SLOVENSKI STANDARD
SIST EN 12405-3:2016

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Plinomeri - Korektorji - 3. del: Računalnik pretoka

Gas meters - Conversion devices - Part 3: Flow computer

Gaszähler - Umwerter - Teil 3: Ergänzendes Element

Compteurs de gaz - Dispositifs de conversion - Partie 3 : Calculateurs de débit

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Gas meters - Conversion devices - Part 3: Flow computer

Compteurs de gaz - Dispositifs de conversion - Partie 3: Calculateurs de débit

Gaszähler - Umwerter - Teil 3: Flowcomputer

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12405-3:2015) has been prepared by Technical Committee CEN/TC 237 “Gas meters”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

EN 12405 consists of the following parts:

— Part 1: Volume conversion (and its amendments EN 12405-1:2005/A1:2006 and EN 12405-1:2005+A2:2010 to allow the harmonization of the standard with the Measuring Instruments Directive 2004/22/EC);

— Part 2: Energy conversion;

— Part 3: flow computer (this European Standard).

In the preparation of this European Standard, the content of OIML Publication, “Recommendation 140 – measuring systems for gaseous fuel”, has been taken into account.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

A high accuracy volume conversion device can be needed depending of the intended use. EN 12405-3 is established in order to meet severe requirements concerning accuracy and related functions.

For the purpose of this European Standard, functions are described, although these functions can be physically located in different components (e.g. calibration curve programmed in the measuring equipment itself or in the calculator).

Four main categories of functions are described to achieve data processing:

— Sensor signal Acquisition functions: to process signals from physical quantity provided by sensors and transducers to measurands;

— Sensor functions: to convert measurands to correct measurements, mostly based upon calibration results and filtering procedures;

— Metering functions: to calculate derived values such as volume, calorific value, compression factor etc. based upon international standards and formulas and to take care of the supervision and monitoring for the purpose of high accuracy and substitution values;

— Long Term Data Storage functions: to keep all relevant information necessary to construct or reconstruct calculated values:

  — for later legally relevant purposes (e.g. the conclusion of a commercial transaction);

  — for back up of the relevant data.

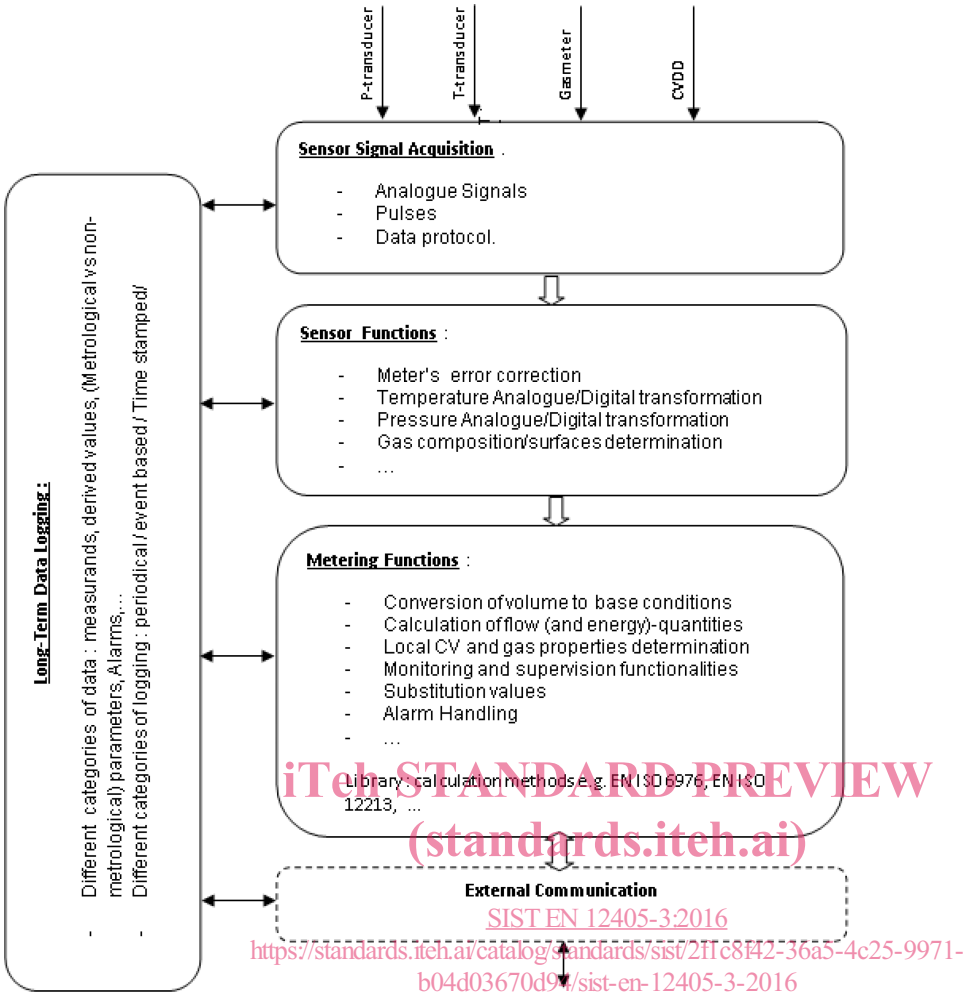

Figure 1 — Description of the functionalities of the flow computer calculator

Modular and global approaches

In the modular approach, the flow computer is an assembly of separate associated measuring instruments and a calculator, which are verified separately. Each instrument is verified according to its testing procedure, using the indication available on the calculator or on the associated measuring instrument itself. In this case, the indication shall correspond to the indication of that measuring instrument, which is directly performing volume conversion. The verification of the functions consists in verifying the calculation concerning each characteristic quantity of the gas and/or the calculation for the volume conversion.

In case of external communication, sufficient resolution of required data is ensured during data transmission.

The associated measuring instruments are validated for or with a type calculator in order to ensure the interoperability of the association.

CVDD is covered in EN 12405-2.

In the global approach, the flow computer is tested as a package including the calculator and its associated measuring instruments and functions.

The testing procedures are given in Annex A.

1 Scope

Part 3 of this European Standard specifies the requirements and tests for the construction, performance, safety and conformity of flow computers (FCs) used to meet the metrological and technical requirements of a high accuracy volume conversion device.

They are used to determine volume of fuel gases, including those of the first and second families according to EN 437.

For the purpose of this European Standard, only flow computers that are intended to operate with ultrasonic meters according to ISO 17089-1 or gas turbine meters conforming to EN 12261 are considered.

For the purpose of this European Standard only classification classes E2 and M1 are considered for the flow computer calculator.

FCs are equipped with external separate transducers for pressure and temperature which may be approved separately.

The provisions concerning pressure and temperature transducers are given in Annex B and C.

Requirements and tests are given for energy calculator in EN 12405-2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 437, *Test gases — Test pressures — Appliance categories*

EN 1776, *Gas supply systems — Natural gas measuring stations — Functional requirements*

EN 12261, *Gas meters — Turbine gas meters*

EN 12405-1:2005+A2:2010, *Gas meters — Conversion devices — Part 1: Volume conversion*

EN 12405-2, *Gas meters — Conversion devices — Part 2: Energy conversion*

EN 55011, *Industrial, scientific and medical equipment — Radio-frequency disturbance characteristics — Limits and methods of measurement (CISPR 11, modified)*

EN 60068-2-1, *Environmental testing — Part 2-1: Tests — Test A: Cold (IEC 60068-2-1)*

EN 60068-2-2, *Environmental testing — Part 2-2: Tests — Test B: Dry heat (IEC 60068-2-2)*

EN 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30)*

EN 60068-2-31, *Environmental testing — Part 2-31: Tests — Test Ec: Rough handling shocks, primarily for equipment-type specimens (IEC 60068-2-31)*

EN 60068-2-64, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance (IEC 60068-2-64)*

EN 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state (IEC 60068-2-78)*

EN 60068-3-1, *Environmental testing — Part 3-1: Supporting documentation and guidance — Cold and dry heat tests (IEC 60068-3-1)*

EN 60079-0, *Explosive atmospheres — Part 0: Equipment — General requirements (IEC 60079-0)*

EN 60079-7, *Explosive atmospheres — Part 7: Equipment protection by increased safety "e" (IEC 60079-7)*

EN 60079-11, *Explosive atmospheres — Part 11: Equipment protection by intrinsic safety "i" (IEC 60079-11)*

EN 60079-25, *Explosive atmospheres — Part 25: Intrinsically safe electrical systems (IEC 60079-25)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 60751, *Industrial platinum resistance thermometers and platinum temperature sensors (IEC 60751)*

EN 60947-5-6, *Low-voltage switchgear and controlgear — Part 5-6: Control circuit devices and switching elements — DC interface for proximity sensors and switching amplifiers (NAMUR) (IEC 60947-5-6)*

EN 60950-1, *Information technology equipment — Safety — Part 1: General requirements (IEC 60950-1)*

EN 61000-4-1, *Electromagnetic compatibility (EMC) — Part 4-1: Testing and measurement techniques — Overview of IEC 61000-4 series (IEC 61000-4-1)*

EN 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test (IEC 61000-4-2)*

EN 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3)*

EN 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test (IEC 61000-4-4)*

EN 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test (IEC 61000-4-5)*

EN 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Section 6: Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6)*

EN 61000-4-8, *Electromagnetic compatibility (EMC) — Part 4-8: Testing and measurement techniques — Power frequency magnetic field immunity test (IEC 61000-4-8)*

EN 61000-4-11, *Electromagnetic compatibility (EMC) — Part 4-11: Testing and measurement techniques — Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11)*

EN 61000-4-29, *Electromagnetic compatibility (EMC) — Part 4-29: Testing and measurement techniques — Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests (IEC 61000-4-29)*

EN 62054-21, *Electricity metering (a.c.) —Tariff and load control — Part 21: Particular requirements for time switches (IEC 62054-21)*

EN 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) (IEC 62262)*

EN ISO 6976, *Natural gas — Calculation of calorific values, density, relative density and Wobbe index from composition (ISO 6976)*

EN ISO 12213-2:2009, *Natural gas — Calculation of compression factor — Part 2: Calculation using molar-composition analysis (ISO 12213-2:2006)*

EN ISO 12213-3:2009, *Natural gas — Calculation of compression factor — Part 3: Calculation using physical properties (ISO 12213-3:2006)*

EN ISO 15970, *Natural gas — Measurement of properties — Volumetric properties: density, pressure, temperature and compression factor (ISO 15970)*

IEC 61520, *Metal thermowells for thermometer sensors — Functional dimensions*

ISO 17089-1, *Measurement of fluid flow in closed conduits — Ultrasonic meters for gas — Part 1: Meters for custody transfer and allocation measurement*

ISO/IEC/IEEE 60559, *Information technology — Microprocessor Systems — Floating-Point arithmetic*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
absolute pressure
value of the pressure of the gas relative to vacuum

3.1.2
associated measuring instrument
instrument for measuring certain quantities which are characteristic of the gas, e.g. temperature, pressure, or calorific value, whose indications are used by the calculator with a view to making a correction and/or a conversion

Note 1 to entry: For the purpose of this European Standard, when dealing with the ECD in modular approach, the VCD and CVDD are considered as associated measuring instrument.

3.1.3
base conditions
fixed conditions used to express the volume of gas independently of the measurement conditions and the superior calorific value

Note 1 to entry: The pressure base for both volumetric metering and combustion is always 1,01325 bar. The temperature is specified.

EXAMPLE Temperature of 273,15 K and absolute pressure of 1,013 25 bar or temperature of 288,15 K and absolute pressure of 1,013 25 bar.

3.1.4
calculator
electronic device that receives the output signals from measuring and data acquisition systems, e.g. associated gas meter or transducers, and processes them

3.1.5
calorific value determining device
CVDD
associated measuring instrument for determining the calorific value of gas

Note 1 to entry: For the purpose of this European Standard, the CVDD is described as a gas chromatograph (GC) because of the needs of using the gas composition for checks and calculations.

3.1.6
compression factor
parameter which indicates the deviation from the ideal gas

3.1.7
conversion factor
factor equal to the volume at base conditions divided by the corrected volume, or if there is no gas meter error correction, equal to the volume at base conditions divided by the volume at measurement conditions

3.1.8
conventional true value
value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose

3.1.9
corrected volume
volume at measurement conditions corrected for the error curve of the gas meter

3.1.10
correction
value added algebraically to the uncorrected result of a measurement to correct the systematic error

3.1.11
correction factor
numerical factor by which the measured volume is multiplied to correct it to compensate the error curve of the gas meter

3.1.12
display
element or assembly of elements of the indicating device on which the results of measurement and memorized values are displayed

3.1.13
disturbance
influence quantity having a value within the limits specified but outside the specified rated operating conditions of the measuring instrument

Note 1 to entry: An influence quantity is a disturbance if the rated operating conditions for that influence quantity are not specified.

3.1.14
durability
ability of an instrument to maintain its performance characteristics over a specified period of use

3.1.15
energy conversion device
ECD
energy conversion device calculates, integrates and displays energy using volume at base conditions and the calorific value or the gas composition

3.1.16
environmental class
class referring to climatic, i.e. ambient temperature and humidity, mechanical and electromagnetic conditions

3.1.17
error of conversion
difference between the conversion factor C displayed by a conversion device and the conventional true value of the conversation factor C_{CT} expressed as a percentage of the conventional true value of the conversion factor

3.1.18
error of indication
indication of a measuring instrument minus the (conventional) true value of the corresponding input quantity

3.1.19
flow computer
FC
high accuracy gas-volume conversion device associating measuring instruments with a calculator integrating data processing and monitoring functions

Note 1 to entry: More information on functions can be found in the introduction.

3.1.20
gas-volume conversion device
VCD
device that computes, integrates and indicates the volume increments measured by a gas meter if it were operating at base conditions, using as inputs the volume at measurement conditions as measured by the gas meter, and other parameters such as gas temperature, pressure and gas composition

Note 1 to entry: The conversion device can also compensate for the error curve of a gas meter and associated measuring transducers.

Note 2 to entry: The deviation from the ideal gas law can be compensated by the compression factor.

3.1.21
gauge pressure
value of the pressure of the gas relative to the ambient atmospheric pressure

3.1.22
global approach
approach ensuring that the performances of the conversion device are verified and approved with a completely integrated package including the calculation, the associated measuring instruments and other functions

3.1.23
HF
high frequency pulse generator in accordance with EN 60947-5-6

Note 1 to entry: If the meter is fitted with a high frequency output, the high frequency signal at Q_{max} is in the range of 0,3 kHz to 5 kHz.

3.1.24
indicating device
part of a measuring instrument that displays an indication i.e. alphanumeric string

3.1.25
influence factor
influence quantity having a value within the specified rated operating conditions of the measuring instrument

3.1.26
influence quantity
quantity that is not a measurand but that affects the result of the measurement (e.g. ambient temperature)

3.1.27
maximum operating pressure
MOP

maximum pressure at which a system can be operated continuously under normal conditions

Note 1 to entry: Normal conditions are: no fault in any device or stream.

3.1.28
maximum permissible error
MPE
extreme value of the measurement error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument or measuring system

Note 1 to entry: Generally the two extreme values are taken together and are termed “maximum permissible errors” or “limit of error”.

Note 2 to entry: The term “tolerance” should not be used to designate “maximum permissible error”.

3.1.29
measurand
particular quantity subject to measurement

3.1.30
measurement conditions
conditions of the gas, the volume of which is measured at the point of measurement (e.g. the temperature and the pressure of the gas)

3.1.31
measuring interval
time interval in which a consumption of gas is determined by the meter

Note 1 to entry: To each measuring interval belongs a single value.