥ 5 μ s |
| Voltage | min. 1 V max. 5 V (determined by sensor) |

5.1.2.1. Power supply

| Power supply | |
|-----------------------------|--|
| Internal battery | Lithium cell 3.6 V; in the device (battery pack) |
| External 6-24 V DC via X6 | via U_{ext} + battery pack (NON-Ex) |
| External 6-10.5 V DC via X6 | via U_{ext} + battery pack (Ex) |
| External 6-24 V DC via X9 | via current loop connection + battery pack |

5.1.2.2. Pulse In measuring inputs (sensor 1 / 2)

Note

For Ex connection values, see approval

84

The cable length to the Wiegand sensor must not exceed 15 m. With use of an external pressure transducer, this maximum length is limited to 3 m.

5.1.2.3. Temperature input

The temperature sensor is connected at the factory; the Ex connection values are met in this process.

| | |
|-----------------|---------------|
| Measuring range | -25°C to 60°C |
| Resolution | ± 0.2 °C |

5.1.2.4. Pressure transducer

The pressure sensor is connected at the factory; the Ex connection values are met in this process.

Wika TI-1

Measuring ranges (absolute pressure)

- 0.8 bar to 2.5 bar
- 0.8 bar to 6.0 bar
- 2.0 bar to 10.0 bar
- 4.0 bar to 20.0 bar

Accuracy (at reference conditions according to IEC 61298-1)

- ≤ ±0.25 % of span

Endress+Hauser

Not yet released.

5.1.3. Outputs

| Non-Ex | |
|-----------------|--------|
| U_{min} | 5 V |
| $U_{max} (U_i)$ | 30 V |
| I_{max} | 100 mA |

85

For use of the TME400 in hazardous areas the values for the HF, LF and alarm output must be taken from the ATEX certificate.

5.1.4. Digital interface

| RS-485 data interface | |
|-----------------------|------------|
| U_{ext} | 6.0 – 24 V |

For use of the TME400 in hazardous areas the values must be taken from the ATEX certificate.

Note

When using the RS485 interface, the device must be supplied with power via U_{ext} .

Note

In an Ex version, the connection must only be made to a certified, intrinsic safe current circuit.

The Ex-relevant connection values are specified in the approval.

5.1.5. Current loop connection

| Current loop connection | |
|----------------------------|--|
| $U_{ext} (min)$ | 12 V |
| $U_{ext} (max)$ | 28 V |
| I_{min} | 3.5 mA |
| I_{max} | 23 mA |
| External resistance (max.) | See: <i>Figure 14: Load depending on feeder supply</i> |

Current output for

| | |
|---------------------|-------------------|
| - minimum flow rate | 4 mA |
| - maximum flow rate | 20 mA |
| - alarm | 3.5 mA or 21.8 mA |

Current output accuracy better than 1% of the end value

86

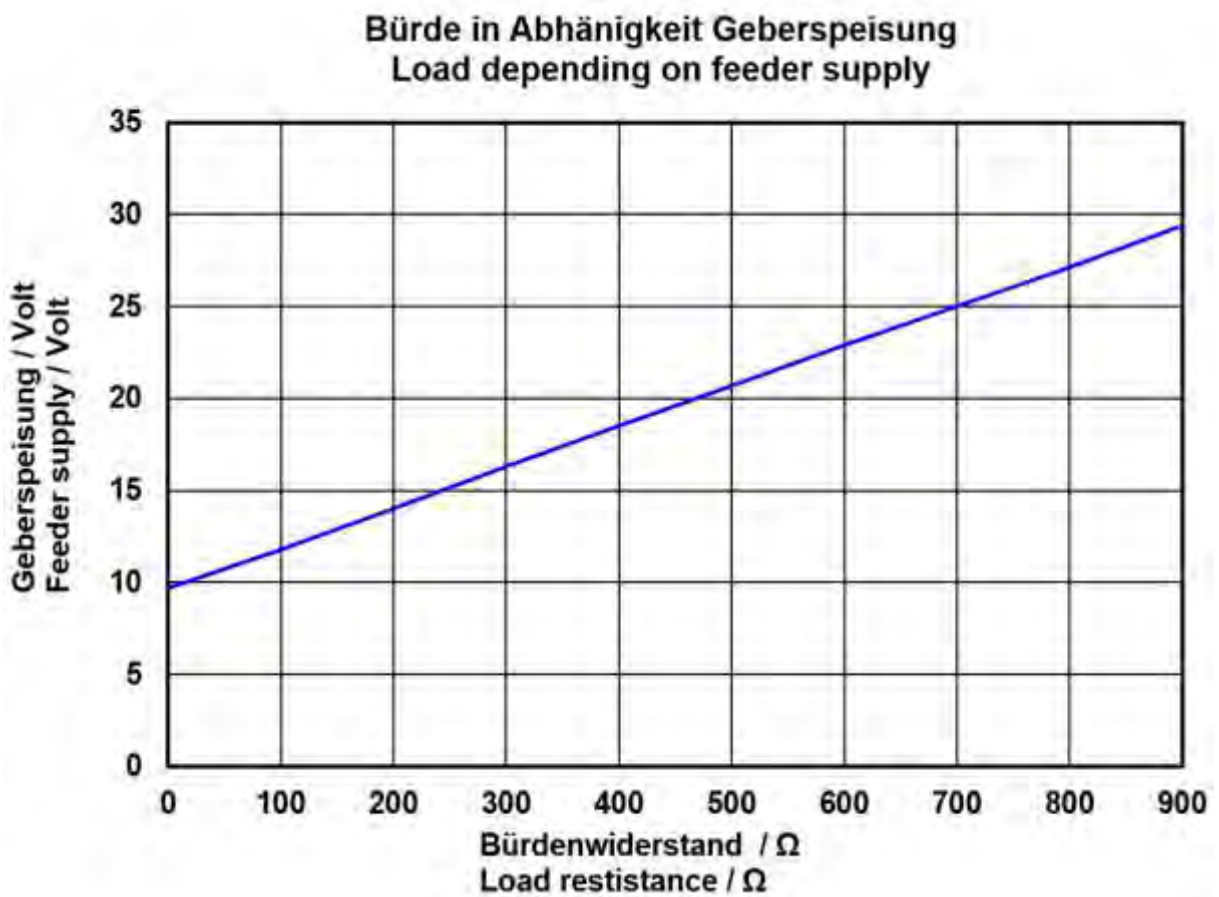


Figure 14: Load depending on feeder supply

For use of the TME400 in hazardous areas the values must be taken from the ATEX certificate.

5.1.6. Cable

Signal cables (LF output, HF output, current loop connection, control input) must have 2 or more wires twisted in pairs and shielded (LiYCY-TP).

4-wire, twisted and shielded cables (LiYCY-TP) must be used for the data cables (RS-485).

The shielding must be grounded on both ends - on the TME400, as described in the *section 5.1.7. Cable connection*.

Cable cross-sections of 0.5 mm² are recommended. Due to the cable screw connection, the outer diameter of the cable must be between 4.5 and 6.5 mm.



Caution

The maximum cable length is limited when used in hazardous areas due to the limit values for intrinsically safe current circuits and depending on the inductivity and capacity of the cable.

5.1.7. Cable connection

Connect the shield on both ends to the cable screw connections on the outside of the housing, as shown in the figure below:

- Unscrew the union nut.
- Pull the terminal insert out of the plastic.
- Slide the cable end through the union nut and the terminal insert and bend the shielding back.
- Plug the terminal insert back into the connecting piece.
- Tighten the union nut.
- Every Ex signal circuit must be routed with a dedicated cable which must be guided through the appropriate PG screw coupling.

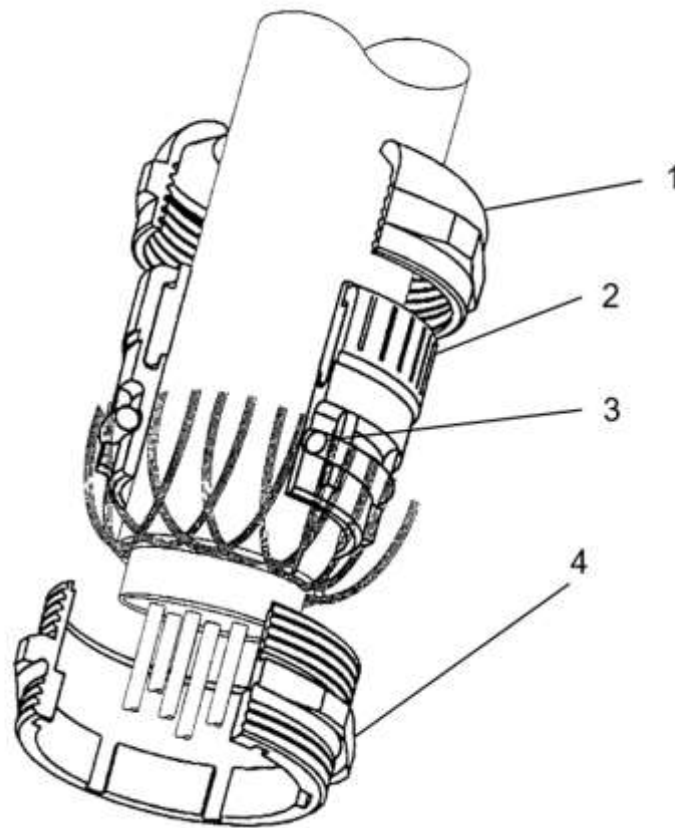


Figure 15: Terminal screw connection

- | | | | |
|---|-----------------|---|------------------|
| 1 | Coupling nut | 3 | O-ring |
| 2 | Terminal insert | 4 | Connecting piece |

5.1.8. Ground

Note

To avoid measuring errors due to electromagnetic interference, the meter housing must be grounded with the ground connection on the lower right section of the housing (see *Figure 16: Grounding the meter*).

Minimum cable cross-section:

- length of up to 10 m: 6 mm²
- length of 10 m or higher: 10 mm²



Figure 16: Grounding the meter

In the process, a conductive connection between the TME400 and the pipeline must be provided as shown in the figure below.

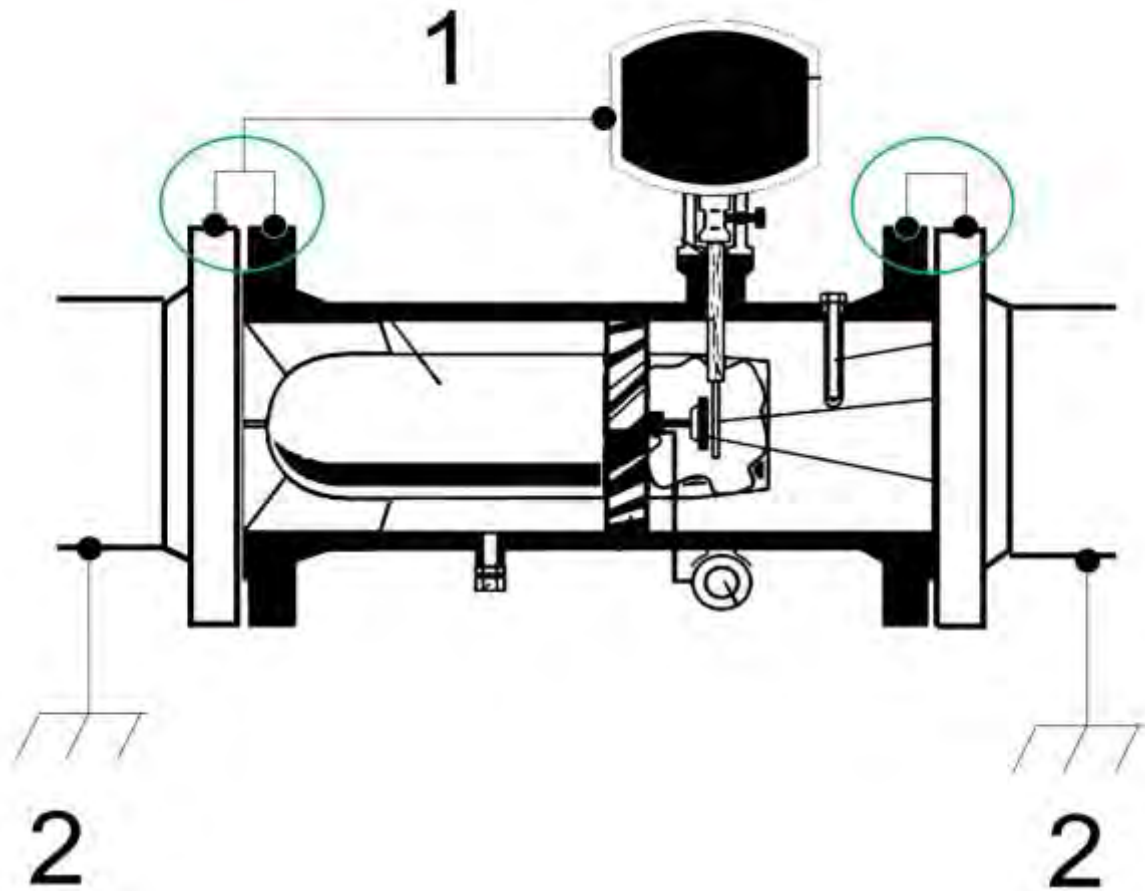


Figure 17: Grounding with the connecting pipes

- 1 Equipotential bonding conductor (PE) min. 6 mm²
- 2 Measuring system potential

5.2. Overview of materials in use

| Name | Material |
|-----------------------------|--|
| Housing | Cast iron, cast steel, stainless steel, aluminum or welded steel |
| Flow straightener | Delrin, aluminum or steel |
| Turbine wheel | Delrin or aluminum |
| Measuring unit | Aluminum |
| Ball bearings | Stainless steel |
| Shafts | Stainless steel |
| Gear wheels | Stainless steel or plastic |
| Magnetic coupling | Stainless steel |
| Meter head | Plastic |
| Meter printed circuit board | Aluminum, zinc die-casting or brass |

6. Error messages

Error messages are shown in the display as an error number and "unit" "Err".



Figure 18: Error message in the display

The message types are:

- E = Error
- W = Warning
- H = Hint

There are the following error messages:

| Message type | Error no. | Brief description | Comment |
|--------------|-----------|-----------------------|----------------------|
| E | 1 | EEprom version error | Contact RMG service. |
| E | 2 | EEprom error | Contact RMG service. |
| E | 3 | Pt1000 hardware error | Contact RMG service. |

| | | | |
|---|-----|---------------------------------|---|
| E | 4 | Temperature min/max error | Check the alarm setting for the temperature. |
| E | 5 | Pressure sensor hardware error | Contact RMG service. |
| E | 6 | Pressure min/max error | Check the alarm setting for the pressure. |
| E | 7 | Gas equation calculation error | Check the alarm setting for the gas equation. Check the parameter entries for the correct unit and reference to the standard conditions. |
| E | 8 | Flow rate min/max error | Check the alarm setting for the flow rate. |
| E | 9 | X:Y pulse comparison error | Check the alarm setting for the pulse comparison. |
| E | 10 | Max. output pulse error | Check the alarm setting for the max. output pulse. |
| E | 11 | Current output error | Check your power connections. Contact RMG service in case of uncertainty. |
| E | 12 | Error CRC Calibration Parameter | Contact RMG service. |
| W | 101 | Warning Battery Capacity low | Please change the battery |
| H | 201 | New software version | You have a new firmware version |
| H | 202 | Metrology switch open | Metrology switch open |
| H | 203 | Code word set | Code word is set |

Appendix

A Modbus

The TME400 has a passive RS-485 interface, which means the interface must be supplied with power externally.

94

Parameterizing the Modbus

Modbus activation

H03 RS-485 protocol

| | |
|---|----------------------|
| 0 | Off |
| 1 | Modbus RTU (default) |
| 2 | Modbus ASCII |

The **Modbus - ID** is adjusted via the coordinate H04 (default is 1)

The **Modbus - Register - Offset** (MRO) is entered via coordinate H05 (default is 1). The MRO applies for read and write operations.

Baud rate

H01 Baud rate RS-485 interface

| | |
|---|---------------------|
| 0 | 2400 Bps |
| 1 | 9600 Bps |
| 2 | 19200 Bps |
| 3 | 38400 Bps (default) |

Interface parameters

The interface parameters can be adjusted in coordinate H02.

H02 RS-485 interface parameters

| | |
|---|---------------|
| 0 | 8N1 (default) |
| 1 | 8E1 |
| 2 | 8O1 |
| 3 | 7N1 |
| 4 | 7E1 |
| 5 | 7O1 |

The TME400 recognizes the following Modbus commands:

- (03 Hex) Read Holding Registers
- (06 Hex) Preset Single Register
- (10 Hex) Preset Multiple Regs
- (08 Hex) Subfunction 00 Hex: Return Query data

TME400 Exception Codes

- 01 Illegal Function
- 02 Illegal Data Address (register not available)
- 03 Illegal Data Value (register not writable or incorrect value)

Example (Modbus query/response):

| Query: | Send character | |
|---------------------|----------------|--------|
| Start Char | : | |
| Slave Address | 01 | |
| Function | 03 | |
| Starting Address Hi | 07 | |
| Starting Address Lo | CF | 2000-1 |
| No. of Points Hi | 00 | |
| No. of Points Lo | 02 | |
| LRC | 24 | |
| carriage return | cr | |
| line feed | lf | |

| Response: | Receive character | |
|--------------------|-------------------|-----------|
| Start Char | : | |
| Slave Address | 01 | |
| Function | 03 | |
| Byte Count | 04 | |
| Data Hi (Reg 2000) | 3F | see below |
| Data Lo (Reg 2000) | 80 | see below |
| Data Hi (Reg 2001) | 00 | see below |
| Data Lo (Reg 2001) | 00 | see below |
| LRC | 39 | |
| carriage return | cr | |
| line feed | lf | |

Example (Modbus number formats)

| Data type | Register | Value | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 | Byte 8 | Byte 9 | Byte 10 |
|-----------|----------|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| float | 2 | 1.0 | 0x3f | 0x80 | 0x00 | 0x00 | | | | | | |
| Text | 5 | "90111200" | 0x39 | 0x30 | 0x31 | 0x31 | 0x31 | 0x32 | 0x30 | 0x30 | 0x00 | 0x00 |
| int | 1 | 1357 | 0x05 | 0x4d | | | | | | | | |
| long | 2 | 698614 | 0x00 | 0x0a | 0xa8 | 0xf6 | | | | | | |

96

Refer to the Modbus specifications for further information.

Characteristics of the TME400 Modbus

- Data types (float, text ...) can only be read or written completely

| | | |
|----------|---|------------|
| menu16 | : | 1 Register |
| int16 | : | 1 Register |
| uint16 | : | 1 Register |
| int32 | : | 2 Register |
| uint32 | : | 2 Register |
| float | : | 2 Register |
| string8 | : | 4 Register |
| string12 | : | 6 Register |

- A maximum of 125 registers can be read or written (in one command).

- Text fields must have at least one terminating zero (0x00).

- Writing of certain parameters causes internal initialization of the hardware and/or:

- Deletion of intermediate results (pulse output, meter calculation, etc.).
- Therefore, the parameters should only be overwritten as necessary (e.g. meter factor)
- Meter statuses are delivered as a uint32 value (without decimal)

Modbus - Register (Version:0.001; Matrix: 001; June 2018)

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|---------------------------|--------|--------------------|---|
| 300 | 2 | uint32 | RW | A01 | Volume Base | E | &VolumeUnit | Volume at base conditions |
| 302 | 2 | uint32 | RW | A02 | Volume Measurement | E | &VolumeUnit | Volume at measurement conditions |
| 304 | 2 | uint32 | RW | A03 | Volume Base Error | E | &VolumeUnit | Volume at base conditions error |
| 306 | 2 | uint32 | RW | A04 | Volume Measurement Error | E | &VolumeUnit | Volume at measurement conditions error |
| 308 | 2 | uint32 | RW | A05 | Volume Measurement Uncor. | E | &VolumeUnit | Volume at measurement conditions uncor. |
| 310 | 2 | uint32 | RW | A06 | Volume Start/Stop | N | &VolumeUnit | Volume Start/Stop |
| 312 | 2 | uint32 | RW | A07 | Volume Reset | N | &VolumeUnit | Volume Reset |
| 314 | 2 | uint32 | RW | G06 | Metering Point | E | --- | Name of metering point |
| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
| 318 | 2 | float | R | B01 | Flow Rate Base | A | &FlowUnit | Flow rate at base conditions |
| 320 | 2 | float | R | B02 | Flow Rate Measurement | A | &FlowUnit | Flow rate measurement |
| 322 | 2 | float | R | B03 | Frequency | A | Hz | Frequency |
| 324 | 2 | float | R | D01 | Temperature | A | °C | Temperature |
| 326 | 2 | float | R | C01 | Pressure | A | bar | Current pressure value |
| 328 | 2 | float | R | E01 | Conversion factor | A | Zu | Conversion factor |
| 330 | 2 | float | R | F01 | Current | A | mA | Current to be output |
| 332 | 1 | uint16 | R | Z10 | Error Register 1 | A | Hex | Error register 1 |
| 333 | 1 | uint16 | R | Z11 | Error Register 2 | A | Hex | Error register 2 |
| 334 | 1 | uint16 | R | Z12 | Status Register 1 | A | Hex | Status register 1 |
| 335 | 1 | uint16 | R | Z13 | Status Register 2 | A | Hex | Status register 2 |
| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
| 500 | 6 | string12 | RW | A10 | Meter Factor | E | &CounterFactorUnit | Meter factor |
| 506 | 2 | float | RW | A11 | Output Pulse Factor | E | &CounterFactorUnit | Output pulse factor |
| 508 | 2 | float | R | A12 | Meter Factor corrected | A | &CounterFactorUnit | Meter factor corrected |
| 510 | 1 | menu16 | RW | A20 | Display Factor | E | | Display factor |

| | | | | | | | | |
|-----|---|--------|----|-----|------------------------------|---|----|------------------------------|
| 511 | 1 | menu16 | RW | A21 | Digital Output 2 Mode | E | | Digital output 2 mode |
| 512 | 1 | menu16 | RW | A22 | Digital Output 2 Pulse Width | N | ms | Digital output 2 pulse width |

98

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|----------------|--------|-----------|-------------------|
| 521 | 2 | float | RW | B05 | Flow Rate min. | E | &FlowUnit | Flow rate minimum |
| 523 | 2 | float | RW | B06 | Flow Rate max. | E | &FlowUnit | Flow rate maximum |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|-----------------|--------|-----------|---|
| 527 | 2 | float | RW | B08 | QmUg | E | &FlowUnit | |
| 529 | 1 | uint16 | RW | B09 | QmMinTime | E | s | |
| 530 | 2 | float | RW | B10 | Coefficient A-2 | E | Am2 | Error curve linearization coefficient A-2 |
| 532 | 2 | float | RW | B11 | Coefficient A-1 | E | Am1 | Error curve linearization coefficient A-1 |
| 534 | 2 | float | RW | B12 | Coefficient A0 | E | A0 | Error curve linearization coefficient A0 |
| 536 | 2 | float | RW | B13 | Coefficient A1 | E | A1 | Error curve linearization coefficient A1 |
| 538 | 2 | float | RW | B14 | Coefficient A2 | E | A2 | Error curve linearization coefficient A2 |
| 540 | 2 | float | RW | B15 | KKMaxProz | E | kkp | |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|----------------------------|--------|------|--|
| 555 | 1 | menu16 | RW | C02 | Pressure Mode | E | | Source for pressure measurement |
| 556 | 2 | float | RW | C03 | Pressure Default | E | bar | Default value for pressure |
| 558 | 2 | float | RW | C04 | Pressure Minimum | E | bar | Lowest valid pressure |
| 560 | 2 | float | RW | C05 | Pressure Maximum | E | bar | Highest valid pressure |
| 562 | 2 | float | RW | C08 | Pressure Offset | E | | Pressure offset |
| 564 | 2 | float | RW | C09 | Pressure Slope | E | | Pressure slope |
| 566 | 2 | float | R | C10 | Temp. pressure sensor | E | °C | Temperature pressure sensor |
| 568 | 2 | float | R | C11 | Temp. pressure sensor min. | E | °C | Temperature range pressure sensor min. |
| 570 | 2 | float | R | C12 | Temp. pressure sensor max. | E | °C | Temperature range pressure sensor max. |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|------|--------|------|-------------|
|--------|-------------|-----------|-----------|------------|------|--------|------|-------------|

| | | | | | | | | |
|-----|---|--------|----|-----|---------------------|---|-----|------------------------------------|
| 587 | 1 | menu16 | RW | D02 | Temperature Mode | E | | Source for temperature measurement |
| 588 | 2 | float | RW | D03 | Temperature Default | E | T-V | Default value for temperature |
| 590 | 2 | float | RW | D04 | Temperature min | E | °C | Lowest valid temperature |
| 592 | 2 | float | RW | D05 | Temperature max | E | °C | Highest valid temperature |
| 594 | 2 | float | RW | D06 | Temperature Damping | E | T-D | Damping temperature |

99

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|--------------------------|--------|------|------------------------------------|
| 602 | 2 | float | R | D11 | Resistance PT1000 | A | Ohm | Resistance of PT1000 (corrected) |
| 604 | 2 | float | R | D12 | Resistance PT1000 uncor. | A | Ohm | Resistance of PT1000 (uncorrected) |
| 606 | 2 | float | R | D30 | Temperature (uncor.) | A | °C | Temperature (uncorrected) |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|----------------------------|--------|------|----------------------------|
| 616 | 2 | float | RW | D35 | Temperature target value 1 | N | °C | Temperature target value 1 |
| 618 | 2 | float | RW | D36 | Temperature target value 2 | N | °C | Temperature target value 2 |
| 620 | 2 | float | RW | D37 | Temperature target value 2 | N | °C | Temperature target value 2 |
| 622 | 2 | float | RW | D38 | Temperature target value 2 | N | °C | Temperature target value 2 |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|-------------------------|--------|------|-------------------------------------|
| 628 | 1 | menu16 | RW | D41 | Temperature Corr. Write | E | | Write temp. correction factors f0/1 |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|--------------------|--------|------|--------------------------------------|
| 633 | 2 | float | R | E02 | Compression factor | A | K | Compression factor (from AGA8, etc.) |

| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
|--------|-------------|-----------|-----------|------------|----------------------------|--------|------|--|
| 639 | 1 | menu16 | RW | E05 | Calculation Method | E | | Calculation method for compress. |
| 640 | 2 | float | RW | E06 | Default Compression factor | E | K-V | Default value for the compression factor |
| 642 | 2 | float | RW | E07 | Calorific Value | E | Hon | Calorific value |

100

| 644 | 2 | float | RW | E08 | Standard Density | E | rhN | Standard density |
|--------|-------------|-----------|-----------|------------|--------------------------------|--------|------|---|
| 646 | 2 | float | RW | E09 | Relative Density | E | dv | Relative density |
| 648 | 2 | float | RW | E10 | Percentage carbon dioxide | E | CO2 | mole fraction of carbon dioxide |
| 650 | 2 | float | RW | E11 | Nitrogen | E | N2 | mole fraction of Nitrogen |
| 652 | 2 | float | RW | E12 | Hydrogen | E | H2 | mole fraction of Hydrogen |
| 654 | 1 | menu16 | RW | E20 | Selection Base Pressure | E | | Selection of base pressure |
| 655 | 1 | menu16 | RW | E21 | Selection Base Temperature | E | | Selection of base temperature |
| 656 | 1 | menu16 | RW | E22 | Selection Base Temp. Cal. Fac. | E | | Selection of base temp. calorific value |
| 657 | 1 | menu16 | RW | F02 | Current Mode | N | | Mode current output |
| 658 | 1 | menu16 | RW | F03 | Current Source | N | | Source current output |
| 659 | 2 | float | RW | F04 | Physical minimum value | N | | Current output phys. minimum value |
| 661 | 2 | float | RW | F05 | Physical maximum value | N | | Current output phys. maximum value |
| 663 | 2 | float | RW | F06 | Current default | N | mA | Current output default |
| 665 | 2 | float | RW | F07 | Current Damping | N | I-D | Damping current output |
| 667 | 2 | float | RW | F10 | Calibration Value 4mA | N | mA | Calibration: Actual value 4mA |
| 669 | 2 | float | RW | F11 | Calibration Value 20mA | N | mA | Calibration: Actual value 20mA |
| 671 | 4 | string8 | RW | F12 | Module Serial Number | N | SN | Current output module serial no. |
| 675 | 1 | uint16 | R | G01 | Current Error | A | ERR | Current activated error codes |
| 676 | 2 | float | R | G02 | Software Version | A | Rev | Software version |
| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
| 680 | 2 | int32 | RW | G04 | Serial number | E | SNr | Serial number |
| 682 | 1 | uint16 | R | G05 | Firmware Checksum | A | CRC | Firmware checksum |
| 683 | 2 | float | R | G10 | Pressure Base | A | bar | Pressure at base condition |
| 685 | 2 | float | R | G11 | Pressure Range min | A | bar | Pressure range minimum |
| 687 | 2 | float | R | G12 | Pressure Range max | A | bar | Pressure range maximum |
| 689 | 6 | string12 | R | G13 | Pressure Sensor Serial Number | A | --- | Serial number pressure sensor |

| 695 | 2 | float | R | G14 | Temperature Base | A | TN | Temperature at base condition |
|--------|-------------|-----------|-----------|------------|------------------------------|--------|------|----------------------------------|
| 697 | 2 | int32 | RW | G17 | Temp. Sensor Serial Number | E | TNr | Serial number temperature sensor |
| 699 | 2 | int32 | RW | G18 | Serial Number Gas Meter | E | ZNr | Serial number gas meter |
| 701 | 4 | string8 | RW | G19 | Meter size | E | G | Meter size |
| 705 | 3 | string8 | RW | G20 | Date of Battery Exchange | C | Bat | Date of battery exchange |
| 790 | 1 | uint16 | R | G24 | Remaining Battery Capacity | A | % | Remaining Battery Capacity |
| 791 | 1 | menu16 | RW | G25 | Battery Change | C | - | Battery Change |
| 792 | 2 | uint16 | R | G26 | Operating Hours | A | h | Operating Hours |
| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
| 709 | 1 | menu16 | RW | H01 | RS485 Baudrate | N | Bps | RS485 interface baudrate |
| 710 | 1 | menu16 | RW | H02 | RS485 Parameter | N | | RS485 interface parameter |
| 711 | 1 | menu16 | RW | H03 | RS485 Protocol | N | | RS485 selection of protocol |
| 712 | 1 | uint16 | RW | H04 | Modbus ID | N | MID | Modbus ID |
| 713 | 1 | uint16 | RW | H05 | Modbus Register Offset | N | Mof | Modbus register offset |
| 714 | 3 | string8 | RW | X01 | Time | E | T | Time |
| 717 | 3 | string8 | RW | X02 | Date | E | D | Date |
| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
| 722 | 1 | menu16 | RW | X10 | Delete Parameter Archive | E | | Delete parameter archive |
| 723 | 1 | uint16 | R | X11 | Fill level Para. Archive | A | % | Fill level parameter archive |
| 724 | 1 | menu16 | RW | X12 | Delete Parameter Archive(E) | E | | Delete parameter archive (E) |
| 725 | 1 | uint16 | R | X13 | Fill level Para. Archive (E) | A | % | Fill level parameter archive (E) |
| 726 | 1 | menu16 | RW | X14 | Delete Event Archive | E | | Delete event archive |
| 727 | 1 | uint16 | R | X15 | Fill level Event Archive | A | % | Fill level event archive |
| 728 | 1 | menu16 | RW | X16 | Mode archives | E | | Mode Archives |
| 729 | 1 | menu16 | RW | X17 | Interval Minute Archive | E | | Interval minute archiv |
| 730 | 1 | menu16 | RW | X18 | Delete Minute Archive | E | | Delete minute archive |
| 731 | 1 | uint16 | R | X19 | Fill level Minute Archive | A | % | Fill level minute archive |

102

| 732 | 1 | menu16 | RW | X20 | Delete Day Archive | E | | Delete day archive |
|--------|-------------|-----------|-----------|------------|--------------------------|--------|------|--|
| 733 | 1 | uint16 | R | X21 | Fill level Day Archive | A | % | Fill level day archive |
| 734 | 1 | menu16 | RW | X22 | Delete Month archive | E | | Delete month archive |
| 735 | 1 | uint16 | R | X23 | Fill level Month Archive | A | % | Fill level month archive |
| 812 | 1 | menu16 | W | X24 | Delete all archives | E | - | Deleting of all archives |
| MB reg | Reg. number | Data type | MB access | Coordinate | Name | Access | Unit | Description |
| 775 | 1 | uint16 | RW | Z04 | X:Y maximum Pulse Errors | E | X | Pulse compare X:Y maximum pulse errors |
| 776 | 1 | uint16 | RW | Z05 | X:Y maximum Pulses | E | Y | Pulse compare X:Y maximum pulses |
| 777 | 1 | uint16 | RW | Z15 | Code Word Input | N | COD | Code word input |
| 778 | 1 | uint16 | RW | Z16 | Code Word Change | C | C-V | Code word change |
| 779 | 1 | menu16 | RW | Z17 | Device Type | E | | Device type |
| 780 | 1 | menu16 | RW | Z24 | Display on max. | N | | Maximum time display on |
| 781 | 1 | menu16 | RW | Z25 | Volume Count Mode | E | | Selection mode of volume counter |
| 782 | 1 | menu16 | RW | Z26 | Curve Linearization | E | | Selection curve linearization |
| 783 | 1 | menu16 | RW | Z27 | Sensor Type 1 | E | | Selection turbine sensor channel 1 |
| 784 | 1 | menu16 | RW | Z28 | Sensor Type 2 | E | | Selection turbine sensor channel 2 |
| 785 | 1 | menu16 | RW | Z29 | Unit Volume | E | | Selection volume unit |

The Modbus access has the meaning:

R = no protection
 RW = calibration button

B Structure of the archives

In this appendix you will find more information about the archives:

- Archive size
- Archive types
 - Parameter archives
 - Event archives
 - Measured values archives
- Calculation of the storage size
- Archive header
- Reading the archive data via Modbus

B1 Archive size

The TME400 has an archive storage divided into the following archive types with the given archive sizes:

| | |
|--|--------------|
| Event archive | 200 Entries |
| Parameter archive (custody transfer) | 300 Entries |
| Parameter archive (non-custody transfer) | 300 Entries |
| Month archive | 25 Entries |
| Day archive | 100 Entries |
| Periodic archive | 9000 Entries |

B2 Archive types

Below is a list of further data on the parameter, event and measured value archives.

B2.1 Parameter archives

The parameter archive contains the history of all parameter changes. The time of the change and the old and the new parameter values are stored in the archive.

The parameter archives are divided into one archive each for custody transfer and non-custody transfer parameters.

Internal structure of an entry:

| Content | Data type | Length in Bytes |
|-------------------------|-----------|-------------------------|
| Position number | UINT16 | 2 |
| Unix time (device time) | UINT32 | 4 |
| Coordinate | UINT16 | 2 |
| Old parameter value | CHAR | 12 |
| New parameter value | CHAR | 12 |
| CRC16 (Modbus) | UINT16 | 2 |
| | | Total length: 34 |

Coordinate:

- High byte: column („A“-„Z“ as ASCII)
- Low byte: line

A value in the coordinate field 4103h corresponds to coordinate A 03.

B2.2 Event archives

The event archive stores error messages, warnings and notes that occurred or disappeared during operation of the TME400.

Internal structure of an entry:

| Content | Data type | Length in Bytes |
|-------------------------|-----------|-------------------------|
| Position number | UINT16 | 2 |
| Unix time (device time) | UINT32 | 4 |
| Event type | UINT16 | 2 |
| Event number | UINT16 | 2 |
| CRC16 (Modbus) | UINT16 | 2 |
| | | Total length: 12 |

Event type:

- High byte: type ('E' = error, 'W' = warning, 'H' = note)
- Low byte: 0 = Event passes, 1 = Event is coming

B2.3 Measured values archives

In the measured value archives, meter readings and average values of important measured variables are periodically stored.

There are three types of measured value archives implemented:

- Periodic archive (adjustable: 15, 30 or 60 minutes)
- Daily archive
- Monthly archive

Internal structure of an entry:

| Content | Data type | Length in Bytes |
|-------------------------|-----------|-------------------------|
| Position number | UINT16 | 2 |
| Unix time (device time) | UINT32 | 4 |
| Standard volume | UINT32 | 4 |
| Operating volume | UINT32 | 4 |
| Standard volume Error | UINT32 | 4 |
| Operating volume Error | UINT32 | 4 |
| Exponent (to base 10) | INT16 | 2 |
| Mean pressure | FLOAT | 4 |
| Mean temperature | FLOAT | 4 |
| Mean compressibility | FLOAT | 4 |
| Status | UINT16 | 2 |
| CRC16 (Modbus) | UINT16 | 2 |
| | | Total length: 40 |

B3 Calculation of the storage size

The total available storage for archives is 506880 bytes.

| Archive type | Bytes / entry | Amount entries | Sum in bytes |
|--|---------------|----------------|---------------|
| Parameter archive (custody transfer) | 34 | 300 | 10200 |
| Parameter archive (non-custody transfer) | 34 | 300 | 10200 |
| Event archive | 12 | 200 | 2400 |
| Periodic archive | 40 | 9000 | 360000 |
| Daily archive | 40 | 100 | 4000 |
| Monthly archive | 40 | 25 | 1000 |
| Sum | | | 387800 |

B4 Archive header

Each archive type contains an administration header that gives information about how to access the archive.

The header is arranged as follows:

| Content | Data type | Length in Bytes |
|--|-----------|------------------------|
| Position number of the next archive (largest value = 9999, then again = 0) | UINT16 | 2 |
| Index oldest entry | UINT16 | 2 |
| Index newest entry | UINT16 | 2 |
| CRC16 (Modbus) | UINT16 | 2 |
| | | Total length: 8 |

There are four headers for each archive type, which are organized in memory as ring buffers. This is to ensure that the information is stored safely in case of cell defects in the EEPROM. Each time a new archive entry is written, the corresponding archive header is updated and stored as the next entry in the ring buffer:

Empty header ring buffer at the beginning after writing a new entry:

| Storage index | |
|---------------|--|
| 0 | Archive header (Position number 1) -> Actual header |
| 1 | empty |
| 2 | empty |
| 3 | empty |

107

Ring buffer after the writing of four entries:

| Storage index | |
|---------------|--|
| 0 | Archive header (Position number 1) |
| 1 | Archive header (Position number 2) |
| 2 | Archive header (Position number 3) |
| 3 | Archive header (Position number 4) -> Actual header |

Ring buffer after the writing of six entries:

| Index | |
|-------|--|
| 0 | Archive header (Position number 5) |
| 1 | Archive header (Position number 6) -> Actual header |
| 2 | Archive header (Position number 3) |
| 3 | Archive header (Position number 4) |

Content of an empty header:

| Content | Data type | Value |
|-------------------------------------|-----------|-------|
| Position number of the next archive | UINT16 | 0 |
| Index of the oldest entry | UINT16 | FFFFh |
| Index of the newest entry | UINT16 | FFFFh |
| CRC16 | UINT16 | xxxxh |

Content of the header after the writing of the first archive entry:

| Inhalt | Data type | Value |
|-------------------------------------|-----------|-------|
| Position number of the next archive | UINT16 | 1 |
| Index of the oldest entry | UINT16 | 0 |
| Index of the newest entry | UINT16 | 0 |
| CRC16 | UINT16 | xxxxh |

Content of the header after the writing of the second archive entry:

| Content | Data type | Value |
|-------------------------------------|-----------|-------|
| Position number of the next archive | UINT16 | 2 |
| Index of the oldest entry | UINT16 | 0 |
| Index of the newest entry | UINT16 | 1 |
| CRC16 | UINT16 | xxxxh |

Content header after the writing of the 300th archive entry (archive full):

| Content | Data type | Value |
|-------------------------------------|-----------|-------|
| Position number of the next archive | UINT16 | 300 |
| Index of the oldest entry | UINT16 | 0 |
| Index of the newest entry | UINT16 | 299 |
| CRC16 | UINT16 | xxxxh |

Content header after the writing of the 301st archive entry (archive full, oldest entry overwritten in the ring buffer):

| Content | Data type | Value |
|-------------------------------------|-----------|-------|
| Position number of the next archive | UINT16 | 301 |
| Index of the oldest entry | UINT16 | 1 |
| Index of the newest entry | UINT16 | 0 |
| CRC16 | UINT16 | xxxxh |

Procedure for determining the indexes to be read in the archive:

- Reading all four archive headers of an archive type
- Recognizing the current header
- Determine the range to be read:
If "Index oldest entry" = FFFFh and
"Index newest entry" = FFFFh, then the corresponding archive is empty

If "Index oldest entry" = 0 and "Index newest entry" = 0, then
the archive contains an entry
- If "Index oldest entry" < "Index newest entry", then the
Number of entries = "Index newest entry" - "Index oldest entry" + 1
- If "Index oldest entry" > "Index newest entry", then the
No. of ent. = max. archive ent. - "Index older ent." + "Index newest ent." + 1
(Archive is always full: Number of entries = Maximum archive entries,
Calculation for the purpose of completeness only)

B5 Reading the archive data via Modbus

Archive entries are accessible via Modbus. The command 14h "Read General Reference" is used for this. This command can be used to index the storage ranges of the archives and the corresponding management headers (see document: "Modicon Modbus Protocol; Reference Guide (PI-MBUS-300 Rev. J)")

The TME400 only supports the processing of a sub-request within one request.

The structure of the request string is as follows:

| Byte | Meaning |
|------|-------------------------------------|
| 1 | Device address |
| 2 | Function (14h) |
| 3 | Number of bytes (07h) |
| 4 | Reference type (00h) |
| 5 | File number (Hi) |
| 6 | File number (Lo) |
| 7 | Start index (Hi) |
| 8 | Start index (Lo) |
| 9 | Number of registers to be read (Hi) |
| 10 | Number of registers to be read (Lo) |
| 11 | CRC (Lo) |
| 12 | CRC (Hi) |

The specified reference type in the request string is not checked in the TME400.

The following file number selects the archive or archive header to be read:

| File number | Archive type |
|-------------|--|
| 1 | Management header custody transfer parameter archive |
| 2 | Custody transfer parameter archive |
| 3 | Management header parameter archive |
| 4 | Parameter archive |
| 5 | Management header event archive |
| 6 | Event archive |
| 7 | Management header minutes archive |
| 8 | Minutes archive |
| 9 | Management header daily archive |
| 10 | Daily archive |
| 11 | Management header monthly archive |
| 12 | Monthly archive |

With the file address the index of the archive to be read is selected.

The number of registers of the bytes which are read from an archive entry (number of bytes = number of registers x 2). The maximum number of registers to be read is limited to 125 per request.

110

The following example shows the data to be read in a request:

- File number: 6 (Event archive, size: 12 Byte per entry)
- Start index: 7 (Read from index 7)
- Number of registers: 13

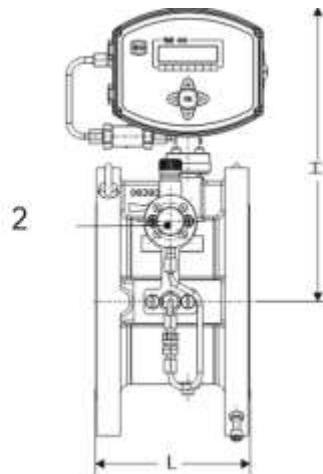
| Archive index | Modbus register | Internal storage address of the TME400 |
|---------------|-----------------|--|
| 7 | 1 (Hi) | 0 (+ Offset) |
| | 1 (Lo) | 1 (+ Offset) |
| | 2 (Hi) | 2 (+ Offset) |
| | 2 (Lo) | 3 (+ Offset) |
| | ... | ... |
| | 6 (Hi) | 10 (+ Offset) |
| | 6 (Lo) | 11 (+ Offset) |
| 8 | 7 (Hi) | 12 (+ Offset) |
| | 7 (Lo) | 13 (+ Offset) |
| | 8 (Hi) | 14 (+ Offset) |
| | 8 (Lo) | 15 (+ Offset) |
| | ... | ... |
| | 12 (Hi) | 22 (+ Offset) |
| | 12 (Lo) | 23 (+ Offset) |
| 9 | 13 (Hi) | 24 (+ Offset) |
| | 13 (Lo) | 24 (+ Offset) |

The example shows the reading of two complete event archive entries (index 7 and 8) and a part archive (2 bytes from index 9). In practice, it makes sense to request only complete archives. The above case is used exclusively to illustrate the mechanism.

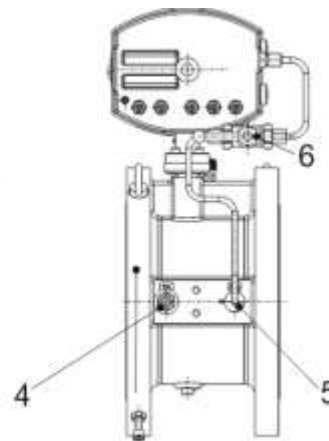
C Dimensions

TME400-VC

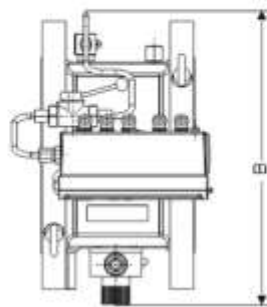
Front view



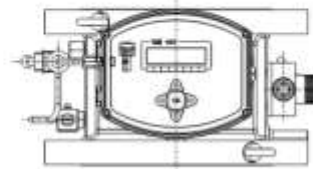
Rear side



7



8



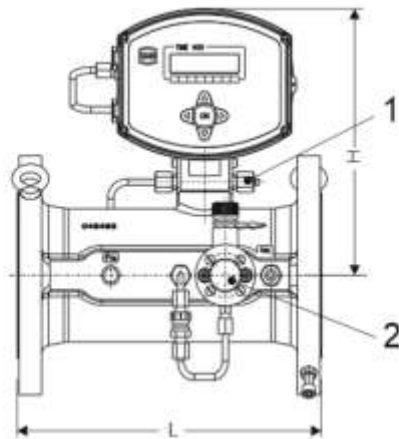
- 1 -
- 2 Oil pump
- 3 -
- 4 Temperature connection

- 5 Pressure connection
- 6 Ball valve
- 7 Top view
- 8 Top view for flow direction from bottom top up to DN200

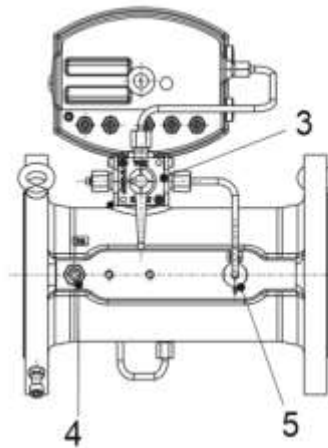
| Size | | Max. Flow rate Qmax m ³ /h | Dimensions | | | Weigth kg |
|------|------|---|------------|---------|---------|--|
| mm | Inch | | Length L | Width B | Hight H | |
| 50 | 2 | 65 | 150 | 235 | 262 | 15 |
| 80 | 3 | 160 | 120 | 265 | 290 | 18 |
| | | 250 | | | | |
| | | 400 | | | | |
| 100 | 4 | 250 | 150 | 285 | 310 | 24 |
| | | 400 | | | | |
| | | 650 | | | | |
| 150 | 6 | 650 | 175 | 325 | 330 | 40 |
| | | 1000 | | | | |
| | | 1600 | | | | |
| 200 | 8 | 1600 | 200 | 400 | 365 | 55 |
| | | 2500 | | | | |
| 250 | 10 | 1600 | 300 | 450 | 400 | ANSI150 = 65 PN10 = 60 PN25 = 71 |
| | | 2500 | | | | |
| | | 4000 | | | | |
| 300 | 12 | 4000 | 300 | 560 | 410 | ANSI150 = 100 PN10 = 90 PN25 = 105 |
| | | 6500 | | | | |
| | | 6500** | | | | |
| 400 | 16 | 6500 | 600 | 640 | 416 | PN16 = 186 PN40 = 275 |
| | | 10000 | | | | |

TME400-VCF

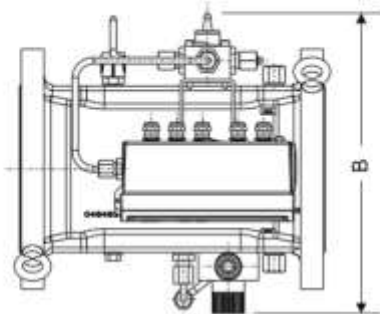
Front view



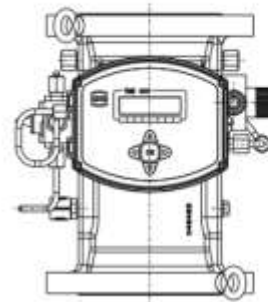
Rear side



7



8

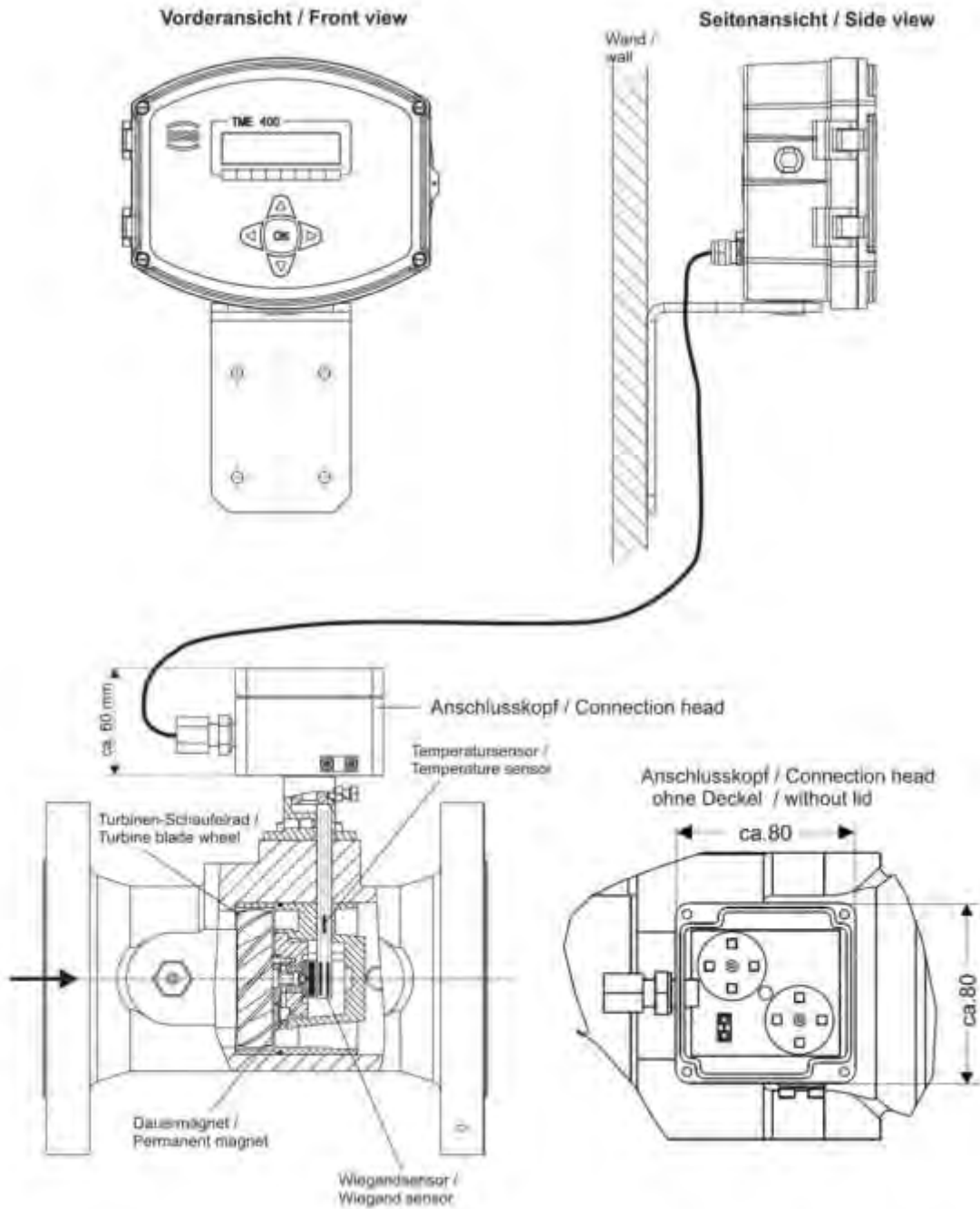


- 1 Pressure test connection
- 2 Oil pump
- 3 Three-way test valve
- 4 Temperature connection

- 5 Pressure connection
- 6
- 7 Top view
- 8 Top view for flow direction from bottom top up to DN200

| Size | | G-Size | Max. Flow rate Qmax m ³ /h | Dimensions | | | Weigth kg |
|------|------|----------|---|------------|---------|---------|---|
| mm | Inch | | | Length L | Width B | Hight H | |
| 50 | 2 | G65 | 65 | 150 | 320 | 310 | 15 |
| 80 | 3 | G100 | 160 | 240 | 270 | 250 | 20 |
| | | G160 | 250 | | | | |
| | | G250 | 400 | | | | |
| 100 | 4 | G160 | 250 | 300 | 285 | 254 | 28 |
| | | G250 | 400 | | | | |
| | | G400 | 650 | | | | |
| 150 | 6 | G400 | 650 | 450 | 310 | 280 | 50 |
| | | G650 | 1000 | | | | |
| | | G1000 | 1600 | | | | |
| 200 | 8 | G1000 | 1600 | 600 | 380 | 320 | 100 |
| | | G1600 | 2500 | | | | |
| 250 | 10 | G1000 | 1600 | 750 | | 345 | ANSI150 = 160 PN16 = 150 PN10 = 150 |
| | | G1600 | 2500 | | | | |
| | | G2500 | 4000 | | | | |
| 300 | 12 | G2500 | 4000 | 900 | | 360 | ANSI150 = 250 PN16 = 215 PN10 = 210 |
| | | G4000 | 6500 | | | | |
| | | G4000-45 | 6500** | | | | |

Remote meter



- Cable length: 10 m
- Pressure sensor: integrated in the connection head
- Height: approx. 80 mm less than the „normal“ height (see above)

D Measuring ranges for TME 400-VMF/ TME 400-VCF

Values for custody transfer metering according to MID approval with natural gas

116

| DN [mm] | G- value | Q _{max} [m ³ /h] | Flow [m ³ /h] at p _{min} =1 bar ^[1] MR ^[2] 1:20 | | Q _{min} [m ³ /h] depending on operating pressure p _{min} [bar(g)] | | | | | | | | | | | |
|------------|-------------|---|---|------------------|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | | Q _t | Q _{min} | MR 1:30 | | MR 1:50 | | MR 1:80 | | MR 1:100 | | MR 1:120 | | MR 1:160 | |
| | | | | | Q _{min} | p _{min} | Q _{min} | p _{min} | Q _{min} | p _{min} | Q _{min} | p _{min} | Q _{min} | p _{min} | Q _{min} | p _{min} |
| 50 | 65 | 100 | 20 | 5 ^[3] | | | | | | | | | | | | |
| | 100 | 160 | 32 | 8 ^[3] | 5 | 15 | 3,2 | 50 | | | | | | | | |
| 80 | 160 | 250 | 50 | 12,5 | 8 | 3 | 5 | 10 | 3,2 | 50 | | | | | | |
| | 250 | 400 | 80 | 20 | 13 | 3 | 8 | 10 | 5 | 25 | | | | | | |
| 100 | 160 | 250 | 50 | 12,5 | 8 | 3 | 5 | 25 | | | | | | | | |
| | 250 | 400 | 80 | 20 | 13 | 3 | 8 | 10 | 5 | 25 | | | | | | |
| | 400 | 650 | 130 | 32 | 20 | 3 | 13 | 4 | 8 | 10 | 6,5 | 15 | 5 | 25 | | |
| 150 | 400 | 650 | 130 | 32 | 20 | 3 | 13 | 10 | 8 | 25 | 6,5 | 40 | | | | |
| | 650 | 1000 | 200 | 50 | 32 | 3 | 20 | 4 | 13 | 10 | 10 | 15 | 8 | 25 | | |
| | 1000 | 1600 | 320 | 80 | 50 | 3 | 32 | 4 | 20 | 10 | 16 | 15 | 13 | 25 | 10 | 40 |
| 200 | 1000 | 1600 | 320 | 80 | 50 | 3 | 32 | 4 | 20 | 10 | 16 | 15 | 13 | 25 | 10 | 40 |
| | 1600 | 2500 | 500 | 125 | 80 | 3 | 50 | 4 | 32 | 10 | 25 | 15 | 20 | 25 | 16 | 40 |
| 250 | 1000 | 1600 | 320 | 80 | 50 | 3 | 32 | 10 | 20 | 25 | 16 | 40 | | | | |
| | 1600 | 2500 | 500 | 125 | 80 | 3 | 50 | 4 | 32 | 10 | 25 | 25 | 20 | 40 | 16 | 60 |
| | 2500 | 4000 | 800 | 200 | 130 | 3 | 80 | 4 | 50 | 10 | 40 | 25 | 35 | 40 | 25 | 60 |
| 300 | 2500 | 4000 | 800 | 200 | 130 | 3 | 80 | 4 | 50 | 10 | 40 | 25 | 35 | 40 | 25 | 60 |
| | 4000 | 6500 | 1300 | 320 | 220 | 3 | 130 | 10 | 80 | 25 | 65 | 40 | 55 | 60 | 40 | 80 |
| | 4000-45 | 6500 | 1300 | 320 | 220 | 3 | 130 | 10 | 80 | 25 | 65 | 40 | 55 | 60 | 40 | 80 |

[1] p = 1 bar; means atmospheric pressure

[2] MR = Measuring range = Q_{max} / Q_{min}

[3] MR: 1:20; for p ≥ 3 bar(g)

E Type plate

Main type plate TME400-VC for DN25, for Non-Ex, no custody transfer applications

| | | | |
|------------------|----------------------|---|-------------------------------|
| TME400-VC | | CE | |
| P | <input type="text"/> | bara | |
| DN | <input type="text"/> | | |
| Q max | <input type="text"/> | m ³ /h | T min <input type="text"/> °C |
| Q min | <input type="text"/> | m ³ /h | T max <input type="text"/> °C |
| PS | <input type="text"/> | 5 bar | |
| PS | <input type="text"/> | bar | IP65 |
| TS | <input type="text"/> | | |
| S.-Nr./S.-no. | <input type="text"/> | RMG Messtechnik GmbH | RMG |
| Jahr/Year | <input type="text"/> | Oben-Hafen-Str. 5 39100 Rottbach / Germany | |

117

Main type plate TME400-VC from DN40, for Non-Ex, no custody transfer applications

| | | | |
|------------------|----------------------|---|-------------------------------|
| TME400-VC | | CE 0091 | |
| P | <input type="text"/> | bara | T min <input type="text"/> °C |
| DN | <input type="text"/> | | T max <input type="text"/> °C |
| Q max | <input type="text"/> | m ³ /h | |
| Q min | <input type="text"/> | m ³ /h | |
| PS | <input type="text"/> | bar | IP65 |
| TS | <input type="text"/> | | |
| S.-Nr./S.-no. | <input type="text"/> | RMG Messtechnik GmbH | RMG |
| Jahr/Year | <input type="text"/> | Oben-Hafen-Str. 5 39100 Rottbach / Germany | |

Main type plate TME400-VC for DN25, for Ex, no custody transfer applications

| | | | | |
|---|----------------------|--|-------------------------------|--|
| TME400-VC | | CE 0158 | | II 2 G Ex ia IIC T4 Gb -25°C ≤ T _{amb} ≤ +55°C TÜV 17 ATEX 207566X IECEx TUN 18.0009 X |
| P | <input type="text"/> | bara | | |
| DN | <input type="text"/> | | | |
| Q max | <input type="text"/> | m ³ /h | T min <input type="text"/> °C | |
| Q min | <input type="text"/> | m ³ /h | T max <input type="text"/> °C | |
| PS <small>brennbare Gase flammable gas</small> | <input type="text"/> | 5 bar | | |
| PS <small>nichtbrennbare Gase non-flammable gas</small> | <input type="text"/> | bar | IP65 | |
| TS | <input type="text"/> | | | |
| S.-Nr./S.-no. | <input type="text"/> | | | |
| Jahr/Year | <input type="text"/> | | | |
| | | RMG Messtechnik GmbH Otto-Hahn-Str. 5 35510 Butzbach / Germany | | Elektrische Daten siehe EU-Baumusterprüfbescheinigung Electrical data see certificate |

Main type plate TME400-VC from DN40, for Ex, no custody transfer applications

| | | | | |
|------------------|----------------------|--|-------------------------------|--|
| TME400-VC | | CE 0091 0158 | | II 2 G Ex ia IIC T4 Gb -25°C ≤ T _{amb} ≤ +55°C TÜV 17 ATEX 207566X IECEx TUN 18.0009 X |
| P | <input type="text"/> | bara | T min <input type="text"/> °C | |
| DN | <input type="text"/> | | T max <input type="text"/> °C | |
| Q max | <input type="text"/> | m ³ /h | | |
| Q min | <input type="text"/> | m ³ /h | | |
| PS | <input type="text"/> | bar | IP65 | |
| TS | <input type="text"/> | | | |
| S.-Nr./S.-no. | <input type="text"/> | | | |
| Jahr/Year | <input type="text"/> | | | |
| | | RMG Messtechnik GmbH Otto-Hahn-Str. 5 35510 Butzbach / Germany | | Elektrische Daten siehe EU-Baumusterprüfbescheinigung Electrical data see certificate |

F Seal diagrams

The following figures show the positions of the seals on the TME400.

Front side



Security seal
Sicherheitsplombe

Back side



Seal cap with lead seal
Siegelkappe mit Bleiplombe

In the electronic enclosure



Security seal
Sicherheitsplombe

At the connection head



Sicherheitsplombe
Security seal

G Later installation of the power module

⚠ Caution

The power module must only be installed in a de-energized state.

120

In order to switch of any power supply the battery must be removed (see *chapter Fehler! Verweisquelle konnte nicht gefunden werden.3.1.4 Battery replacement*) and any external supply voltage must be switched off, i.e. in the case of an external supply, the wires from terminals X6 / +Uext and X6 / -Uext must be removed.

The power module (3) must be plugged on as shown in *Figure 1: Electronic with power module*. The current module is factory adjusted and **does not need** to be calibrated before operation.

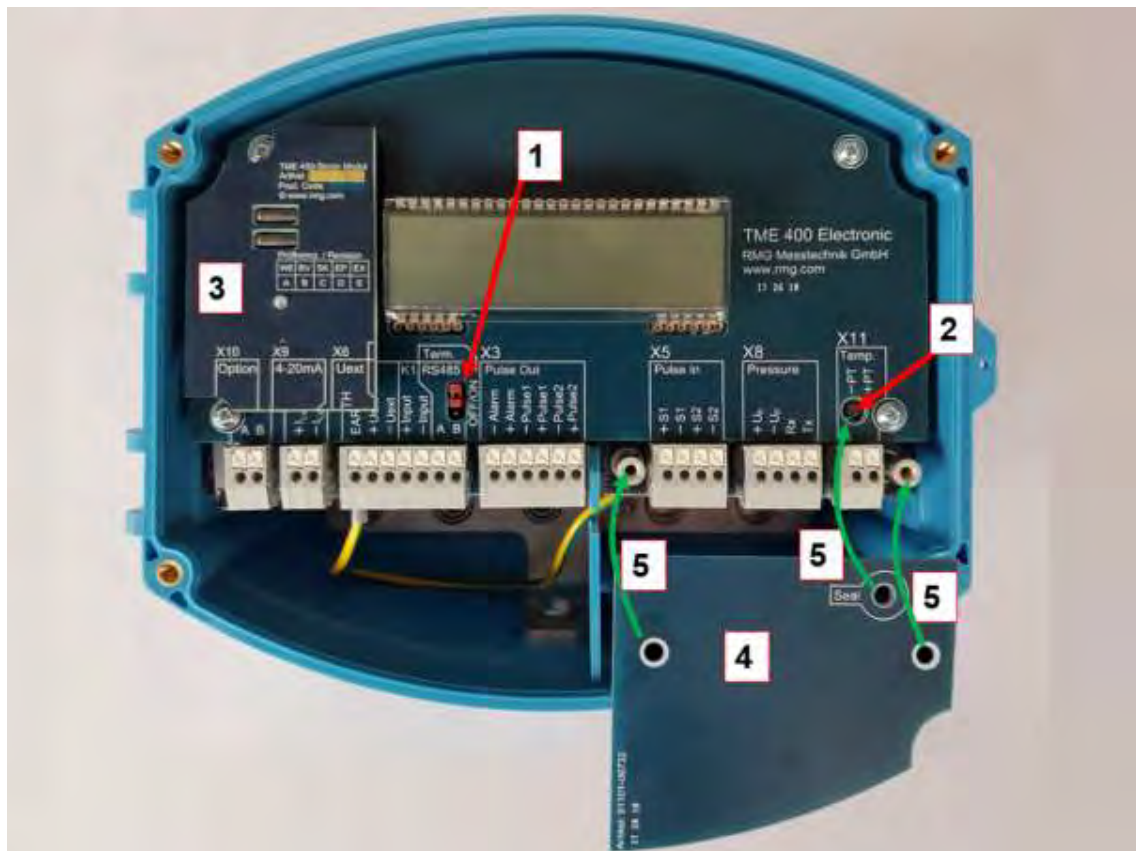



Figure 1: Electronic with power module

- 1 Jumper for RS 485 terminating resistor. Bridged: with 120 Ω ; open: $\infty \Omega$
- 2 Calibration switch
- 3 Current module board
- 4 Cover plate for pressure and temperature sensor and calibration switch

5 Normal position, indicated by green arrows

Putting the power module into operation

After reconnecting the TME400 supply voltages, the current loop power supply must be connected to X9 and the current output parameterized.

| |
|--|
|  Caution |
| <p>The voltages of the current loop and the external supply must be electrically isolated (galvanically isolated see <i>chapter 2.1 Electrical connections</i>, especially the connection drawings in the Ex- /Non-Ex area at the end of the chapter).</p> |

Parameterization of the current module

To complete the installation, various parameters must be checked or configured. To do this, the parameter protection must be removed, either by entering the code word (see *chapter 4.3.3.10 Settings*) or by pressing the calibration button (see *Figure 1: Electronic with power module*).

1. First the date and time must be entered in the coordinates X1 and X2
2. The current output parameters F02, F03, F04, F05 (see *chapter 4.3.3.6 Current output*) must then be parameterized according to the application.

For example, a typical parameterization may look like this:

| | | |
|------|-----|------------------------------------|
| F02: | 1 | Without error |
| F03: | 1 | Operating flow rate |
| F04: | 0 | i.e. 4 mA = 0 m ³ /h |
| F05: | 200 | i.e. 20 mA = 200 m ³ /h |

For testing, F03 can be set to 0 (default) and a current value in the range of 4 - 20mA can be selected with F06.

H Spare parts and accessories

| Order number | Description |
|--------------|-------------|
|--------------|-------------|

Mechanical components

| | |
|--------------|--------------------------------------|
| 00.49.511.14 | Thermowell G1/2"-G1/4" EL=63TA=100 |
| 00.55.518.14 | Thermowell G1/4" EL=42 TA=70 T |
| 00.55.523.14 | Thermowell G1/4" EL=33 TA=70 T |
| 00.59.545.14 | Thermowell G1/4" M14x1,5 TA=110 |
| 00.59.618.14 | Thermowell 1/2"-3/4"NPT TA=110 |
| 00.59.619.14 | Thermowell 1/2"-3/4"NPT TA=135 |
| 00.59.665.14 | Thermowell M14x1,5 TA=125 |
| 84.08.021.00 | Check valve compl. RHD06L3BLUFTCF |
| 90.59.266.00 | Piston pump+adjusting screw+oil tank |
| 00.66.960.00 | Remote totalizer |

Elektronical components

| | |
|--------------|---|
| 98800-16590 | NonEx TME current module 4-20mA passive |
| 38.02.016.00 | EExi supply f.4-20mA current output |
| 86.98.211.01 | Power supply 24V/DC 1.4A surface mounted |
| 86.98.249.00 | Ex-i power supply 24 V |
| 30.00.619.00 | Transmitter power supply KFD2-STC5-1 |
| 30.00.733.00 | Transmitter power supply KFD2-STC5-Ex1 |
| 35.00.013.00 | Isolating amplifier TURCK IM1-12-T |
| 30.00.019.00 | Interface/pulse separating module Datcom K3 |
| 35.00.000.00 | PS (230V/AC - 12V/DC) for K3 module |
| 86.76.553.00 | OMRON DC/DC adapter for Datcom K3 |

Expendable materials

| | |
|--------------|---------------------------------|
| 92102-00200 | Power supply battery |
| 38.11.148.01 | Lubricant 2-4°E/20°C TRZ/DKZ 1L |
| 38.11.148.05 | Lubricant 2-4°E/20°C TRZ/DKZ 5L |

I Certificates and approvals

The **TME400** is approved for custody-transfer measurements. Approvals are available for operation in hazardous environments and for the Pressure Equipment Directive, which are provided as copies in the appendix.

1. EU Declaration of Conformity
2. NMI Evaluation Certificate
3. ATEX
4. IECEx
5. EU-Type Examination Certificate Directive 2014/34/EU
6. PED Module D
7. EU-Type Examination Certificate Module B Directive 2014/68/EU
8. Production Quality Assurance

Reliable Measurement of Gas



EU-Declaration of Conformity
EU-Konformitätserklärung



We **RMG Messtechnik GmbH**
 Wir *Otto – Hahn – Straße 5*
35510 Butzbach
Germany

Declare under our sole responsibility that the product is in conformity with the directives. Product is labeled according to the listed directives and standards and in accordance with the Type-Examination
Erklären in alleiniger Verantwortung, dass das Produkt konform ist mit den Anforderungen der Richtlinien. Das entsprechend gekennzeichnete Produkt ist nach den aufgeführten Richtlinien und Normen hergestellt und stimmt mit dem Baumuster überein

Product **Turbine Meter TME400VM / Volume Corrector TME400VC**
 Produkt *Turbinenredgaszähler TME400VM / Zustandsmengenurwörter TME400VC*

| Harmonisation Legislations <i>Harmonisierungs-richtlinievorschriften</i> | EMV | ATEX | PED |
|--|---|---|--|
| EU- Directives <i>EU-Richtlinie</i> | 2014/30/EU | 2014/34/EU | 2014/68/EU |
| Marking <i>Kennzeichnung</i> | — | II 2G Ex ia IIC T4 Gb | — |
| Normative Documents <i>Normative Dokumente</i> | EN 61000-6-3:2012 EN 61000-4-2:2009 EN 61000-4-3:2011 EN 61000-4-4:2013 EN 61000-4-5:2015 EN 61000-4-6:2014 EN 61000-4-8:2010 EN 61000-6-29:2001 | EN 60079-0:2012 + A11:2013 EN 60079-11:2012 | AD 2000 – Merkblätter |
| EC Type-Examination issued by <i>EG-Baumusterprüfung ausgestellt durch</i> | Prüfbericht/ Test Report: 1-5657/17-01-03_A (Fa. CTC advanced) | TÜV 17 ATEX 207566 X TÜV Nord CERT GmbH Germany | ISG-22-12-1979_Rev. M TÜV Hessen Germany |
| Approval of a Quality System by <i>Anerkennung eines Qualitätssicherungs-systems durch</i> | — | Modul D BVS 17 ATEX ZQS/E139 Notified Body: 0158 DEKRA EXAM Germany | Modul D 73 202 2839 Notified Body: 0091 TÜV Hessen Germany |

RoHS
 2011/65/EU
 The object of the declaration described above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
Der oben beschriebene Gegenstand der Erklärung erfüllt die Vorschriften der Richtlinie 2011/65/EU des Europäischen Parlaments und des Rates vom 8. Juni 2011 zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten.

RMG Messtechnik GmbH
 Butzbach, den 04.09.2019

Thorsten Dietz, Managing Director

Sascha Körner, Technical Manager


*Sitz der Gesellschaft Butzbach • Amtsgericht Friedberg 1100 310
 Geschäftsführung: Thorsten Dietz
 Qualitätsmanagement (QMS) (DIN ISO 9001:2015)*

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Evaluation Certificate


Number **TC11907** revision 0
Project number 2249056
Page 1 of 1



| | |
|---|--|
| Issued by | NMI Certin B.V.; |
| In accordance with | <ul style="list-style-type: none"> - WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring Instruments under the MID" - European Standard EN 12405-1:2005+A2:2010 "Gas meters – Conversion devices – Part 1: volume conversion". |
| Producer | RMG Messtechnik GmbH Otto-Hahn-Straße 5 35510 Butzbach Germany |
| Part | A calculating and indicating device , intended to be used as part of an electronic gas-volume conversion device (EVCD) or gas meter. |
| Type | TME400-VCF (config. 1a/1b*) TME400-VMF (config. 2a/2b*) |
| Manufacturer's mark or name | RMG |
| Conversion principle (config. 1a/1b*) | T, PT or PTZ |
| Conversion principle (config. 2a/2b*) | None (* see description page 1) |
| Ambient temperature range | -25 °C / +55 °C |
| Designed for | Condensing and non-condensing humidity |
| Environment classes | M2 / E2 |
| The intended location for the instrument is open. | |
| Further properties are described in the annexes: | <ul style="list-style-type: none"> - Description TC11907 revision 0; - Documentation folder TC11907-1. |

| | |
|--|--|
| Issuing Authority | NMI Certin B.V., Notified Body number 0122 4 September 2020 |
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| | | | |
|--|---|--|---|
|  | | EU-type examination certificate | |
| | | Number T11741 revision 0 Project number 2341823 Page 1 of 1 | |
| Issued by | NMI Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity modules mentioned in article 17 of Directive 2014/32/EU, after having established that the Measuring instrument meets the applicable requirements of Directive 2014/32/EU, to: | | |
| Manufacturer | RMG Messtechnik GmbH Otto-Hahn-Strasse 5 D-35510, Butzbach Germany | | |
| Measuring instrument | A Turbine Gas Meter with optional EVCD | | |
| | Types | TME400-VCF TME400-VMF | |
| | Manufacturer's mark or name | RMG Messtechnik | |
| | Destined for the measurement of | Gas volume | |
| | Accuracy class Turbine meter | Class 1,0 | |
| | Environment classes | M1 / E2 | |
| | Environment temperature range | -25 °C / +55 °C | |
| | Gas temperature range | -25 °C / +55 °C | |
| | Further properties are described in the annexes: - Description T11741 revision 0; - Documentation folder T11741-1. | | |
| Valid until | 4 September 2030 | | |
| Issuing Authority | NMI Certin B.V., Notified Body number 0122 4 September 2020 | | |
| | Certification Board | | |
| NMI Certin B.V. Thijsseweg 11 2629 JA Delft The Netherlands T +31 88 836 2332 certin@nmi.nl www.nmi.nl | This document is issued under the provision that no liability is accepted and that the manufacturer shall indemnify third-party liability. | Reproduction of the complete document only is permitted. |  |
| | The designation of NMI Certin B.V. as Notified Body can be verified at: http://ec.europa.eu/governance/ce-marking/ndb/index.cfm | This document is digitally signed and sealed. The digital signature can be verified in the blue ribbon at the top of the electronic version of this certificate. | |



EU-type examination certificate

Number **T11742** revision 0
Project number 2249056
Page 1 of 1

| | | | | | | | | | | | | | |
|-----------------------------|---|------|-------------------------------|-----------------------------|-------|----------------------|----------------|---------------------------|-----------------|--------------|---------------------------|---------------------|-----------|
| Issued by | NMI Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity modules mentioned in article 17 of Directive 2014/32/EU, after having established that the Measuring instrument meets the applicable requirements of Directive 2014/32/EU, to: | | | | | | | | | | | | |
| Manufacturer | RMG Messtechnik GmbH Otto-Hahn-Straße 5 35510 Butzbach Germany | | | | | | | | | | | | |
| Measuring instrument | An electronic gas-volume conversion device (EVCD) , intended to be used for gas volume conversion as a sub-assembly (according to article 4 of the MID) of a gas meter. | | | | | | | | | | | | |
| | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Type</td> <td>- TME400-VCF (config. 1a/1b*)</td> </tr> <tr> <td>Manufacturer's mark or name</td> <td>- RMG</td> </tr> <tr> <td>Conversion principle</td> <td>- T, PT or PTZ</td> </tr> <tr> <td>Ambient temperature range</td> <td>-25 °C / +55 °C</td> </tr> <tr> <td>Designed for</td> <td>- non-condensing humidity</td> </tr> <tr> <td>Environment classes</td> <td>- M2 / E2</td> </tr> </table> <p>The intended location for the instrument is open.</p> | Type | - TME400-VCF (config. 1a/1b*) | Manufacturer's mark or name | - RMG | Conversion principle | - T, PT or PTZ | Ambient temperature range | -25 °C / +55 °C | Designed for | - non-condensing humidity | Environment classes | - M2 / E2 |
| Type | - TME400-VCF (config. 1a/1b*) | | | | | | | | | | | | |
| Manufacturer's mark or name | - RMG | | | | | | | | | | | | |
| Conversion principle | - T, PT or PTZ | | | | | | | | | | | | |
| Ambient temperature range | -25 °C / +55 °C | | | | | | | | | | | | |
| Designed for | - non-condensing humidity | | | | | | | | | | | | |
| Environment classes | - M2 / E2 | | | | | | | | | | | | |
| | <p>Further properties are described in the annex: - Description T11742 revision 0.</p> | | | | | | | | | | | | |
| Valid until | 4 September 2030 | | | | | | | | | | | | |

| | |
|-------------------|---|
| Issuing Authority | NMI Certin B.V., Notified Body number 0122 04 September 2020 |
| | <p style="text-align: center;">Certification Board</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>NMI Certin B.V. Thijsseweg 11 2629 JA Delft The Netherlands T +31 88 836 2332 certin@nmi.nl www.nmi.nl</p> </div> <div style="width: 35%;"> <p>This document is issued under the provision that no liability is accepted and that the manufacturer shall indemnify third-party liability.</p> <p>The designation of NMI Certin B.V. as Notified Body can be verified at http://ec.europa.eu/governance/certification/</p> </div> <div style="width: 30%;"> <p>Reproduction of the complete document only is permitted.</p> <p>This document is digitally signed and sealed. The digital signature can be verified in the blue ribbon at the top of the electronic version of this certificate.</p> </div> </div> <div style="text-align: right; margin-top: 10px;">  </div> |

TÜV NORD CERT GmbH
Langemarckstr 20
45141 Essen



ATEX Prüfungsbericht

18 203 207566 vom 05.07.2018

Auftraggeber: RMG Messtechnik GmbH
Otto-Hahn-Straße 5
35510 Butzbach

Auftragsnummer: 8000476316

ZA Nummer: 35207566

Prüfgegenstand: Elektronischer Gasmengenumwerter Typ VC, VM, VCF, VMF

Beurteilungsgrundlagen: EN 60079-0:2012 Allgemeine Bestimmungen
+A11:2013
EN 60079-11:2012 Geräteschutz durch Eigensicherheit "I"

Prüflabor: TÜV NORD CERT GmbH
Büro Hannover
Am TÜV 1
30519 Hannover

Ort der Prüfung: Siehe oben

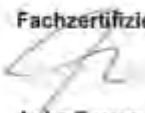
Eingangsdatum des Prüfgegenstandes: H/2017/2341 und H/2018/2384

Datum der Prüfung: bis 05.07.2018

Interpretationen: Das Testergebnis bestätigt die Übereinstimmung des Gerätes mit den Anforderungen der oben genannten Beurteilungsgrundlagen

Prüfung:

Klaus Hoferichter

Fachzertifizierung:

Anke Drews

Dieser Bericht umfasst 6 Seiten

Dieser technische Bericht stellt das Ergebnis der Prüfung an dem vorgestellten Prüfgegenstand dar. Eine allgemein gültige Aussage über die Qualität der Produkte aus der laufenden Fertigung kann daraus nicht abgeleitet werden. Die auszugsweise Vervielfältigung dieses technischen Berichts und die Verwendung zu Werbezwecken bedürfen der schriftlichen Genehmigung des Prüflaboratoriums.

PI 7-F-100 05.15



1. Auftragsbeschreibung:

Prüfung des Gerätes „Elektronischer Gasmengenumwerter TME 400 Typ VC, VM, VCF, VMF“ und Ausstellen einer EU-Baumusterprüfbescheinigung und eines IECEx Certificate of Conformity

2. Spezifikation des Prüfgegenstandes:

Der elektronische Gasmengenumwerter TME 400 Typ VC, VM, VCF, VMF ist ein Gerät zur Verwendung in durch Gas explosionsgefährdeten Bereichen. Es dient zur Gasmessung, Steuerung und Regelung durch die Bestimmung von Druck, Temperatur und Volumenimpulsen.

Der zulässige Umgebungstemperaturbereich beträgt -25 °C ... 55 °C.

Elektrische Daten

Versorgungsstromkreis in Zündschutzart Eigensicherheit Ex ia IIC.
(Terminal X6; 2 and 3) Nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis
Höchstwerte:
U_i = 10,7 V
I_i = 219 mA
P_i = 325 mW
Wirksame innere Kapazität: C_i = 7 nF
Wirksame innere Induktivität: L_i = 300 µH

Versorgungsstromkreis Batterie Verbindung zu interner Batterie
intern Saft, type LS33600, 17 Ah oder
(Steckverbinder X12; 1 und 2) XENO, type XL 205-F, 19 Ah

Signaleingang in Zündschutzart Eigensicherheit Ex ia IIC
(Klemmen X6; 4 und 5) Höchstwerte:
U_o = 5,9 V
I_o = 3 mA
P_o = 5 mW
Kennlinie: linear

| Ex ia | IIC | | |
|-------------------------------------|---------|---------|---------|
| höchstzulässige äußere Induktivität | 0,2 mH | 0,1 mH | 0,05 mH |
| höchstzulässige äußere Kapazität | 4100 nF | 5000 nF | 6200 nF |

RS 485 und Signaleingang in Zündschutzart Eigensicherheit Ex ia IIC
(Klemmen X6; 6 und 7) Höchstwerte:
U_o = 5,9 V
I_o = 60 mA
P_o = 88 mW
Kennlinie: linear

| Ex ia | IIC | | |
|-------------------------------------|---------|---------|---------|
| höchstzulässige äußere Induktivität | 1,7 mH | 0,7 mH | 0,2 mH |
| höchstzulässige äußere Kapazität | 2100 nF | 2800 nF | 3100 nF |



Pulsausgang in Zündschutzart Eigensicherheit Ex ia IIC
 (Terminals X3; 1 ... 6)
 Höchstwerte:
 $U_a = 5,9 \text{ V}$
 $I_a = 2 \text{ mA}$
 $P_a = 3 \text{ mW}$

| Ex ia | IIC | | |
|----------------------------------|-------------------------------------|---------|---------|
| | höchstzulässige äußere Induktivität | 0,2 mH | 0,1 mH |
| höchstzulässige äußere Kapazität | 4100 nF | 5000 nF | 6200 nF |

Pulsausgang in Zündschutzart Eigensicherheit Ex ia IIC
 (Klemmen X3; 1 ... 6)
 Nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis
 Höchstwerte:
 $U_i = 30 \text{ V}$
 $I_i = 120 \text{ mA}$
 $P_i = 1,2 \text{ W}$
 Wirksame innere Kapazität: $C_i = 3 \text{ nF}$
 Die wirksame innere Induktivität ist vernachlässigbar klein.

Stromausgang in Zündschutzart Eigensicherheit Ex ia IIC
 (Klemmen X9; 1 und 2)
 Nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis
 Höchstwerte:
 $U_i = 28 \text{ V}$
 $I_i = 110 \text{ mA}$
 $P_i = 805 \text{ mW}$
 Wirksame innere Kapazität: $C_i = 2 \text{ nF}$
 Wirksame innere Induktivität: $L_i = 300 \text{ } \mu\text{H}$

Optionaler Pulsausgang in Zündschutzart Eigensicherheit Ex ia IIC
 (Klemmen X9; 1 und 2)
 Höchstwerte:
 $U_a = 5,9 \text{ V}$
 $I_a = 1 \text{ mA}$
 $P_a = 1 \text{ mW}$

| Ex ia | IIC | | |
|----------------------------------|-------------------------------------|---------|---------|
| | höchstzulässige äußere Induktivität | 0,2 mH | 0,1 mH |
| höchstzulässige äußere Kapazität | 4100 nF | 5000 nF | 6200 nF |



Impulseingang Reed/Wiegand, intern in Zündschutzart Eigensicherheit Ex ia IIC
(Klemmen X5; 1 ... 4)

Höchstwerte:
 $U_o = 5,9 \text{ V}$
 $I_o = 8 \text{ mA}$
 $P_o = 8 \text{ mW}$
 Kennlinie: linear

| Ex ia | IIC | | |
|-------------------------------------|---------|---------|---------|
| höchstzulässige äußere Induktivität | 20 mH | 10 mH | 5 mH |
| höchstzulässige äußere Kapazität | 1800 nF | 1900 nF | 2100 nF |

Drucksensor-Stromkreis, intern in Zündschutzart Eigensicherheit Ex ia IIC
(Klemmen X8; 1 ... 4)

Höchstwerte:
 $U_o = 5,9 \text{ V}$
 $I_o = 100 \text{ mA}$
 $P_o = 148 \text{ mW}$
 Kennlinie: linear

| Ex ia | IIC | |
|-------------------------------------|------------------|------------------|
| höchstzulässige äußere Induktivität | 30 μH | 25 μH |
| höchstzulässige äußere Kapazität | 4100 nF | 2000 nF |
| Sensor | UTC30 | TI-1 |

Pt1000 Temperatureingang, intern in Zündschutzart Eigensicherheit Ex ia IIC
(Klemmen X11; 1 und 2)

Höchstwerte:
 $U_o = 5,9 \text{ V}$
 $I_o = 9 \text{ mA}$
 $P_o = 13 \text{ mW}$
 Kennlinie: linear

| Ex ia | IIC | | |
|-------------------------------------|---------|---------|---------|
| höchstzulässige äußere Induktivität | 0,5 mH | 0,2 mH | 0,1 mH |
| höchstzulässige äußere Kapazität | 3200 nF | 4000 nF | 4900 nF |

Alle Höchstwerte L_o and C_o Werte dürfen auch als konzentrierte Induktivitäten und Kapazitäten ausgenutzt werden.

Aus sicherheitstechnischer Sicht sind alle eigensicheren Stromkreise galvanisch miteinander über das GND-Potential verbunden und sicher galvanisch vom Erdpotential getrennt.

Bei der Zusammenschaltung von eigensicheren Stromkreisen sind die Regeln für die Zusammenschaltung von eigensicheren Stromkreisen zu beachten.

3. Kennzeichnung des Prüfgegenstandes und Typenschild (unverändert):



II 2 G Ex ia IIC T4 Gb

Seite 5 von 6 des ATEX Prüfungsberichts Nr. 18 203 207566

**4. Erläuterungen zu den Beurteilungsgrundlagen:**

Das o. g. Gerät wurde nach den auf der ersten Seite genannten Normen beurteilt.
Bezüglich der Normen

IEC 60079-0: 2011 General requirements

IEC 60079-11: 2011 Equipment protection by intrinsic safety "i"

existieren die in Abschnitt 5. genannten Dokumente.

Die Kennzeichnung gemäß der Richtlinie 2014/34/EU unterscheidet sich von der Kennzeichnung gemäß den o. g. Normen (siehe 3. Kennzeichnung des Prüfgegenstandes).

5. Prüfergebnis:

Die einzelnen Prüfungen sind in dem folgenden Test Report gelistet:

PrüfgrundlageIEC 60079-0:2011, 6th Edition.IEC 60079-11:2011, 6th Edition**ExTR Free Reference
No.**

18 217 207567

6. Eingereichte Dokumentation:

| Zeichnung Nr. | Bezeichnung. | Rev. Stand. | Datum. |
|---------------------|---|-------------|------------------------------|
| - | Ex- Description for TME400 (30 Seiten) | 1.3 | 2018-03-28 |
| 98800-16924 Ex | "Ex-Blockschaltbild" | 1.3 | 2018-03-29 |
| 066062.1 | "Elektronisches Zählwerk TME400" | a | 2018-02-28 |
| 066151.4 | "Hauptschild TME400 " | b | 2018-04-03 |
| 066564.4 | "Hauptschild TME400 " | b | 2018-04-03 |
| 066667.4 | "Hinweisschild TME400 " | - | 2018-04-12 |
| 98800-16294 | Turbine Meter Electronic (13 Seiten) | 4 | 2018-04-15 |
| 98800-16294 | Parts list (2 Seiten) | - | 2018-06-27 |
| 98800-16294 | Turbine Meter Electronic TME 400 Controller (10 Seiten) | 4 | 2018-04-15 and 2018-03-16 |
| 98800-16374 | Turbine Meter Electronics (2 Seiten) | 4 | 2018-06-05 |
| 98800-16374 | Parts list | - | 2018-06-11 |
| 98800-16374 | Turbine Meter Electronics TME 400 Stromausgang ... (7 Seiten) | 4 | 2018-06-05 |
| 98800-17080 | Turbine Meter Electronics + Parts list (2 Seiten) | 3 | 2017-10-15 |
| PBB NO.:91101-06830 | Turbine Meter Electronics TME 400 -PWM_Adp. (5 Seiten) | A | 2017-10-15 |



| Zeichnung Nr. | Bezeichnung | Rev. Stand | Datum |
|---------------------|--|------------|------------------------------|
| 98800-17002 | Turbine Meter Electronic WIKA Drucksensor Adapter | 2 | 2018-05-15 |
| 98800-17002 | Parts list | - | 2018-06-27 |
| 98800-17002 | Turbine Meter Electronic TME 400 Wika Adapter ... (8 Seiten) | 2 | 2018-05-15 and 2018-04-11 |
| 98800-18991 | Turbine Meter Electronic Backlight | 1 | 2017-10-25 |
| 98800-18992 | Parts list | - | 2018-04-16 |
| 98800-18992 | Turbine Meter Electronic TME 400 Beleuchtung (5 Seiten) | 2 | 2018-04-10 |
| PCB NO. 91101-06722 | Turbine Meter Electronic Electronic Abdeckung Top Assembly Drawing | 2 | 2018-04-12 |

7. Hinweise für Errichtung und Betrieb:


1. Für die Gehäuseteile sind elektrostatische Aufladungen zu vermeiden. Das Warnschild ist zu beachten.
2. Die Erdungsklemme ist mit dem Potentialausgleich im explosionsgefährdeten Bereich zu verbinden.

8. Umgebungsbedingungen:

Temperatur: Siehe zugehöriger Test Report
 Luftfeuchtigkeit: Nicht erforderlich

— Ende des ATEX Prüfungsberichtes —

| | | | |
|---|--|---|---|
| | | <h2>IECEX Certificate of Conformity</h2> | |
| <p>INTERNATIONAL ELECTROTECHNICAL COMMISSION IEC Certification Scheme for Explosive Atmospheres <small>For rules and details of the IECEX Scheme visit www.iecex.com</small></p> | | | |
| Certificate No.: | IECEX TUN 18.0009X | Issue No.: | 0 |
| Status: | Current | <u>Certificate history:</u> Issue No. 0 (2018-07-25) | |
| Date of Issue: | 2018-07-25 | Page 1 of 3 | |
| Applicant: | RMG Messtechnik GmbH Otto-Hahn-Straße 5 35510 Butzbach Germany | | |
| Equipment: | Electronic gas value corrector TME400 type VC, VM, VCF, VMF | | |
| Optional accessory: | | | |
| Type of Protection: | Intrinsic Safety "i" | | |
| Marking: | Ex ia IIC T4 Gb | | |
| Approved for issue on behalf of the IECEX Certification Body: | Frank Hiller | | |
| Position: | Deputy Head of the Certification Body | | |
| Signature: (for printed version) | _____ | | |
| Date: | _____ | | |
| 1. This certificate and schedule may only be reproduced in full. 2. This certificate is not transferable and remains the property of the issuing body. 3. The Status and authenticity of this certificate may be verified by visiting the Official IECEX Website . | | | |
| Certificate issued by: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>TÜV NORD CERT GmbH Hanover Office Am TÜV 1, 30519 Hannover Germany</p> </div> <div style="text-align: center;"> </div> </div> | | | |

| | | | |
|--|---|---|---|
|  | | <h2 style="margin: 0;">IECEX Certificate of Conformity</h2> | |
| Certificate No: | IECEX TUN 19.0009X | Issue No: | 0 |
| Date of Issue: | 2018-07-25 | Page 2 of 3 | |
| Manufacturer: | RMG Otto-Hahn-Straße 5 35510 Butzbach Germany | | |
| Additional Manufacturing location(s): | | | |
| This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEX Quality system requirements. This certificate is granted subject to the conditions as set out in IECEX Scheme Rules, IECEX 02 and Operational Documents as amended. | | | |
| STANDARDS: | | | |
| The apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards. | | | |
| IEC 60079-0 : 2011 Edition:6.0 | Explosive atmospheres - Part 0: General requirements | | |
| IEC 60079-11 : 2011 Edition:6.0 | Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "I" | | |
| This Certificate does not indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above. | | | |
| TEST & ASSESSMENT REPORTS: | | | |
| A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in | | | |
| Test Report: | | | |
| DE/TUN/ExTR18 0018/00 | | | |
| Quality Assessment Report: | | | |
| DE/EVS/QARR6 0011/07 | | | |

| IEC | | IECEX | | IECEX Certificate of Conformity | |
|--|--------------------|-------------|---|------------------------------------|--|
| Certificate No: | IECEX TUN 18.0009X | Issue No: | 0 | | |
| Date of Issue: | 2018-07-25 | Page 3 of 3 | | | |
| Schedule | | | | | |
| EQUIPMENT: | | | | | |
| <i>Equipment and systems covered by this certificate are as follows:</i> | | | | | |
| The electronic gas value corrector TME400 type VC, VM, VCF is an apparatus for use in gas explosion hazardous areas. | | | | | |
| It is used for gas measuring, control and regulating purposes by detection of pressure, temperature and volume pulses. | | | | | |
| The permissible ambient temperature range is -25 °C ... 55 °C | | | | | |
| See attachment for details. | | | | | |
| SPECIFIC CONDITIONS OF USE: YES as shown below: | | | | | |
| 1. Electrostatic charge has to be avoided for all housing parts. The warning label has to be observed. | | | | | |
| 2. The earth terminal has to be connected with the potential equalization in the explosion hazardous area. | | | | | |
| Annex: | | | | | |
| Attachment_TUN_18.0009X_TME400.pdf | | | | | |

TÜV NORD CERT GmbH
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 30519 Hannover
 Germany



Page 1 of 4
 Attachment to IECEx TUN 18.0009 X issue No.: 0

Product:

The electronic gas value corrector TME 400 type VC, VM, VCF,VMF is an apparatus for use in gas explosion hazardous areas. It is used for gas measuring, control and regulating purposes by detection of pressure, temperature and volume pulses.

The permissible ambient temperature range is -25 °C... 55 °C

Electrical data

Supply circuit in type of protection Intrinsic Safety Ex ia IIC
 (Terminal X6; 2 and 3) Only for connection to a certified intrinsically safe circuit
 Maximum values:
 $U_i = 10.7 \text{ V}$
 $I_i = 219 \text{ mA}$
 $P_i = 325 \text{ mW}$
 Effective internal capacitance: $C_i = 7 \text{ nF}$
 Effective internal inductance: $L_i = 300 \text{ }\mu\text{H}$

Supply circuit battery, internal connection to internal battery
 (Plug connector X12; 1 and 2) Saft, type LS33600, 17 Ah or
 XENO, type XL 205-F, 19 Ah

Signal input in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X6; 4 and 5) Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 3 \text{ mA}$
 $P_o = 5 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|-------------------|-------------------|------------------|
| | 200 μH | 100 μH | 50 μH |
| max. permissible external inductance | 200 μH | 100 μH | 50 μH |
| max. permissible external capacitance | 4100 nF | 5000 nF | 6200 nF |

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 30519 Hannover
 Germany



Page 2 of 4
 Attachment to IECEx TUN 18.0009 X issue No.: 0

RS 485 and signal input
 (Terminals X6; 6 and 7) In type of protection Intrinsic Safety Ex ia IIC
 Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 60 \text{ mA}$
 $P_o = 88 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|--------------------|-------------------|-------------------|
| max. permissible external inductance | 1700 μH | 700 μH | 200 μH |
| max. permissible external capacitance | 2100 nF | 2600 nF | 3100 nF |

RS 485 and signal input
 (Terminals X6; 6 and 7) In type of protection Intrinsic Safety Ex ia IIC
 Only for connection to a certified intrinsically safe circuit
 Maximum values:
 $U_i = 10.7 \text{ V}$
 $I_i = 219 \text{ mA}$
 $P_i = 325 \text{ mW}$
 Effective internal capacitance: $C_i = 2.1 \text{ nF}$
 Effective internal inductance: $L_i = 300 \mu\text{H}$

Pulse output
 (Terminals X3; 1 ... 6) In type of protection Intrinsic Safety Ex ia IIC
 Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 2 \text{ mA}$
 $P_o = 3 \text{ mW}$

| Ex ia | IIC | | |
|---------------------------------------|-------------------|-------------------|------------------|
| max. permissible external inductance | 200 μH | 100 μH | 50 μH |
| max. permissible external capacitance | 4100 nF | 5000 nF | 6200 nF |

Pulse output
 (Terminals X3; 1 ... 6) In type of protection Intrinsic Safety Ex ia IIC
 Only for connection to a certified intrinsically safe circuit
 Maximum values:
 $U_i = 30 \text{ V}$
 $I_i = 120 \text{ mA}$
 $P_i = 1.2 \text{ W}$
 Effective internal capacitance: $C_i = 3 \text{ nF}$
 The effective internal inductance is negligibly small.

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Page 3 of 4
 Attachment to IECEx TUN 18.0009 X issue No.: 0

Current output in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X9; 1 and 2) Only for connection to a certified intrinsically safe circuit
 Maximum values:
 $U_i = 28 \text{ V}$
 $I_i = 110 \text{ mA}$
 $P_i = 805 \text{ mW}$
 Effective internal capacitance: $C_i = 2 \text{ nF}$
 Effective internal inductance: $L_i = 300 \text{ }\mu\text{H}$

Optional pulse output in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X9; 1 and 2) Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 1 \text{ mA}$
 $P_o = 1 \text{ mW}$

| Ex ia | IIC | | |
|---------------------------------------|--------------------------------------|-------------------|-------------------|
| | max. permissible external inductance | 200 μH | 100 μH |
| max. permissible external capacitance | 4100 nF | 5000 nF | 6200 nF |

Impulse input Reed/Wiegand, internal in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X5; 1 ... 4) Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 6 \text{ mA}$
 $P_o = 8 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|--------------------------------------|---------|---------|
| | max. permissible external inductance | 20 mH | 10 mH |
| max. permissible external capacitance | 1800 nF | 1900 nF | 2100 nF |

Pressure sensor circuit, internal in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X8; 1 ... 4) Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 100 \text{ mA}$
 $P_o = 148 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | |
|---------------------------------------|--------------------------------------|------------------|
| | max. permissible external inductance | 30 μH |
| max. permissible external capacitance | 4100 nF | 2000 nF |
| Sensor | UTC30 | TI-1 |

TÜV NORD CERT GmbH
 Hannover Office
 Am TÜV 1
 30519 Hannover
 Germany



Page 4 of 4
 Attachment to IECEx TUN 18.0009 X issue No.: 0

Pt1000 temperature input, internal (Terminals X11: 1 and 2) In type of protection Intrinsic Safety Ex ia IIC
 Maximum values:
 $U_o = 5,9 \text{ V}$
 $I_o = 9 \text{ mA}$
 $P_o = 13 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|-------------------|-------------------|-------------------|
| max. permissible external inductance | 500 μH | 200 μH | 100 μH |
| max. permissible external capacitance | 3200 nF | 4000 nF | 4900 nF |

All maximum values L_o and C_o are also allowed to be utilized as concentrated capacitances and as concentrated inductances.

For safety reasons, all intrinsically safe circuits are galvanically interconnected with each other via GND potential and safely galvanically separated from earth potential.

At interconnection of intrinsically safe circuits, the rules for interconnection of intrinsically safe circuits have to be observed.

Special Conditions for Safe Use:

1. Electrostatic charge has to be avoided for all housing parts. The warning label has to be observed.
2. The earth terminal has to be connected with the potential equalization in the explosion hazardous area.

140

Translation

(1) **EU-Type Examination Certificate**

(2) Equipment and protective systems intended for use in potentially explosive atmospheres, Directive 2014/34/EU

(3) **Certificate Number** TÜV 17 ATEX 207566 X **Issue:** 01

(4) for the product: Electronic gas value corrector TME 400 type VC, VM, VCF, VMF

(5) of the manufacturer: RMG Messtechnik GmbH

(6) Address: Otto-Hahn-Straße 5
35510 Butzbach

Order number: 8003000905

Date of issue: 2019-03-12

(7) The design of this product and any acceptable variation thereto are specified in the schedule to this EU-Type Examination Certificate and the documents therein referred to.

(8) The TÜV NORD CERT GmbH, Notified Body No. 0044, in accordance with Article 17 of the Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in the confidential ATEX Assessment Report No. 19 203 235606.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60079-0:2012+A11:2013 EN 60079-11:2012
except in respect of those requirements listed at item 18 of the schedule.

(10) If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions for Use specified in the schedule to this certificate.

(11) This EU-Type Examination Certificate relates only to the design, and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the product shall include the following:
Ex II 2 G Ex ia IIC T4 Gb

TÜV NORD CERT GmbH, Langemarkstraße 20, 45141 Essen, notified by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The head of the notified body


Christian Rode

Hanover office, Am TÜV 1, 30519 Hannover, Tel. +49 511 908-61455, Fax +49 511 906-61500




This certificate may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH

DTZ.F.011 Rev. 01.04.18 page 18



(13) **SCHEDULE**

(14) **EU-Type Examination Certificate No. TÜV 17 ATEX 207566 X Issue 01**

(15) **Description of product**

The electronic gas value corrector TME 400 type VC, VM, VCF,VMF is an apparatus for use in gas explosion hazardous areas.
It is used for gas measuring, control and regulating purposes by detection of pressure, temperature and volume pulses.

The permissible ambient temperature range is -25 °C ... 55 °C.

Electrical data

Supply circuit in type of protection Intrinsic Safety Ex ia IIC
(Terminal X6; 2 and 3) Only for connection to a certified intrinsically safe circuit.
Maximum values:
 $U_i = 10.7V$
 $I_i = 219 mA$
 $P_i = 325 mW$
Effective internal capacitance: $C_i = 7 nF$
Effective internal inductance $L_i = 300 \mu H$

Supply circuit battery, internal connection to internal battery
(Plug connector X12; 1 and 2) Saft, type LS33600, 17 Ah or
XENO, type XL 205-F, 19 Ah

Signal input in type of protection Intrinsic Safety Ex ia IIC
(Terminals X8; 4 and 5) Maximum values:
 $U_c = 5.9 V$
 $I_a = 3 mA$
 $P_c = 5 mW$
Characteristic line: linear

| | Ex ia | | IIC | |
|---------------------------------------|--------------------------------------|-------------|-------------|------------|
| | max. permissible external inductance | 200 μH | 100 μH | 50 μH |
| max. permissible external capacitance | 4100 nF | 5000 nF | 6200 nF | |



Schedule to EU-Type Examination Certificate No. TÜV 17 ATEX 207566 X Issue 01

RS 485 and signal input (Terminals X6; 6 and 7) in type of protection Intrinsic Safety Ex ia IIC
 Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 60 \text{ mA}$
 $P_o = 88 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|--------------------------------------|--------------------|-------------------|
| | max. permissible external inductance | 1700 μH | 700 μH |
| max. permissible external capacitance | 2100 nF | 2800 nF | 3100 nF |

RS 485 and signal input (Terminals X6; 6 and 7) in type of protection Intrinsic Safety Ex ia IIC
 Only for connection to a certified intrinsically safe circuit
 Maximum values:
 $U_i = 10.7 \text{ V}$
 $I_i = 219 \text{ mA}$
 $P_i = 325 \text{ mW}$
 Effective internal capacitance: $C_i = 2.1 \text{ nF}$
 Effective internal inductance: $L_i = 300 \mu\text{H}$

Pulse output (Terminals X3; 1 ... 5) in type of protection Intrinsic Safety Ex ia IIC
 Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 2 \text{ mA}$
 $P_o = 3 \text{ mW}$

| Ex ia | IIC | | |
|---------------------------------------|--------------------------------------|-------------------|-------------------|
| | max. permissible external inductance | 200 μH | 100 μH |
| max. permissible external capacitance | 4100 nF | 5000 nF | 6200 nF |

Pulse output (Terminals X3; 1 ... 5) in type of protection Intrinsic Safety Ex ia IIC
 Only for connection to a certified intrinsically safe circuit
 Maximum values:
 $U_i = 30 \text{ V}$
 $I_i = 120 \text{ mA}$
 $P_i = 1.2 \text{ W}$
 Effective internal capacitance: $C_i = 3 \text{ nF}$
 The effective internal inductance is negligibly small.



Schedule to EU-Type Examination Certificate No. TÜV 17 ATEX 207566 X Issue 01

Current output in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X9; 1 and 2) Only for connection to a certified intrinsically safe circuit.
 Maximum values:
 $U_i = 28 \text{ V}$
 $I_i = 110 \text{ mA}$
 $P_i = 805 \text{ mW}$
 Effective internal capacitance: $C_i = 2 \text{ nF}$
 Effective internal inductance: $L_i = 300 \text{ }\mu\text{H}$

Optional pulse output in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X9; 1 and 2) Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 1 \text{ mA}$
 $P_o = 1 \text{ mW}$

| Ex ia | IIC | | |
|---------------------------------------|-------------------|-------------------|------------------|
| max. permissible external inductance | 200 μH | 100 μH | 50 μH |
| max. permissible external capacitance | 4100 nF | 5000 nF | 6200 nF |

Impulse input Reed/Wiegand, internal in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X5; 1 – 4) Maximum values:
 $U_a = 5.9 \text{ V}$
 $I_a = 5 \text{ mA}$
 $P_a = 8 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|---------------------|---------------------|--------------------|
| max. permissible external inductance | 20000 μH | 10000 μH | 5000 μH |
| max. permissible external capacitance | 1800 nF | 1900 nF | 2100 nF |

Pressure sensor circuit, internal in type of protection Intrinsic Safety Ex ia IIC
 (Terminals X8; 1 – 4) Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 100 \text{ mA}$
 $P_o = 148 \text{ mW}$
 Characteristic line: linear

| Ex ia | IIC | |
|---------------------------------------|------------------|------------------|
| max. permissible external inductance | 30 μH | 25 μH |
| max. permissible external capacitance | 4100 nF | 2000 nF |
| Sensor | UTC30 | TI-1 |



Schedule to EU-Type Examination Certificate No. TÜV 17 ATEX 207566 X Issue 01

Pt1000 temperature input, internal
(Terminals X11, 1 and 2)

In type of protection Intrinsic Safety Ex ia IIC
Maximum values:
 $U_o = 5.9 \text{ V}$
 $I_o = 9 \text{ mA}$
 $P_o = 13 \text{ mW}$
Characteristic line: linear

| Ex ia | IIC | | |
|---------------------------------------|-------------------|-------------------|-------------------|
| max. permissible external inductance | 500 μH | 200 μH | 100 μH |
| max. permissible external capacitance | 3200 nF | 4000 nF | 4900 nF |

All maximum values L_o and C_o are also allowed to be utilized as concentrated capacitances and as concentrated inductances.

For safety reasons, all intrinsically safe circuits are galvanically interconnected with each other via GND potential and safely galvanically separated from earth potential.

All interconnection of intrinsically safe circuits, the rules for interconnection of intrinsically safe circuits have to be observed.

(16) Drawings and documents are listed in the ATEX Assessment Report No. 19 203 235606.

(17) Specific Conditions for Use

1. Electrostatic charge has to be avoided for all housing parts (TME400 and optional associated connection head). The warning label has to be observed.
2. The earth terminal has to be connected with the potential equalization in the explosion-hazardous area (TME400 and optional associated connection head).

(18) Essential Health and Safety Requirements

no additional ones

- End of Certificate -



CERTIFICATE

Management system as per

Pressure Equipment Directive 2014/68/EU Module D

Evidence of conformity with the above standard(s) has been furnished and is certified in accordance with TUV PROFICERT procedures for



RMG Messtechnik GmbH
Otto-Hahn-Straße 5
D-35510 Butzbach
GERMANY

scope:

Production of gas meters and associated items of equipment

Certificate registration No. **73 202 2839**

Certificate valid from 2018-07-16 to **2021-07-15**

Audit report No. 4331 6307



Authorized Signature
Date of this document
Date of approval

Information: This certificate is issued in accordance with the TUV PROFICERT auditing and certification procedures and is subject to regular surveillance audits. The issuing authority is responsible for the continued development of pressure equipment according to the current technical regulations. The issuing authority is not responsible for the design and construction of the equipment. The issuing authority is not responsible for the design and construction of the equipment. The issuing authority is not responsible for the design and construction of the equipment.

TÜV Technische Überwachung Hessen GmbH
Industrie Service

Hans – Böckler – Straße 4 35440 Linden
 Telefon: 06403/ 9008-0 Telefax: 06403/ 9008-39



ZERTIFIKAT

(EU-BAUMUSTERPRÜFBESCHEINIGUNG FÜR BAUMUSTER)
 (EU-type examination certificate – production type)

EU-Baumusterprüfung (Modul B für Baumuster) nach Richtlinie 2014/68/EU
 EU-type examination (Module B - production type) according to directive 2014/68/EU

Zertifikat – Nr.: ISG-22-12-1979_Rev. M

Name und Anschrift des Herstellers: **RMG Messtechnik GmbH**
Otto-Hahn-Strasse 5
 Name and postal address of the manufacturer: **D-35510 Butzbach**

Hiermit wird bestätigt, dass das unten genannte Baumuster die Anforderungen der Richtlinie 2014/68/EU erfüllt. Das Druckgerät ist mit dem abgebildeten Zeichen gekennzeichnet.
 We herewith certify that the type mentioned below meets the requirements of the directive 2014/68/EU. The pressure equipment carries the mark as illustrated.

CE0091

Prüfbericht – Nr.: siehe Beiblatt zu/ see attached sheet to: ISG-22-12-1979_Rev. M
 Test report No.

Bezeichnung: Turbinenradgaszähler TERZ94 / TEC24 / TME400
 Designation: DN40, DN50, DN80, DN100, DN150, DN200, DN250, DN300, DN400

Geltungsbereich: Turbinenradgaszähler TERZ94 / TEC24 / TME400
 Scope of examination: siehe Beiblatt zu/ see attached sheet to: ISG-22-12-1979_Rev. M

Prüfobjekt: druckhalt, Ausrüstungsteil (pressure accessory)
 Inspection item:

Kategorie: I - IV
 Category:

Fertigungsstätte: Otto-Hahn-Str. 5, D-35510 Butzbach
 Manufacturing plant:

Gültig bis: Juli, 2022
 Valid:

Bemerkungen / Hinweise: **Das Zertifikat ISG-22-12-1979_Rev. L vom 27.02.2019 wird durch vorliegendes Zertifikat ersetzt und verliert somit seine Gültigkeit!**
 Remarks / hints:

Anlagen: siehe Beiblatt zu/ see attached sheet to: ISG-22-12-1979_Rev. M
 documents:

TÜV Technische Überwachung Hessen GmbH
 Notified body, No. 0091

Linden, 2019-09-04
 place, date

T. Budeshelm H. Diebich S. Drob

Übersetzte Hinweise beachten / see hints overleaf

ISG_22_12_1979_Rev_M_TME400_TERZ94_TEC24_Turbinenradgaszähler DN40-400

148

1 Production Quality Assurance Notification

2 Equipment and Protective Systems intended for use in potentially explosive atmospheres
 Directive 2014/34/EU
 Annex IV - Module D: Conformity to type based on quality assurance of the production process
 Annex VII - Module E: Conformity to type based on product quality assurance

3 Notification number: **BVS 17 ATEX ZQS/E139**

4 Product category: **Equipment and components equipment-group II, category 2G: Manufacturing and sale of Volume Meters, Electronic Correctors and Gas Analysers, Electrical equipment and devices**

5 Manufacturer: **RMG Messtechnik GmbH**

6 Address: **Otto-Hahn-Straße 5, 35510 Butzbach, Germany**
 Site(s) of manufacture: **Otto-Hahn-Straße 5, 35510 Butzbach, Germany**
RMG Messtechnik GmbH, Heinrich-Lanz-Straße 9, 67259 Beindersheim, Germany

7 The certification body of DEKRA EXAM GmbH, Notified Body No 0158 in accordance with Article 17 of the Council Directive 2014/34/EU of 28 February 2014 notifies that the manufacturer has a production quality system, which complies with Annex IV of the Directive. This quality system in compliance with Annex IV of the Directive also meets the requirements of Annex VII. In the updated annex all products covered by this notification and their type examination certificate numbers are listed.

8 This notification is based on audit report ZQS/E139/17 issued 2017-10-24. Results of periodical re-assessments of the quality system are a part of this notification.

9 This notification is valid from 2017-10-28 until 2020-10-28 and can be withdrawn if the manufacturer does not satisfy the production quality assurance surveillance according to Annex IV and VII.

10 According to Article 18 (3) of the Directive 2014/34/EU the CE marking shall be followed by the identification number 0158 of DEKRA EXAM GmbH as notified body involved in the production control phase.

DEKRA EXAM GmbH
 Bochum, 2017-10-24

 Certifier

 Approver

This is a translation from the German original.
 In the case of arbitration only the German wording shall be valid and binding.

Page 1 of 1
 This notification may only be reproduced in its entirety and without any change.
 DEKRA EXAM GmbH Dinnendahlstrasse 8 44809 Bochum Germany Phone +49.234.3696-105 Fax +49.234.3686-110
 e-mail za-exam@dekra.com

Contact

Subject to technical changes

More information

If you would like to learn more about the products and solutions from RMG, visit our website:

www.rmg.com

or contact your local sales representative

RMG Messtechnik GmbH

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