SIST

SLOVENSKI STANDARD
SIST-TP CEN/TR 16061:2010

01-december-2010

Plinomeri - Pametni plinomeri

Gas meters - Smart Gas Meters

Gaszähler - Intelligente Gaszähler (Smart Gas Meters)

Compteurs de gaz - Compteurs de gaz intelligents

Ta slovenski standard je istoveten z: CEN/TR 16061:2010

ICS:

91.140.40 Sistemi za oskrbo s plinom Gas supply systems

SIST-TP CEN/TR 16061:2010 en,fr,de

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 16061

October 2010

ICS 91.140.40

English Version

Gas meters - Smart Gas Meters

Compteurs de gaz - Compteurs de gaz intelligents

Gaszähler - Intelligente Gaszähler (Smart Gas Meters)

This Technical Report was approved by CEN on 19 July 2010. It has been drawn up by the Technical Committee CEN/TC 237.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. CEN/TR 16061:2010: E

Contents

Page

Foreword

This document (CEN/TR 16061:2010) has been prepared by Technical Committee CEN/TC 237 "Gas meters", the secretariat of which is held by BSI.

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.

This document is intended to be a precursor to a formal standard for Gas Meters that provide some additional functions beyond that required under the Measuring Instruments Directive (MID). It is noted that other CEN and CENELEC Technical Committees are active in the areas of metering communications – most relevant being CEN/TC 294 "Communication systems for meters and remote reading of meters", which covers automatic reading of Gas Meters in great detail. The functions described are mainly for use on Residential Utility meters, but may be equally applicable to meters used for commercial and industrial applications. A number of the requirements may be applicable to "add-on" devices to Gas Meters. However, it is outside the scope of the TC to standardise beyond Gas Metering devices.

1 Scope

This Technical Report outlines recommendations for "smart gas meters", specifies recommendations where there is clear consensus, and identifies areas where there are barriers to standardisation. It indicates how functions may be implemented in a harmonized way if they are selected. It does not seek to select which functions are to be implemented in a smart meter. The report covers simple to complex implementations of smart metering.

This Technical Report is applicable to 1^{st}, 2^{nd} and 3^{rd} family gases according to EN 437.

2 Definitions, glossary

2.1 Glossary

MID	Measuring Instruments Directive, 2004/22/EC
AtEx	"Atmospheres Explosibles". A pair of EU Directives governing hazardous areas, 99/92/EC; and the equipment that can be used within hazardous areas, 94/9/EC
CEN	European Committee for Standardization: European standards body for non-electrical equipment
CENELEC	European Committee for Electrotechnical Standardisation: European standards body for electrical equipment
BSI	British Standards Institution
DLMS UA	The Device Language Message Specification User Association
Harmonised standard	European Standard adopted by a European standardisation body, made available to the public and that has been recognised as a method to demonstrate conformity to Essential Requirements of a European Directive
PED	Pressure Equipment Directive, 97/23/EC
WELMEC	Western European Legal Metrology Cooperation: an organisation of legal metrologists
ESCO	Energy End-Use Efficiency and Energy Services Directive, 2006/32/EC
Basic Meter	a meter that is safe and provides no function beyond that required by the MID
IT System	Information Technology System
AMR	Automatic Meter Reading. A technology that allows a meter to be read that does not require direct observation of the meter
AMM	Advanced Meter Management
AMI	Advanced Meter Infrastructure
Connector	a mechanical device, or pair of devices, that makes a semi-permanent circuit between the meter and a cable

Normative document	a document containing technical specifications adopted by the Organisation Internationale de Métrologie Légale (OIML), subject to the procedure stipulated in Article 16(1) of the MID
Standard	a technical specification approved by a recognised standardisation body for repeated or continuous application, with which compliance is not compulsory and which is one of the following: — International Standard: a standard adopted by an international standardisation organisation and made available to the public; — European Standard: a standard adopted by a European standardisation body and made available to the public; — national standard: a standard adopted by a national standardisation body and made available to the public
Base Condition	specific conditions to which the measured quantity of gas is converted[1)] EXAMPLES Temperature of 273,15 K and absolute pressure of 1,013 25 bar or temperature of 288,15 K and absolute pressure 1,013 25 bar.
Burst Data	this may be generated at the pulse outputs of electronic indexes and volume converters. To save power, electronic devices will only wish to switch on output circuits infrequently. Therefore, rather than emit a pulse as soon as one should be generated, the output circuit will only be switched on infrequently, and then a burst of pulses is transmitted
Gas Metering Day	for billing purposes, the "day" may not start at 00:00; it may start at some other time. This start time may also be subject to daylight savings time changes, leading to "days" with lengths other than 24 h
UTC	Coordinated Universal Time. This is a "world time", without daylight savings
Electronic Index Assembly	the register, electronics, and battery
Index Housing	an enclosure to contain the index assembly, where the index assembly is not contained in the body of the meter
Register	the display element + data store

2.2 Numerical list of standards

NOTE Other documents are listed in the Bibliography.

Body	Reference	Title	Note
CEN	EN 12261	Gas meters — Turbine gas meters	Standard for Turbine Meters, Harmonised with MID.

1) The calorific values of gas are expressed usually in megajoules per cubic metre (MJ/m^3). The amount of gas in the determined volume, however, will depend on temperature and pressure. Therefore a nominated base condition is used. Volume conversion takes the volume of gas measured, then converts this to a volume of gas at the equivalent base condition. See EN 12480:2002, 3.1.9, and EN 12405-1.

Body	Reference	Title	Note
CEN	EN 12405-1	Gas meters — Conversion devices — Part 1: Volume conversion	Standard for Volume Converters. Harmonised with MID.
CEN	EN 12480:2002	Gas meters — Rotary displacement gas meters	Standard for Rotary Piston meters. Harmonised with MID.
CEN	EN 1359:1998	Gas meters — Diaphragm gas meters	Standard for diaphragm meters, Harmonised with MID.
CEN	EN 13757	Communication systems for and remote reading of meters	Multi-part document detailing communications formats
CEN	EN 13757-1	Communication system for and remote reading of meters — Part 1: Data exchange	OBIS-COSEM Application layer for Gas, etc. meters.
CEN	EN 13757-2	Communication systems for and remote reading of meters — Part 2: Physical and link layer	
CEN	EN 13757-3	Communication systems for and remote reading of meters — Part 3: Dedicated application layer	M-Bus Wired specification
CEN	EN 13757-4	Communication systems for and remote reading of meters — Part 4: Wireless meter readout (Radio meter reading for operation in the 868 MHz to 870 MHz SRD band)	M-Bus Radio specification
CEN	EN 14236:2007	Ultrasonic domestic gas meters	Standard for Ultrasonic meters. Harmonised with MID.
CEN	EN 13463	(In a number of parts) Non-electrical equipment for use in potentially explosive atmospheres	
CENELEC/IEC	EN 60079-10; IEC 60079-10	Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas	
CENELEC/IEC	EN 60079; IEC 60079	(In a number of parts) Electrical apparatus for explosive gas atmospheres	

Body	Reference	Title	Note
CENELEC	EN 62056-61	Electricity metering — Data exchange for meter reading, tariff and load control — Part 61: Object identification system (OBIS) (IEC 62056-61:2006)	For information. Sister document to EN13757-1
CENELEC	EN 62056-21	Electricity metering — Data exchange for meter reading, tariff and load control — Part 21: Direct local data exchange (IEC 62056- 21:2002)	For information. Electricity standard for opto-electrical ("flag") interface.
CENELEC/IEC	EN 60529:1991	Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)	

3 What is a Smart Meter?

3.1 General

A Smart Meter is one that is compatible with the MID and ESCO directives, and has communications capabilities.

The following sections detail the variations of functional complexity that are likely to make up smart meters or may form part of a smart metering system. The table below details some of the possible aims and methods that may form part of a smart meter.

Table 1 — Aims and methods for smart meters

Aim	Means	Possible methods
Reduction of costs for meter reading (in case frequent meter reading is obliged)	Remote meter reading	Minimum one way communication from meter
Reduction of complaints – improved quality of meter reading	Remote meter reading	Minimum one way communication from meter
Reduction of payment arrears	Prepayment, or shutting off customer supply	Remotely operated valve in meter; Two-way communication
Regular billing based on real consumption	Remote meter reading	Minimum one way communication from meter
Providing customer consumption information	Info on meter display (or home display unit)	Two-way Communication; Electronic Display
Advertising	Info on meter display (or home display unit)	Two-way Communication; Electronic Display

Aim	Means	Possible methods
Limitation of production capacity	Peak shaving by differential tariffs	Two way communication; Electronic Display; Interval data
Stop supply during shortage	Switching off customers	Remotely operated valve in meter; Two way communication
Safeguard for excess flow sensed at the meter	Switch off customers when there is a customer installation problem (e.g. caused by a leak)	Local control of valve in meter
Safeguard for network issues	Control signal for an area	Remotely operated valve in meter; Two way communication

3.2 Basic meter

It may be helpful, as a starting point, to observe that a "Basic" meter is one that is safe and provides no function beyond that required by the MID[2]. It is worth noting the quotations from MID Annex 1, "Essential Requirements" that are contained in Annex A of this document.

It can be argued that prepayment meters that provide data back to the suppliers IT systems via a token are Smart. To try to clarify the different types of meter that are available, different categories are defined below.

3.3 Basic meter with output of pulses or data

3.3.1 General

A basic meter with output can be part of a smart (AMR) system. It may be possible for this system to meet the recommendations of ESCO.

3.3.2 Pulse output

The basic meter may have an integrated or a remotely equipped pulse output or a data output. The pulse is widely used as a method of providing data from a meter. The meter emits a pulse each time a fixed volume is measured.

The pulse value outputs are marked as 1 imp ≙ … m^3 (or dm^3) or 1 m^3 (or dm^3) ≙ … imp.

The most widely used method for pulse output is to use a magnet in one of the least significant wheels in the index. A reed switch is commonly used to detect the passage of the magnet.

3.3.3 Data output

Data outputs can be provided through serial interfaces. Data outputs should provide information on meter readings, meter identification and meter status. The index value (as read on the meter) is provided by the data output. Data outputs can be built-in or provided by add-on to an existing meter. Depending on the interface used, data encryption and access control has to be considered. Guidance on data outputs is detailed in WELMEC Software Guides 7.1 and 7.2.

2) Please note that meters with pre-MID approvals will also usually meet this recommendation.

3.4 AMR meter

An Automatic Meter Reading (AMR) meter can form part of a smart metering system. An AMR-equipped meter can provide data to an IT system. In its simplest form, it provides a current meter read without physical access to the meter. A number of technologies exist that can be used to collect and transfer the data – from inductive pad, where a meter reader needs to physically connect a reading device to a component connected to the meter, through walk-by and drive-by systems, to fixed wired or wireless networks with star or mesh topologies.

An AMR system can be built based on a basic meter with pulse or data output.

An AMR meter may or may not log data, and provide information about events[3)] and its status when it transmits data.

While it is possible for an AMR Meter to be truly one way, broadcasting data either continuously or at pre-set intervals, most systems are at least 1,5 way (which report when stimulated), and many are two way, and give answers to specific questions.

3.5 Prepayment meter

Prepayment, or "pay as you go", meters allow customers to make advanced payment for energy[4)]. In their simplest form, a mechanical token (or coin) is used to allow the valve within the meter to be opened until a measured quantity of gas has been consumed. State of the art prepayment meters use electronic tokens or SMS to add credit to the meter, set tariffs on the meter and provide data on consumption and events to the IT system. The latest meters can remotely manage the repayment of debts, and perform the calculations to consume the credit applied to the meter based on tariff and energy conversion data. They can manage change of retailer in a competitive retail market for energy, and some can even be switched to a mode where they function as a credit meter.

3.6 Smart meters

There are a number of terms, such as "AMI", "Smart", "AMM", where there is no commonly agreed definition.

A smart meter will have communications[5)] operating within acceptable timeframes and at least one additional function from the following list:

— Built-in Customer Display of time of use information (see 6.7);

— Local provision of time of use information (see 6.8);

— Shut-off Valve (see 6.9);

— Home Automation interface (see 6.8.1);

— Prepayment functionality (see 6.5, 6.6, 6.7 and 6.9);

— Remote update of configuration data[6)] (see 6.3);

3) The term "event" covers changes of status within the meter. Changes of status can occur when a meter senses something out of the ordinary (perhaps flow beyond the Q_{max} of the meter, or battery level falling to a pre-set level), when there is a tamper or fraud attempt, or if there is an error.

4) Energy Cost and transportation costs are accrued when the supplier collects money from the customer. Transportation charges may, in some cases, require meter reading data to be provided.

5) Communications in this context can be either wired or wireless.

6) Note that metrological parameters may not be updated under MID rules.

— Datalogging functionality (see 6.3).

Fraud and Tamper detection will be a feature of most smart meters. The levels of protection from fraud and tamper will be related to the complexity of the meter. Meters that include a valve will require high levels of protection and detection of fraud and tamper attempts. This is discussed further in 6.10.

The above is not intended to be an exhaustive list, and it is likely that there will be updates to this document on an ongoing basis as further additional functions become defined.

Firmware upgrade may be required in some situations. This is discussed in 6.4 of this Technical Report and the WELMEC Software Guide.

4 Smart metering system – The smart meter in its context

Meters form part of a system. The huge majority of gas meters are used simply as part of a chain that provides an invoice for energy to the energy customer.

In the simplest system, basic meters communicate via a "visual read" to a meter reader, who transmits the data into a meter read system, where the data is validated, and then passed through to the billing system, where volume conversion and energy calculation is performed.

A smart metering system performs the same functions with the meter reader eliminated. Basic AMR will eliminate the "eyeball" element of the read, and AMR into a fixed network will remove the need for the meter reader to visit site and thus provide the Wide Area Network (WAN) functionality. A meter with more functionality (or, in the case of industrial gas use, a Volume Conversion system) may be able to perform the volume conversion and the energy consumption calculation by applying values supplied by the IT system.

The tariff and energy conversion technology in prepayment meters can be applied to a smart meter which will lead to an ability to estimate energy usage and cost for the customer. In theory, this could be extended to the point where the bill is calculated on the meter, and the billing amount provided to the energy supplier via a communications channel, though provision of calorific value (CV), pressure and temperature is a significant issue in taking this approach. While there are technologies that can register energy directly, none have come to market in a way that delivers cost effective real-time energy calculation, except on large industrial applications. This adds a complexity to the accurate provision of energy consumption on the meter; either

— calorific value, pressure and temperature would have to be available in "real time"; or

— the meter would have to be capable of retrospectively recalculating the energy based on information when validated data becomes available.

It should be noted that the auditing of software capable of retrospective recalculation would be a very difficult task. It should also be noted that a gas meter that estimates the energy usage and the cost for the customer will, inevitably, provide information that differs from the invoice, and therefore some customers will query the difference. This difference is similar to that noted when electricity customers have "clip on" electricity monitors that estimate energy consumption.

A method that may be adopted to manage the difference between real time energy estimates and billed energy is to set the calorific value used for real time estimates a little higher than expected. This will mean that meters give a slightly high estimate of energy consumption, and it is expected that most energy customers will be unlikely to contact their energy supplier on this basis.

It should be noted that the end-to-end process of invoice generation is not changed by the application of smart meters, but smart meters will automate the data collection, and may push the energy and tariff calculation from the central system to the meter.