BS EN 14154-4:2014

BSI Standards Publication

Water meters

Part 4: Additional functionalities

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National foreword

This British Standard is the UK implementation of EN 14154-4:2014.

The UK participation in its preparation was entrusted to Technical Committee CPI/30/7, Volume flow-rate methods.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Wasserzähler - Teil 4: Zusätzliche Funktionalitäten

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Foreword

This document (EN 14154-4:2014) has been prepared by Technical Committee CEN/TC 92 “Water meters”, the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by May 2015, and conflicting national standards shall be withdrawn at the latest by May 2015.

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.

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Introduction

This European Standard has been defined as part of the work being undertaken by the European Standards Organizations (CEN/CENELEC/ETSI) under the Commission Mandate M/441. This standard utilizes the six functionalities agreed by the Smart Meters Coordination Group (SM-CG) (see Annex B) as the basis for its additional functionalities. It is not required for the Additional Functionality Device (AFD) to incorporate all functions defined in this standard.

Communications for water meters are outside the scope of this standard and are covered by the appropriate parts of EN 13757-1, EN 13757-2, EN 13757-3, EN 13757-4, EN 13757-5 and EN 13757-6 which provide a number of protocols and transport layers for meter communications for Gas, Water and Heat meters. The additional functionality for water meters can be provided by a number of methods; these are illustrated below, see Figure 1, and described in detail within this standard. The AFD can be integrated in the meter, attached to the meter or remote from the meter.

1 Scope

This European Standard specifies definitions, requirements and testing of additional functionalities for water meters, without metrological impact, in combination with Additional Functionality Devices (AFD) and in response to EU/EFTA Mandate M/441 EN. These AFDs are to be considered as “ancillary devices" as defined in EN ISO 4064-1 and EN ISO 4064-4.

This European Standard does not cover the changing of metrological software within the meter or the upload/download of metrological software.

NOTE A manufacturer can claim compliance only for additional functionalities described in this European Standard. It is not mandatory that an AFD complies with all additional functionalities described herein.

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 14154-1, *Water meters – Part 1: General requirements*

EN 14154-2, *Water meters – Part 2: Installation and conditions of use*

EN 14154-3, *Water meters – Part 3: Test methods and equipment*

EN ISO 4064-1, *Water meters for cold potable water and hot water - Part 1: Metrological and technical requirements (ISO 4064-1)*

EN ISO 4064-2, *Water meters for cold potable water and hot water - Part 2: Test methods (ISO 4064-2)*

EN ISO 4064-4, *Water meters for cold potable water and hot water - Part 4: Non-metrological requirements not covered in ISO 4064-1 (ISO 4064-4)*

EN ISO 4064-5, *Water meters for cold potable water and hot water - Part 5: Installation requirements (ISO 4064-5)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

3 Terms and definitions

The terms, definitions and symbols of EN ISO 4064-1, EN ISO 4064-2, EN ISO 4064-4 and EN ISO 4064-5, EN 14154-1, EN 14154-2 and EN 14154-3 apply.

NOTE Additionally for the purposes of this part of the European Standard, the following terms and definitions only related to additional functionalities apply.

3.1
functionality
process which constantly or at defined intervals, automatically or on demand, performs specific activities such as sampling data, reading a data set, verifying or changing a status, or activating a switch

3.2
additional functionality
functionality that a smart meter provides, over and above the metrological functionality covered by the Measuring Instruments Directive

3.3
additional functionality device
device providing any additional functionality

3.4
additional functionality device type 1 (AFD1)
additional functionality device integrated into the meter

3.5
additional functionality device type 2 (AFD2)
additional functionality device directly attached to the meter

3.6
additional functionality device type 3 (AFD3)
additional functionality device remotely connected to the meter

3.7
automatic meter reading
technology for obtaining metering data from an on-site meter by communication from a remote access point

3.8
universal time coordinated (UTC)
world time, without daylight savings

3.9
reading
primary indication of the total volume passed through the meter

3.10
metrological software
software identified during the type testing examination, which is part of the meter and is critical to its metrological characteristics

3.11
register
Indication of the specific section in the memory of the control and metering unit that records data as determined by the programme in the unit

3.12
event
condition requiring action or to log an action

3.13
event log
temporary or mid-term memorized listing of events, containing their occurrence, actions taken and their reset

3.14
interface
point or means of interaction between two systems

4 General requirements

4.1 Types of additional functionality devices and requirements

The additional functionality shall be provided by one of the following devices:

— AFD1; where all functions are within the same metrological enclosure as the meter;

— AFD2; where the AFD is attached directly to the meter. The manufacturer shall declare the appropriate device compatibility;

— AFD3; where the AFD is located remotely and connected to the meter. The manufacturer shall declare the appropriate device compatibility.

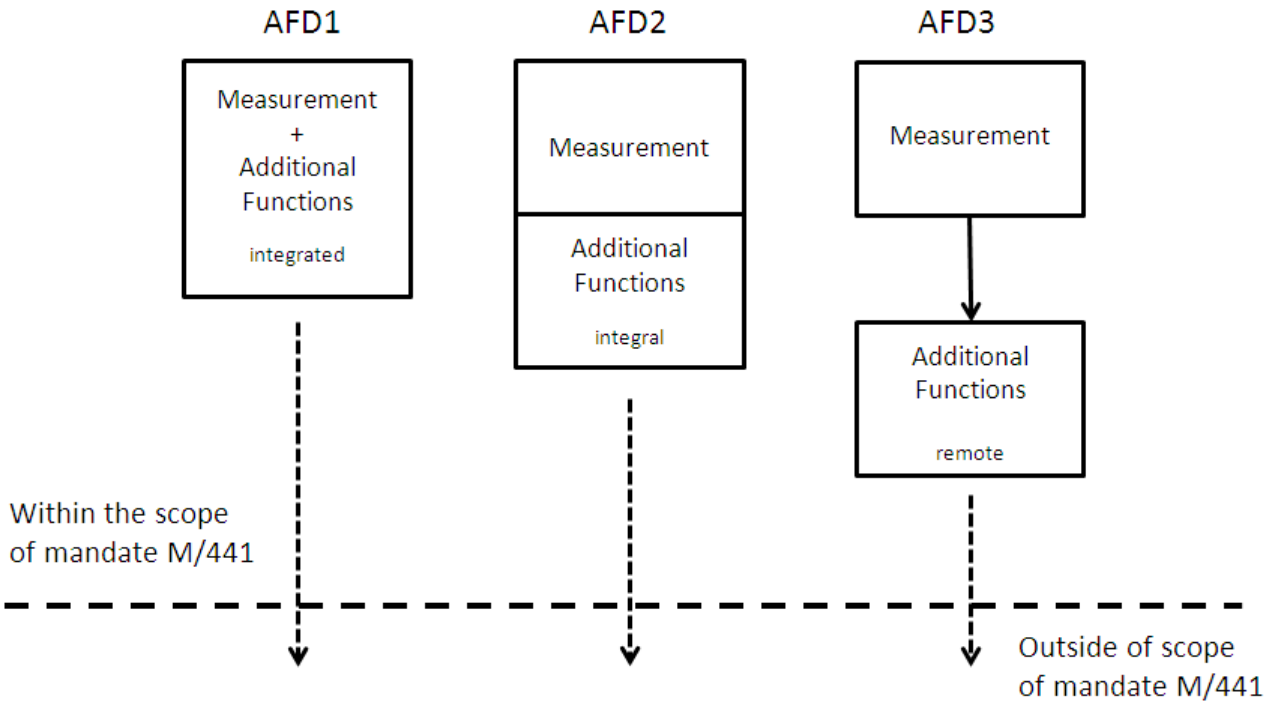


Figure 1 — Additional functionality devices

4.2 Connection requirements

The AFD2 and AFD3 shall be connected to the meter and tested as a combined unit in all the tests given in 4.11.2 to ensure the connection of the AFD to the meter has no metrological influence.

The connection of the AFD to the meter or any labelling on the meter or the AFD shall not obscure or damage any metrological seal of the meter.

The primary indication on the meter shall not be obscured by the connection of the AFD and the indicating device shall be accessible to the consumer without the use of tools.

4.3 Environmental conditions

The AFD shall work with the meter at all operating conditions of the meter as required by the appropriate standards.

Any AFD should be suitable to meet one of the environmental classes from EN ISO 4064-1, A.2 and A.3 and the related tests. An AFD3 may have a different environmental class to that of the meter.

4.4 Security

4.4.1 General

The AFD shall be constructed in such a way that any unauthorized intervention shall either cause permanently visible damage to the AFD or its protective seals, or creates a report in the event log. Any physical seals shall be visibly fixed, and easily accessible.

4.4.2 Software, data and hardware security

4.4.2.1 Requirement

When tested in accordance with 4.4.2.2 the requirements below shall be met.

All available connections, ports and interfaces of the AFD which can be used for unauthorized adjustment of the AFDs characteristics and additional functionality shall be effectively secured by protective seals.

No access shall be allowed to software and firmware by unauthorised persons. Software and data shall be protected against accidental or intentional changes by the breaking of a physical seal or by using an electronic seal.

For electronic seals the following requirements shall be met:

a) access shall only be obtained by using a password or a code;

b) unauthorized intervention shall be registered in the event log and the type of intervention identified, and where available date and time to be included.

In the case of intended consumer access to the AFD, it shall be ensured that the access by the consumer cannot inadvertently drain the battery capacity, where applicable.

4.4.2.2 Test

Compliance with the above requirements shall be checked by visual inspection and evaluation of the manufacturer's technical documentation.

4.4.3 Firmware upgrade of AFD

This part of the standard covers non-metrological upgrades only, providing there is clear separation between the metrological and non-metrological functions.

Following any upgrade the information/functionality of the AFD shall be as declared by the manufacturer. Any data still present shall be the same as prior to the upgrade.

NOTE An example of a suitable routine is given in the WELMEC Guide 7.2.

4.4.4 Software identification

The software (including version) shall have an unambiguous identifier that is retrievable.

4.5 Power supply

The power supply of the AFD shall comply with EN ISO 4064-1, EN ISO 4064-4 and EN 14154-1 and shall be tested accordingly.

4.6 Data storage

The AFD shall be capable of storing data such as interval and event data. The manufacturer shall declare which data are stored and how to access the stored data.

The stored data shall be retained in the event of power failure as tested according to EN 14154-3 and EN ISO 4064-2.

4.7 Clock requirements

4.7.1 General

Stored data shall be time stamped. The time stamps shall be generated by a clock which gives:

— a relative time stamp, or

— a non-synchronized time stamp, or

— a synchronized time stamp.

It is recommended that the synchronized time stamp within the AFD uses UTC.

The accuracy of the time stamp shall be suitable for its intended use.

4.7.2 Clock synchronisation

If the manufacturer declares that the AFD has a clock that can be synchronised with the clock of the meter, then it shall be possible to carry out this synchronization.

A record shall also be placed in the event log showing what action was taken.

4.7.3 Clock setting

If the manufacturer allows setting of the clock, access shall only be achieved by the use of an electronic seal or the breaking of a physical seal.

A record shall also be placed in the event log showing what action was taken.

4.8 Marking

4.8.1 Requirements

When tested in accordance with 4.8.2 the AFD shall as a minimum be marked as follows:

a) the number and date of this standard;

b) identification mark or name of the manufacturer;

c) serial number and year of manufacture;

d) mark with respective IP rating (EN 60529:1991);

e) ambient temperature range;

f) information about the type of battery (for security, transport and recycling purposes);

g) any additional marking as required by legislation.

With the exception of b), c) and g), if all applicable information cannot be shown on the AFD this shall be provided on the packaging or with the documentation provided.

4.8.2 Test

This test is carried out by visual inspection.

4.9 Documentation

4.9.1 General

The following information shall be provided with each AFD or group of AFD's used in the same location.

4.9.2 Declaration of conformity

For each AFD a Declaration of Conformity as per Annex A shall be available in written form or electronic format and shall identify the name and address of the manufacturer and the date of issue.

4.9.3 Instruction manual

The operating instructions manual shall cover installation, operation and maintenance and shall be available in written form or electronic format and shall identify the name and address of the manufacturer and the date of issue. Each AFD or meter-AFD combination or packaging units of those shall be delivered with installation, operation and maintenance appropriate instruction manuals, including:

— safe use and hazards arising from misuse and particular features of the design when appropriate;

— rated operating conditions;

— mechanical and electromagnetic environment classes;

— safe disposal and/or recycling guidance;

— conditions for compatibility with interfaces and type of communication protocol, and

— storage requirements.

The manuals may include the following optional information:

— possible installation positions;

— safety requirements concerning commissioning and de-commissioning procedures;

— statement if a maintenance is possible and a relevant instruction;

— way of controlling the proper installation and operation;

— provisions, if any, for transport and handling;

— how to trace the right spare parts, and

— a description of each of the additional functionalities.

4.10 Display

4.10.1 General

This subclause specifies general requirements for an electronic display that may be incorporated in the AFD.

4.10.2 Requirements

Displayed data that is consumer relevant shall be easily legible and available without the use of tools.

When tested in accordance with 4.10.3, information shall be indicated either on:

a) the display fitted to the meter;

b) the display of an AFD;

c) a combination of the above.

The information and flags shall be displayed by means of user action or by means of automatic and sequential scrolling for at least 10 seconds:

The identification and the unit of each information or parameter shall be clear and unambiguous.

The manufacturer shall declare what information can be displayed.

4.10.3 Test

A test shall be executed by visual inspection.

4.11 Metrological influence

4.11.1 Requirement

When tested in accordance with 4.11.2, the AFD shall have no influence on the metrological characteristics of the meter.

If the AFD provides a facsimile/copy of the meter's results, it shall be tested in accordance with 4.11.2 to ensure these results are identical to those on the meter.

When tested in accordance with 4.11.2 the AFD shall operate with the interfaces specified by the manufacturer and display the information as specified by the manufacturer.

4.11.2 Test

Test the meter with the AFD incorporated according to the appropriate standard, i.e. EN ISO 4064-1 to ensure conformity.

Verify the AFD is interoperable with those interfaces specified by the manufacturer. In case of AFD2 or AFD3, examine the meter and AFD and ensure there is the possibility to apply a protective seal between the AFD and the meter.

With water passing through the meter under test at the flow rates of Q1 and Q3, operate each additional function that could have an effect on the metrological characteristics of the meter separately. Operate each additional function as specified by the manufacturer continuously for 1 h or for a minimum of 10 operations at Q1 and Q3. The meter performance shall be within the relevant MPE.

Establish a reference result by repeating the identical test procedure with either;

— the same meter under test with the additional functionalities of the AFD completely disabled, or

— the same meter with a standard counter without the additional functionalities.

Compare the value reading of the established reference to the value reading of the meter under test and ensure that the reading has not deviated by more than one third of the MPE.

If the AFD provides a facsimile/copy of the meter under test results, verify that the results provided by the AFD are identical to those on the meter under test.

4.12 Input to AFD / Output from AFD

4.12.1 General

The manufacturer shall specify the interface to the AFD (e.g. incremental volume pulses or data stream).

4.12.2 Requirement

The manufacturer shall specify the proper connections to and from the AFD.

The AFD instructions shall define the corresponding counterparts or the electrical characteristics and parameters, the type and method of connection, installation, operating system of the AFD.

When tested in accordance with 4.12.3, a signal as described by the manufacturer shall be detected.

4.12.3 Test

Connect in accordance with the manufacturer's instructions and ensure a signal is recognized and correct assembly is obvious.

5 Additional functionalities

5.1 General

The additional functionalities to be provided by the AFD are to be described in full by the manufacturer, and shall comply with the tests described below. The additional functionalities described below are not mandatory and are offered at the discretion of the manufacturer.

5.2 Use cases

5.2.1 Scheduled read

5.2.1.1 Definition

Scheduled read is the regular transmission of the primary indication in a pre-configured schedule.

5.2.1.2 Test procedure

Modify the calendar date in a way that it simulates the pre-configured schedule and verify that the primary indication has been transmitted by the AFD.

5.2.1.3 Acceptance criteria

The test is being considered passed if the primary indication is transmitted correctly and without exception.

5.2.2 Pre-programmed reading date

5.2.2.1 Definition

The primary indication will be stored in the memory at a pre-set date.

5.2.2.2 Test procedure

Enter a requirement to store the reading by setting a date for its storage in the memory. Modify the calendar date to be shortly before the pre-set date. Check if the reading at the pre-set date has been stored in the memory.

5.2.2.3 Acceptance criteria

The test is being considered passed when the primary indication at the simulated reading date has been correctly stored in the memory and is retrievable at a later date.

5.2.3 On demand read

5.2.3.1 Definition

Upon request the primary indication of the water volume consumed to date can be established and transmitted.

5.2.3.2 Test procedure

Request a report from the AFD of the primary indication of the meter and check that the transmission compares accurately with the primary indication.

5.2.3.3 Acceptance criteria

The test is considered passed if the requested primary indication has been transmitted correctly.

5.2.4 History of consumption

5.2.4.1 Requirement

The AFD may allow storage of the primary indication over a specified period of time.

5.2.4.2 Test procedure

Set the start and end date of the relevant period in such a way that they fit to two known primary indications and retrieve the primary indications from those dates from the AFD.

5.2.4.3 Acceptance criteria

The test is considered passed if the retrieved indications match the two known primary indications.

5.2.5 Background leak

5.2.5.1 Definition

Either a permanent background flow or, in the case of an indirect feed system after the meter, an intermittent flow below the expected profile of consumption. This event would normally indicate that an unintentional leak is occurring after the meter. The occurrence of such an event that deviates from a pre-configured leakage flowrate range and period of time threshold shall be detected and reported.

5.2.5.2 Test procedure

The test procedure shall be executed as following;

a) run the meter within the pre-configured leakage flowrate range and period of time stated by the manufacturer and check that the event is reported;

b) run the meter outside of the pre-configured leakage flowrate range and period of time stated by the manufacturer and check that the event is not reported.

This test procedure can alternatively be established via simulation.

5.2.5.3 Acceptance criteria

The test result is considered passed if, in case (a) the event is reported and in case (b) no event is reported.

5.2.6 Burst

5.2.6.1 Definition

A period of flow above a defined, high flow rate. This event would normally indicate that a burst has occurred. The occurrence of such an event that exceeds a pre-configured period shall be detected and reported.

5.2.6.2 Test procedure

The test procedure shall be executed as following;

a) Run the meter at 10 % above the defined, high flow rate for the pre-configured period and check the occurrence of the event.

b) Run the meter at 10 % below the defined, high flow rate for the pre-configured period and check the non-occurrence of the event.

This test procedure can alternatively be established via simulation.

5.2.6.3 Acceptance criteria

The test result is considered passed if, in case (a) the event is becoming reported and in case (b) no event is reported.

5.2.7 Reverse flow

5.2.7.1 Definition

A period of flow in the reverse direction (backflow). This event would normally indicate that reverse flow prevention measures have failed. The occurrence of such an event that exceeds a defined volume of water flowing in the reverse direction shall be detected.

5.2.7.2 Test procedure

Run the meter in reverse direction until the defined volume is exceeded. This test procedure can alternatively be executed via simulation.

5.2.7.3 Acceptance criteria

The test is considered passed when the event has been reported with a tolerance of ± 5 % of the defined reverse flow volume on the primary indication of the meter.

5.2.8 Zero flow

5.2.8.1 Definition

A period of time with no flow detected. This event may indicate that the meter is failing to operate correctly. The occurrence of such an event that exceeds a pre-configured period of time shall be detected and reported.

5.2.8.2 Test procedure

Simulate the above pre-configured period of time accordingly.

5.2.8.3 Acceptance criteria

The test is considered passed when after the pre-configured period time of zero flow the event becomes reported within a ± 5 % accuracy of the pre-configured period.

5.2.9 Tamper of AFD

5.2.9.1 Definition

This functionality only applies if the AFD is sensitive to tampering, in which case the tampering shall be detected and reported. It is the responsibility of the manufacturer to indicate possible methods of tampering.

5.2.9.2 Test procedure

The manufacturer shall provide a list of consistent test procedures to detect possible methods of tampering.

5.2.9.3 Acceptance criteria

Accordingly, the manufacturer shall provide suitable acceptance criteria for each possible method of tampering as described above.

5.2.10 Tamper of meter

5.2.10.1 Definition

If the meter is capable of indicating that it has been tampered with, the AFD shall detect and report this event.

5.2.10.2 Test procedure

Simulate an event that the meter has been tampered with.

5.2.10.3 Acceptance criteria

Verify that the simulated event has been detected and reported by the AFD.

5.2.11 Battery low

5.2.11.1 Definition

A battery, which is used to independently operate the AFD, is running low, indicating that the operational life of the AFD is coming to an end. The event shall be triggered in time to ensure the integrity of the measured data and allow for appropriate time for the necessary corrective action. The event shall be triggered at least 180 days before the end of the operational life time of the battery.

5.2.11.2 Test procedure

The manufacturer shall supply statistically representative evidence that the occurrence of the “Battery Low” event allows for appropriate time for the necessary corrective action.

5.2.11.3 Acceptance criteria

The test is being considered passed when the statistical evidence provided by the manufacturer is satisfactory for the intended purpose.

5.2.12 Presence of air

5.2.12.1 Definition

The presence of air in the pipe system measured leads to incorrect primary indication on the meter resulting in erratic plausibility from billing period to billing period. If the manufacturer declares that the detection of air is available, the event should be detected and reported.

5.2.12.2 Test procedure

Run air only through the meter and establish that the AFD detects and reports the event.

5.2.12.3 Acceptance criteria

The test result is considered passed if the event is reported in the AFD.

5.2.13 Access profiles

5.2.13.1 Definition

Access profiles are programmable and pre-settable defined restrictions or sets of restrictions that prevent the access to certain areas or activities within a smart metering system.

5.2.13.2 Test procedure

Apply defined access restrictions or permissions via the management system to the smart metering system. Test the integrity of the defined access restrictions and permissions as set.

5.2.13.3 Acceptance criteria

The test result is considered passed if neither a restricted area or action can be accessed nor the access to a permitted area or action is being denied.

6 Environmental considerations

Further guidance can be found in CEN Guide 4, Guide for addressing issues in environmental product standards (ed. 3: November 2008).

Annex A
(normative)

Declaration of conformity to EN 14154-4

For each AFD a Declaration of Conformity as per this Annex shall be available in written form or electronic format and shall identify the name and address of the manufacturer and the date of issue.

Company Logo

Declaration of conformity to EN 14154-4

In the case the AFD is already subject to a declaration of conformity, the following declaration of conformity may be added to it:

We herewith declare that the following Additional Functionality Device

Type:

AFD 1	AFD 2	AFD 3
Type description:	Type description:	Type description:

is in conformance with the requirements of EN 14154-4 **of the current issue**

The following additional functionalities have been realised in this product and their function has been tested according to the requirements laid down in this European Standard

Additional functionality	Realised √	Communication bidirectional √	Communication unidirectional √	Clause in EN 14154-4
Scheduled Read				**5.2.1**
Pre-programmed reading date				**5.2.2**
On demand read				**5.2.3**
History of consumption				**5.2.4**
Background leak				**5.2.5**
Burst				**5.2.6**
Reverse flow				**5.2.7**
Zero flow				**5.2.8**
Tamper of AFD				**5.2.9**
Tamper of meter				**5.2.10**
Battery low				**5.2.11**
Presence of air				**5.2.12**
Access profiles				**5.2.13**

Company, town, country, date Name(s) of person(s) responsible

Annex B
(informative)

Smart Metering, overview, core functionalities and definitions

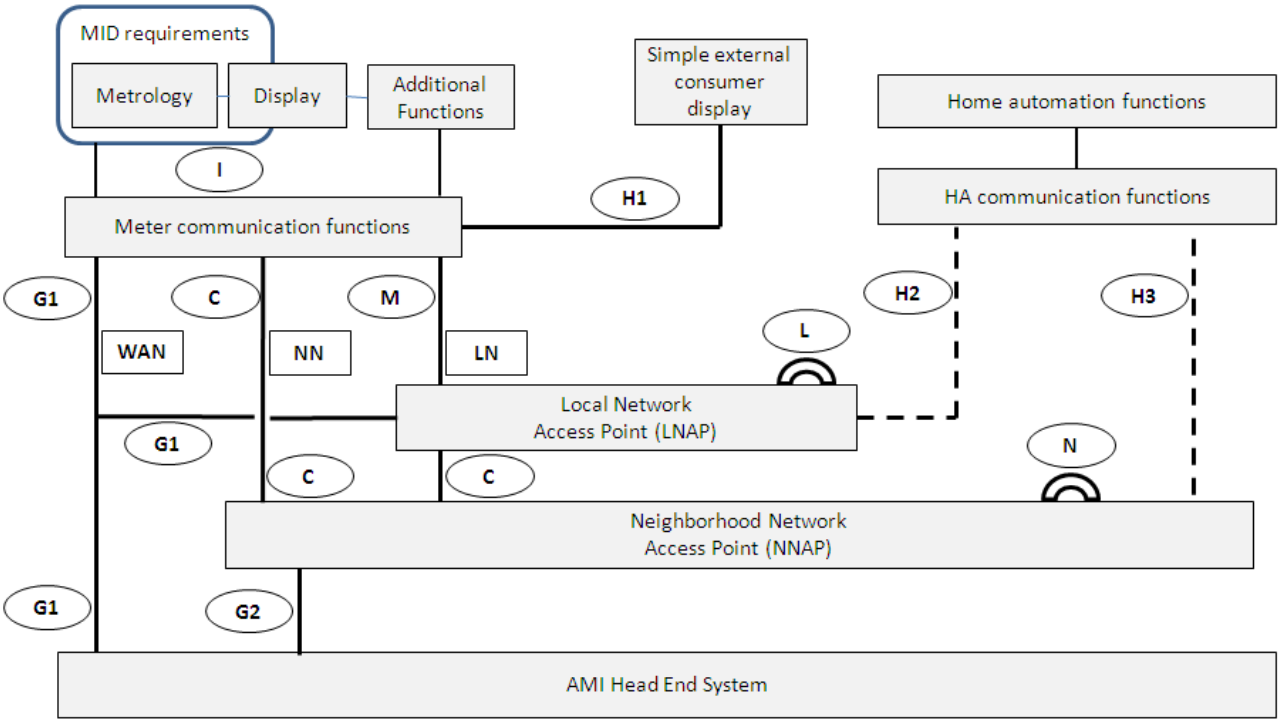
B.1 General

This Annex B is given to show the context of EN 14154-4 within the scope of the SM-CG related to the mandate M/441.

NOTE This is taken from the SM-CG technical report CEN/CLC/ETSI/TR 50572:2011.

B.2 M2M Gateway

M2M Gateway is an entity associated with a meter, data concentrator and/or central system providing meter to meter service capabilities and a data path to these entities.



Key

Definition of the interfaces

H1, H2, H3	Display and Home automation end device interfaces
L, N LNAP / NNAP	Peer interfaces
G	Automated Metering Infrastructure (AMI) to Head End System (HES) interface
C	Neighbourhood Network Access Point interface
M	Metering end device interface

Figure B.1 — Reference architecture diagram for smart metering communications/definition of interfaces

B.3 Clusters

Clusters are groups of use cases that belong to the same business process.

B.4 Primary Use Cases

Primary Use Cases describe the main functions of a smart metering system. They also describe the behaviour of the system as it responds to the request of a primary actor.

B.5 Secondary Use Cases

Secondary Use Cases describe core functionalities of the system and interactions that allow Primary Use Cases to complete. They are started by and deliver to Primary Use Cases only. There is no connection or interaction with any external actor.

Table B.1 — Examples of Clusters and their associated Primary and Secondary Use Cases

Main Business Process Groups (Clusters)	Examples of Primary Use Cases	Examples of Secondary Use Cases
Billing	*Obtain scheduled meter reading *Set billing parameters	**Read a meter **Write information
Customer Information Provision	*Provide information to the customer	**Write information
Configure events, status and actions	*Configure meter events and actions	**Invoke an action **Report event
Installation and configuration	*Clock synchronisation *Configure AMI device	**Invoke an action **Write information
Energy market events	*Manage consumer moving in *Manage consumer moving out	**Read a meter **Write information
Collect AMI events and status information	*Manage supply quality	**Report event **Write information

B.6 Primary Actors

Primary Actors are for example a Meter Data Collector (MDC), a Meter Operator (MO), a Metered Data Aggregator (MDA) or a Meter Data Management System (MDMS).

B.7 Actors

Actors are entities that exist outside the system and which take part in a sequence of activities in a dialogue with the system to achieve a specific goal. Actors may be end users, other systems, or hardware devices.

B.8 Use Cases

Use Cases are descriptions of the interaction between one or more Actors, represented as a sequence of simple steps.

Each Use Case is a complete series of events, described from the point of view of the Actor.

Annex C
(informative)

References to EN 14154-1, EN 14154-2 and EN 14154-3 and EN ISO 4064-1, EN ISO 4064-2, EN ISO 4064-3, EN ISO 4064-4, EN ISO 4064-5

Table C.1 — References to EN 14154-1, EN 14154-2 and EN 14154-3 and EN ISO 4064-1, EN ISO 4064-2, EN ISO 4064-3, EN ISO 4064-4, EN ISO 4064-5

Feature or Property	EN 14154 Part	EN 14154 Clause.	EN ISO 4064 Part	EN ISO 4064 Clause.
Metrological Characteristics	1	7		
Terms and Definitions	1	3	1	3
Operating conditions			1	3.3
Q1, minimum flow	1	3.29	1	3.35
Q2, transitional flow	1	3.30	1	3.34
Q3, permanent flow rate	1	3.31	1	3.32
Q4, overload flow rate	1	3.32	1	3.33
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