BS EN 1434-2:2015

BSI Standards Publication

Heat meters

Part 2: Constructional requirements

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National foreword

This British Standard is the UK implementation of EN 1434-2:2015. It supersedes BS EN 1434-2:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CPI/30, Measurement of fluid flow in closed conduits.

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

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Heat meters - Part 2: Constructional requirements

Compteurs d'énergie thermique - Partie 2: Prescriptions de fabrication

Wärmezähler - Teil 2: Anforderungen an die Konstruktion

This European Standard was approved by CEN on 5 September 2015.

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

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European foreword

This document (EN 1434-2:2015) has been prepared by Technical Committee CEN/TC 176 “Heat meters”, the secretariat of which is held by SIS.

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of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.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.

This document supersedes EN 1434-2:2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

EN 1434-2, *Heat meters* consists of the following parts:

— *Part 1: General requirements*

— *Part 2: Constructional requirements*

— *Part 3: Data exchange and interfaces*[1)]

— *Part 4: Pattern approval tests*

— *Part 5: Initial verification tests*

— *Part 6: Installation, commissioning, operational monitoring and maintenance*

In comparison to EN 1434-2:2007, the following changes have been made:

— additional functionalities for smart metering applications are added;

— minimum requirements for test signal output of calculators are added;

— minimum requirements for test data interface of complete heat meters are added;

— new forms of pockets and sensors and parmeter setting and adjustment through interface are added.

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,

1) EN 1434-3 is maintained by CEN/TC 294.

Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the constructional requirements for heat meters. Heat meters are instruments intended for measuring the energy which in a heat-exchange circuit is absorbed (cooling) or given up (heating) by a liquid called the heat-conveying liquid. The heat meter indicates the quantity of heat in legal units.

Electrical safety requirements are not covered by this European Standard.

Pressure safety requirements are not covered by this European Standard.

Surface mounted temperature sensors are not covered by this European Standard.

This standard covers meters for closed systems only, where the differential pressure over the thermal load is limited.

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 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1092-3, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 3: Copper alloy flanges*

EN 1434-1:2015, *Heat meters — Part 1: General requirements*

EN 1434-3, *Heat Meters — Part 3: Data exchange and interfaces*

EN 60751:2008, *Industrial platinum resistance thermometers and platinum temperature sensors (IEC 60751:2008)*

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 ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1)*

ISO 4903, *Information technology — Data communication — 15-pole DTE/DCE interface connector and contact number assignments*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1434-1:2015 apply.

4 Temperature sensors

4.1 General

The temperature sensor sub-assembly shall consist of platinum resistance temperature sensors selected as matched pairs.

Other types of temperature sensor pairs may be used, where the sub-assembly consists, inseparably, of temperature sensors and calculator.

The maximum admissible working pressure shall be declared by the manufacturer.

Where no dimensional tolerance is specified, the values shall be taken from Table 1.

Table 1 — Tolerances

Dimension mm	0,5 up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400
Tolerance mm	± 0,2	± 0,3	± 1	± 1,5	± 2,5

4.2 Mechanical design

4.2.1 General

For pipe sizes up to and including DN 250, 3 different temperature sensor types are standardized:

— direct mounted short probes - Type DS;

— direct mounted long probes - Type DL;

— pocket mounted long probes - Type PL.

Types PL and DL can be either head probes or have permanently connected signal leads. Type DS shall have permanently connected signal leads only.

4.2.2 Materials of temperature probe sheath and pocket

The temperature pocket and the protective sheath of direct mounted probes shall be of a material that is adequately strong and resistant to corrosion and has the requisite thermal conductivity.

A suitable material has been shown to be EN 10088-3 — X6 Cr Ni Mo Ti 17 12 2.

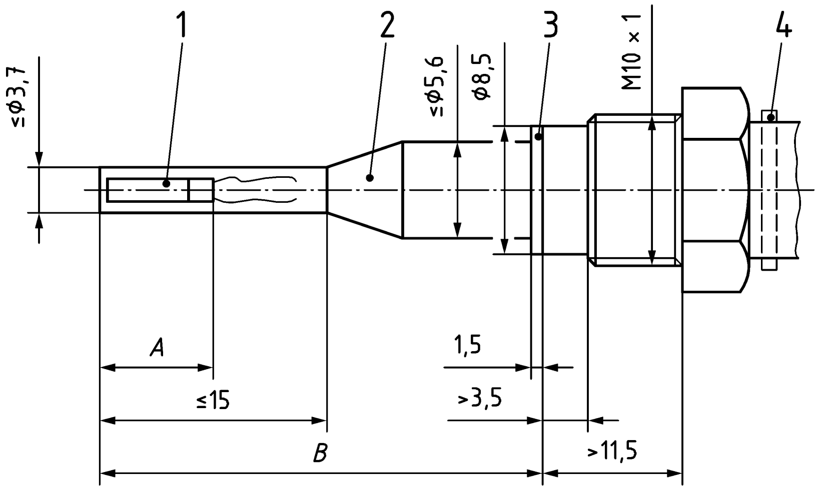
4.2.3 Dimensions of direct mounted short probes - Type DS

The dimensions shall be as given in Figure 1.

Further non-normative information is given in Annex A, Figure A.1.

The qualifying immersion depth shall be 20 mm – or less if so specified by the manufacturer.

Dimensions in millimetres



Key

1 temperature sensing element

2 protective sheath

3 sealing ring

4 ejection device

A: < 15 mm

B: = 27,5 mm or = 38 mm or 60 mm

Figure 1 — Temperature probes type DS

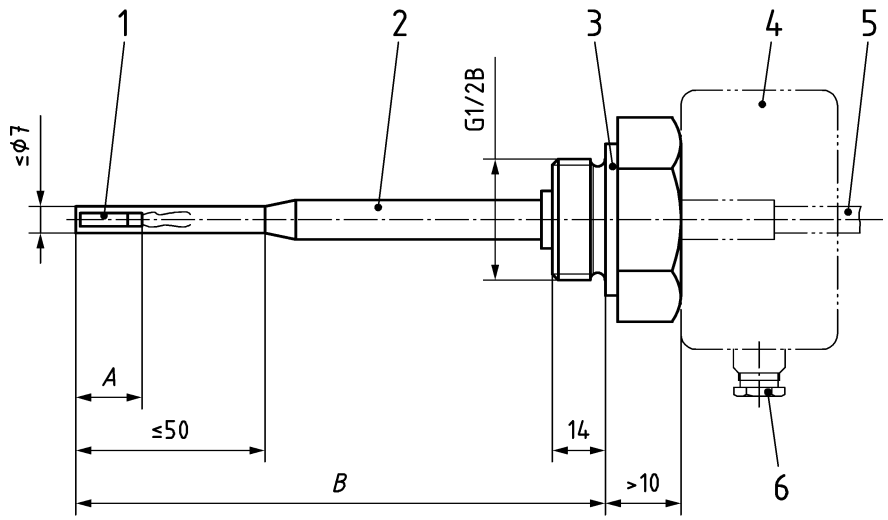
4.2.4 Dimensions of direct mounted long probes - Type DL

The dimensions shall be as given in Figure 2.

Further information is given in Annex A, Figures A.2 and A.3.

The qualifying immersion depth shall be 50 % of the length B – or less if so specified by the manufacturer.

Dimensions in millimetres



Key

1 temperature sensing element
2 protective sheath
3 sealing surface
4 outline of head probe
5 outline of permanently connected signal lead probe
6 inlet for signal cable – ø ≤ 9 mm

G ½ B thread in accordance with EN ISO 228-1

A: < 30 mm or ≤ 50 mm for Pt1000

Alternative lengths	
B	C (head probe only)
85	105
120	140
210	230

Figure 2 — Temperature probes type DL (head or cable)

4.2.5 Dimensions of pocket mounted long probes - Type PL

The dimensions shall be as given in Figure 3.

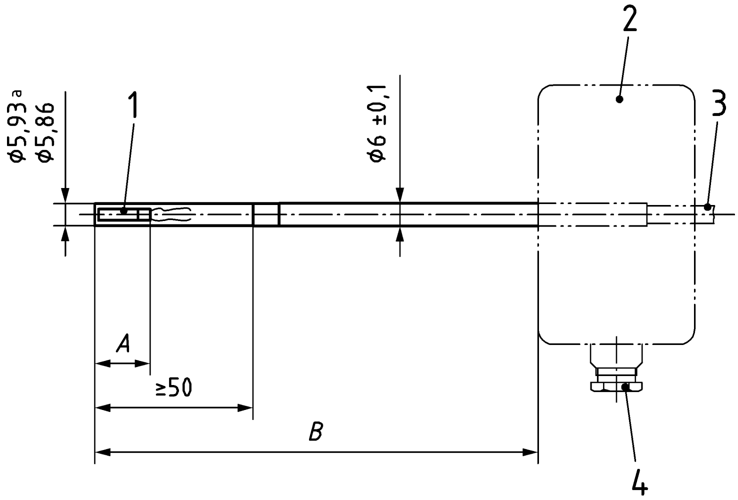
Further information is given in Annex A, Figures A.4 and A.5.

The qualifying immersion depth shall be 50 % of the length B for the shortest pocket specified – or less if so specified by the manufacturer.

4.2.6 Dimensions of temperature pocket

The temperature pocket is designed for use with type PL temperature probes only. It is designed to be capable of being inserted through a pipe wall to which has been externally brazed or welded a boss (see Annex A, Figure A.9) and in this respect only, it is interchangeable with a direct mounted long probe of corresponding insertion length. The dimensions shall be as given in Figure 4.

Dimensions in millimetres



Key

A < 30 mm or ≤ 50 mm for Pt 1000

Alternative lengths
B (head probe only)
105
140
230

1 temperature sensing element

2 outline of head probe

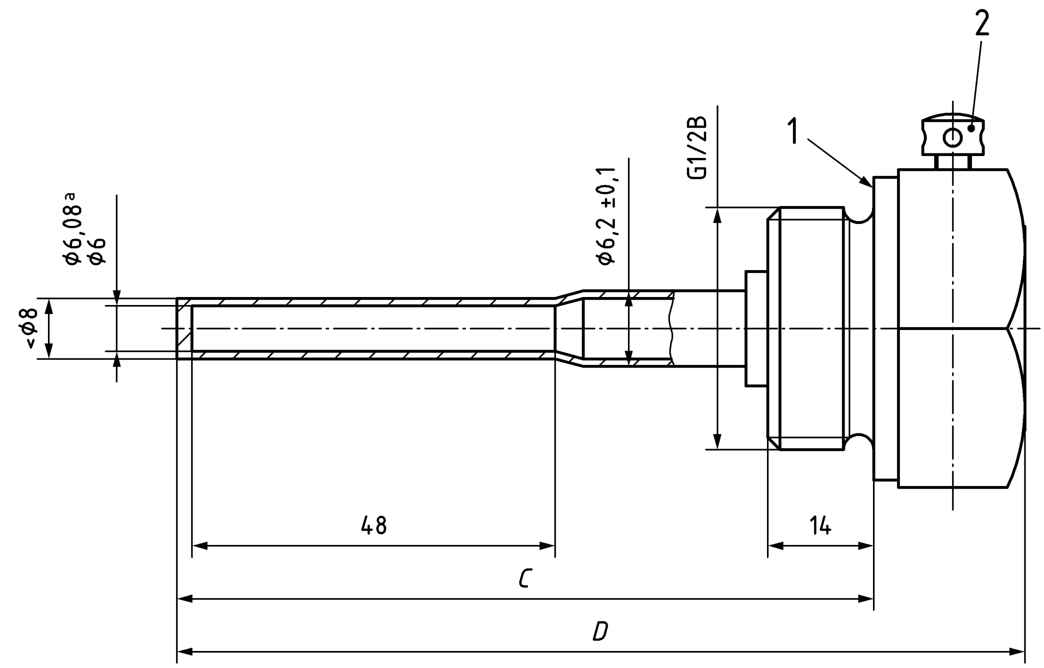
3 outline of permanently connected signal lead probe

4 inlet for signal cable – ø ≤ 9 mm

Corresponding to c11 in EN ISO 286-2, rounded to 2 decimals

Figure 3 — Temperature probes - Type PL (head or cable)

Dimensions in millimetres



Key

1 sealing face

2 probe clamping screw with provision for security sealing

[a] Corresponding to H11 in EN ISO 286-2 rounded to 2 decimals

G ½ B thread in accordance with EN ISO 228-1

Alternative lengths	
C	D
85	≤ 100
120	≤ 135
210	≤ 225

Figure 4 — Temperature pocket

4.2.7 Design of short probes with respect to installation

The sensor shall be mounted perpendicular to the flow and with the sensing element inserted to at least the centre of the pipe.

For internal pressures up to 16 bar, the sensor shall be designed to fit in a pipe fitting (see Annex A, Figure A.7).

4.2.8 Design of long probes with respect to installation

The sensor shall be mounted with the sensing element inserted to at least the centre of the pipe.

The sensor shall be designed to fit in the following types of installation, (for internal pressures up to PN 16):

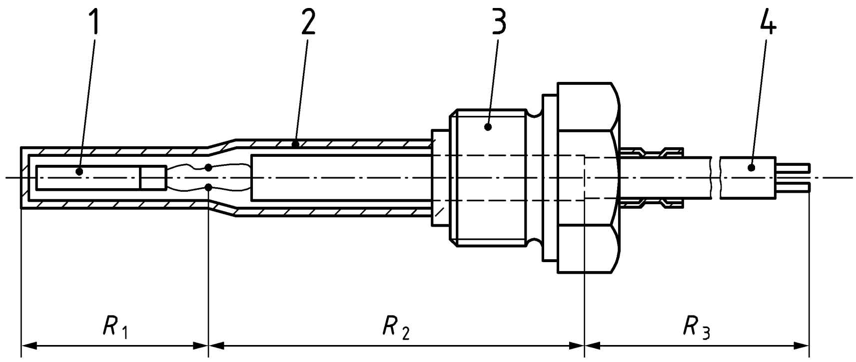
a) in a pipe DN 50 mounted with the tip pointing into the flow in a bend (see Annex A, Figure A.11 b), using welded-in boss (see Annex A, Figure A.9).

b) in a pipe DN 50 mounted at an angle 45° to the direction of the flow with the tip pointing into the flow (see Annex A, Figure A.11 c), using a welded-in boss (see Annex A, Figure A.9).

c) in a pipe DN 65 to DN 250, mounted perpendicular to the flow (see Annex A, Figure A.11 d), using a welded-in boss (see Annex A, Figure A.9).

4.3 Platinum temperature sensor

4.3.1 Specialized definitions for 2 wire temperature probes



Key

R_1 temperature sensing element resistance

R_2 internal wire resistance

R_3 signal lead resistance

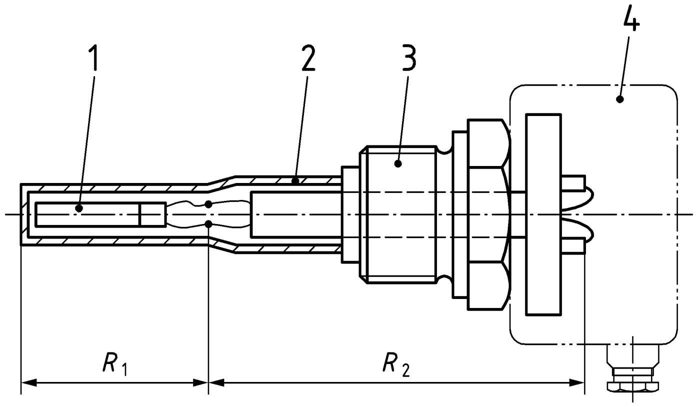
1 temperature sensing element

2 protective sheath

3 mounting thread

4 signal leads

Figure 5 — Temperature probe with permanently connected signal leads



Key

R_1 temperature sensing element resistance

R_2 internal wire and terminals resistance

1 temperature sensing element

2 protective sheath

3 mounting thread

4 signal leads

Figure 6 — Head sensor temperature probe

4.3.2 Resistance characteristics

The calibration of temperature sensors shall be traceable to national temperature standards. The intermediate values of the heat meter temperature sensor shall be interpolated using Formula (1) as follows:

$$R_t = R_0\left(1 + \mathrm{A}t + \mathrm{B}t^2\right) \quad (1)$$

where

R_t is the resistance value at temperature t in Ω (excluding cable resistance - see Figures 5 and 6);

R_0 is the resistance value at temperature 0 °C in Ω (base value) (excluding cable resistance);

A is 3,908 3 × 10^{-3} $°C^{-1}$;

B is -5,775 × 10^{-7} $°C^{-2}$.

NOTE It is assumed that the national temperature standards are established with reference to ITS-90 - The International Temperature Scale of 1990.

4.3.3 Signal leads

For signal leads, leads with strands can be used, or in the case of head probes, solid wires. The lead ends shall be precisely trimmed, if strands are used (e. g. by lead end sleeves). Solder-coating of the lead ends to prevent splicing is not permissible.

A soldered joint to connect the temperature probe signal lead to the calculator is only permitted in the case of non-interchangeable temperature probes.

For screened cables for temperature sensors there shall be no connection between the screen and the protecting sheet.

To ensure best performance and measurement stability the 4-wire method and Pt 100 or Pt 500-platinium resistance temperature sensors should be used.

4.3.4 Temperature sensors for the 2-wire method

The length and cross sectional area of signal leads of paired resistance sensors of separable sub-assemblies shall be equal.

The length of the signal lead as supplied by the manufacturer shall not be changed.

The length shall be within the values given in Table 2.

Table 2 — Maximum lengths of leads for Pt 100 temperature sensors

Lead cross section mm^2	**Max. length for Pt 100** m
0,22	2,5
0,50	5,0
0,75	7,5
1,50	15,0

For sensors of higher resistances the limiting value can be extended proportionally.

NOTE The values given in Table 2 have been obtained in the following manner:

It is assumed, that the difference in temperature of the leads does not exceed one third of the temperature difference between inlet and outlet pipes.

The maximum permissible length of lead for each lead cross section was then calculated, having decided that the error created may not be allowed to exceed 0,2 times the maximum permissible error of the temperature probe pair and using the knowledge of the different resistances created by the temperature differences between the inlet and outlet leads.

The influence of the length of a signal lead can be neglected, if the total resistance of a lead for a Pt 100 temperature sensor does not exceed two times 0,2 Ω.

4.3.5 Temperature sensors for the 4-wire method

If the cable length requirements in 4.3.4 cannot be fulfilled, the 4-wire method shall be used.

The connections shall be clearly identifiable so that they cannot be confused.

A cross-section of 0,5 mm^2 is recommended for head sensors and a minimum cross-section of 0,14 mm^2 for cable sensors.

4.3.6 Thermal response time

The manufacturer shall declare the temperature sensor response time $\tau_{0,5}$ as defined in EN 60751:2008, 6.5.2 using the test method in EN 60751:2008, 4.3.3.3.

4.4 Other temperature sensors

Other types of temperature sensors are permissible, but shall be tested as part of the calculator.

5 Flow sensors

5.1 Maximum admissible working pressure, PS in bar

The maximum admissible working pressure shall be declared by the manufacturer.

5.2 Sizes and dimensions

The flow sensor is designated either by the thread size of the end connections or by the nominal diameter of the flange. For each flow sensor size there is a corresponding value of the permanent flow rate q_p and a set of lengths as given in Tables 3 and 4.

The values in Table 3 apply to the connecting screw and/or the flange and the overall lengths.

For sizes larger than DN 250 the flow sensor dimensions are not standardised.

Table 3 — Preferred dimensions

q_p m³/h	**Overall length** mm	**Threaded end connection**	**Flanged connection** DN	**Overall length** mm	**Threaded end connection**	**Flanged connection** DN	**Overall length** mm	**Threaded end connections**
0,6	110	G ¾ B	15	190	G 1 B	20		
1,0	130	G ¾ B	15	190	G 1 B	20	110	G ¾ B
1,5	165	G ¾ B	15	190	G 1 B	20	110	G ¾ B
2,5	190	G 1 B	20				130	G 1 B
3,5	260	G 1 ¼ B	25				150	G 1 ¼ B
6,0	260	G 1 ½ B	32	260	G 1 ¼ B	25	150	G 1 ¼ B
10	300	G 2 B	40				200	G 2 B
15	300		50	270		50		
25	300		65					
40	350		80	300		80		
60	350		100	360		100		
100	350		125					
150	500		150					
250	500		200					
400	600		250					

To achieve the necessary overall length adaptor pieces can be fitted.

The adjacent lengths larger or smaller than the preferred lengths may be adopted for $q_p \geq 10$ m³/h.

Tolerances on the overall length shall be:

— up to 300 mm $^{0}_{-2}$ mm;

— from 350 to 600 mm $^{0}_{-3}$ mm.

Threaded connection

Dimensions for the threaded end connections are specified in Table 4. Threads shall comply with EN ISO 228-1. Figure 7 outlines the dimensions a and b.

Flanged connection

Flanged end connections shall comply with EN 1092-1, EN 1092-2 and EN 1092-3 (as appropriate) for a nominal pressure corresponding to that of the flow sensor.

Table 4 — Threaded end connections

Range of size and minimum thread lengths in mm

Thread	a	b
G ¾ B	10	12
G 1 B	12	14
G 1 ¼ B	12	16
G 1 ½ B	13	18
G 2 B	13	20

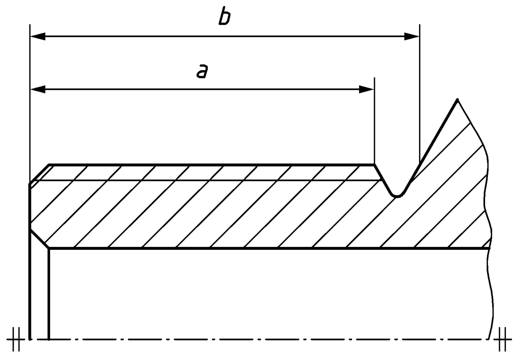


Figure 7 — Outline of the dimensions a and b in Table 4

5.3 Test signal output

For test purposes, it is required that either high resolution pulses using an adaptor according to Annex B shall be provided, or data from a data interface, as described in EN 1434-3, using an adapter (if necessary) shall be employed. The discrimination of these test outputs shall be such, that in a test at q_i (defined in EN 1434-1:2015, 5.3.3), the measurement error resulting from the number of pulses is not greater than 0,8 %, and the test period of 1 h for sizes $q_p < 10$ m³/h or 1,5 h for $q_p \geq 10$ m³/h, is not exceeded.

The nominal relationship between the signal emitted and the quantity measured shall be declared by the manufacturer.

Output names used at pulse output connections are given in Annex B.

For flow sensors having data test interface only (without high resolution pulse outputs), at least the following data shall be available: Unique meter ID and volume register.

5.4 Adjusting device

The flow sensor may be fitted with an adjustment device making it possible to correct the relationship between the indicated and the true value.

For flow sensors the adjustment shall be available through a data interface, if the flow sensors are intended for re-adjustment. This is not applicable for flow sensors with mechanical adjustment. In any case the adjusting shall be protected by security sealing.

6 Calculators

6.1 Terminals - specification and identification

6.1.1 General

The numbers specified in Table 5 or Table 6 respectively shall be used for the inscriptions on the terminals provided. Terminals not required can be omitted. The screening of a screened cable may be connected to the terminal board for earthing purposes. The screening of a screened cable may be anchored to the terminal board to prevent damage of the cable by pulling, provided the cable used is suitable for this.

6.1.2 Terminals for signal leads

The terminals shall meet the following requirements:

a) maximum cable cross-section 1,5 mm^2;

b) distance between terminals 5 mm;

c) suitable for stranded wire;

d) the contact resistance for a two-wire Pt 100 transition between the terminal and the wire shall be ≤ 5 mΩ. The change in contact resistance with time shall be < 5 mΩ;

e) to ensure best performance and measurement stability the 4-wire method should be used.

Table 5 — Numbering of terminals

Terminal no.	Signal descriptor	Signal identification
1	High temperature sensor/assigned to No. 5[a]	
2	High temperature sensor/assigned to No. 6[a]	
3	Low temperature sensor/assigned to No. 7[a]	
4	Low temperature sensor/assigned to No. 8[a]	
5	High temperature sensor	
6	High temperature sensor	
7	Low temperature sensor	
8	Low temperature sensor	
9	Flow sensor, positive supply voltage output	
10	Flow sensor signal input	
11	Flow sensor reference input	
12	Test signals reference output	-U
13	High resolution energy test signal output	CH
14	Flow pulse test signal input	CI
15	High resolution volume test signal input	CT
16	Remote counting pulses energy output	CE
17	Remote counting pulses energy output, reference level	
18	Remote counting pulses volume output	CV
19	Remote counting pulses volume output, reference level	
20	CL 0 - interface with 4-wire	RX+/RTX+
21	CL 0 - interface with 4-wire	RX-/RTX-
22	CL 0 - interface with 4-wire	TX+
23	CL 0 - interface with 4-wire	TX-
24	Meter bus interface	
25	Meter bus interface	

[a] Used only with 4-wire method.

Rules about numbering of terminals:

a) there may be more than one terminal, each of them having the same number, if they are electrically connected (e.g. connection of temperature sensor cable's shield);

b) terminals and their numbers can be omitted, if corresponding signals are not present;

c) for signals other than those described, terminal number 50 and upwards shall be used.

6.1.3 Terminals for connection to the mains supply

Two or, preferably, three terminals shall be provided, which shall be suitable for stranded wire up to a cross-section of 2,5 mm^2. Cables with permanently fitted connections may also be used.

Table 6 — Numbering and marking of the mains terminals

Terminal No	Marking
26	Earth symbol
27	N
28	L

If no polarity indication is needed, the "N" and "L" can be replaced by the standardized symbol for a mains connection.

6.2 Batteries

The life time of the batteries shall be declared by the manufacturer.

6.3 Dynamic behaviour

The manufacturer shall declare how the temperature measurements and integration are related to the flow sensor signal and time.

6.4 Test signal output

A high resolution energy signal is required for testing purposes. The resolution shall be sufficiently high so that at a test at the lower limit of temperature difference and/or flow rate, the additional error caused by the resolution of the energy signal can be shown to be insignificant. The nominal relationship between the high resolution signal and the energy reading shall be stated by the manufacturer.

The energy signal as specified above shall be available either directly at the calculator connection terminal or at the terminal of a testing adapter as stated in Annex B.

The test signal shall be either pulses with a defined value of pulses/energy increment or a data output, specially defined, or a display with correspondingly high resolution.

Pulse output names used at output connections are given in Annex B.

For calculators having data test interface only (without high resolution pulse outputs), at least the following data shall be available:

— unique meter ID,

— energy register,

— volume register,

— inlet temperature, and

— outlet temperature.

Calculators intended for re-adjustment the adjustment shall be available through a data interface. In any case the adjusting shall be protected by security sealing.

6.5 24 h interruption in supply voltage

The calculator shall be able to handle interruptions in the supply voltage for periods of up to 24 h, without a change more than one digit in the energy display.

7 Complete meter

The requirements given in Clauses 3 to 5 shall be applied where relevant.

A test output shall be provided, in which the resolution is high enough to ensure, that the reading error does not exceed 0,5 % for a test duration of 2 h.

The attachment of devices for sampling the test output shall have no effect on the accuracy of the heat meter.

In addition the indicating device may be provided with a high resolution scale for testing purposes, provided that the resolution requirements are met.

It is assumed that the reading error will not exceed half the smallest scale interval for each meter reading or, in the case of digital indicators, cannot exceed 0,99 of the least significant digit.

Pulse output names used at output connections are given in Annex B.

For complete meters having data test interface only (without high resolution pulse outputs), at least the following data shall be available with high resolutions:

— unique meter ID,

— energy register,

— volume register,

— inlet temperature, and

— outlet temperature.

Complete heat meters intended for re-adjustment the adjustment shall be available through a data interface. In any case the adjusting shall be protected by security sealing.

8 Interfaces between sub-assemblies

8.1 General

The type of signals between the calculator, the temperature sensors and the flow sensor shall be clearly defined by the manufacturer.

The definition shall include all relevant data, e.g. type of signal, voltage and current levels and limitations such as maximum and minimum frequency, duty cycles etc.

8.2 Definitions for pulse device interfaces

8.2.1 General

To define the compatibility between a unit with a pulse output and another unit with a pulse input, the following specification shall be used.

8.2.2 Electrical connection

The electrical connection of a pulse device has two terminals. Both terminals shall be isolated from ground (e.g. pipes or casing) with an insulation resistance greater than 100 MΩ measured at 100 V DC under reference conditions.

The possible shielding connection shall be designed to the rules of the electromagnetic compatibility.

8.2.3 Classification of pulse output devices

Class OA: electromechanical switch.

Typical examples of a class OA device is the Reed contact and the electronic switch.

The "ON" state is defined by the closed switch, the "OFF" state by the open switch.

A characteristic feature of the electromechanical switch is bouncing of the mechanical contacts.

Class OB: passive electronic current sink with slow pulses; high current.

Typical example for a passive electronic current sink class OB is the "open collector" with a Darlington transistor. Class OB devices replace the typical models of class OA devices by an electronic solid state solution. These devices do not bounce and need an auxiliary power supply and electronic control signal to switch the current source "ON" and "OFF".

Class OC: passive electronic current sink with slow pulses; low current.

A typical example of a passive electronic current sink class OC is also the "open collector" or "open drain" device. These devices do not bounce and need an auxiliary power supply and electronic control signal to switch the current source "ON" and "OFF". This device has lower voltage drop than Class OB.

Class OD: passive electronic current sink with fast pulses; low current

Class OD devices differ from class OC devices by a shorter pulse length.

Class OE: passive electronic current sink with fast pulses; higher current.

The current sink shall be according to EN 60947-5-6 (NAMUR). It differs from class OD by higher level of current and voltage. It allows to monitor the connecting cable on short and break.

8.2.4 Timing and electrical parameters for pulse output devices (other than test signals)

Table 7 — Timing and electrical parameters

Parameter	Class OA	Class OB	Class OC	Class OD	Class OE
Example	Reed or electronic switch	(Darlington) open collector	Open collector	Open collector or active	
Polarity reversal	Possible	Not possible	Not possible	Not possible	Not possible
Pulse length	≥ 100 ms	≥ 30 ms	≥ 100 ms	≥ 0,1 ms	≥ 0,04 ms
Pulse pause	≥ 100 ms	≥ 100 ms	≥ 100 ms	≥ 0,1 ms	≥ 0,04 ms
Bounce time	≤ 1 ms	-	-	-	-
Max. input voltage	30 V	30 V	6 V	6 V	12,5 V
Max. input current	27 mA	27 mA	0,1 mA	0,1 mA	17 mA
"ON" Condition	U ≤ 2,0 V at 27 mA	U ≤ 2,0 V at 27 mA	U ≤ 0,3 V at 0,1 mA	U ≤ 0,3 V at 0,1 mA	I ≥ 2,2 V
"OFF" Condition	R ≥ 6 MΩ	R ≥ 6 MΩ	R ≥ 6 MΩ	R ≥ 6 MΩ	I ≤ 1,0 MA

8.2.5 Classification of pulse input devices

Class IA:

In a typical example, the actuating coil drives an electromechanical relay or an electromechanical counter - In combination with a fixed voltage source (specified DC voltage: 3 V, 12 V and 24 V), these devices work with class OA and OB pulse output devices.

Class IB:

A typical example is a micro controller CMOS input with a low pass filter for protection against and suppression of bouncing parts of the pulse signal.

A pull-up resistor to stabilize the CMOS input is used as current source for class OC pulse output devices.

Class IC:

Class IC devices are similar to Class IB devices, but the time constant of the low-pass filter is designed to be shorter. IC input devices cannot work with output devices that exhibit bouncing.

Class ID:

The input device shall be according to EN 60947-5-6 (NAMUR). Similar to class IB with higher levels of current and voltage. The switching thresholds are defined as current levels.

The optional supervision of input signal for short or open circuit shall be disabled as default.

Class IE:

The input device shall be according to EN 60947-5-6 (NAMUR). Similar to class ID but for faster signals. IE input devices cannot work with output devices that exhibit bouncing.

The optional supervision of input signal for short or open circuit shall be disabled as default.

8.2.6 Timing and electrical parameter for pulse input devices

Table 8 — Timing and electrical parameters

Parameter	Class IA	Class IB	Class IC	Class ID	Class IE
Voltage supply	≤ 30 V	≤ 6 V	≤ 6 V	7 V to 9 V	7 V to 9 V
Source current	≤ 27 mA	≤ 0,1 mA	≤ 0,1 mA	7 mA to 16 mA	7 mA to 16 mA
High level input threshold	U ≥ 8 V	U ≥ 2 V	U ≥ 2 V	I ≤ 1,2 mA	I ≤ 1,2 mA
Low level input threshold	U ≤ 3 V	U ≤ 0,5 V	U ≤ 0,5 V	I ≥ 1,2 mA	I ≥ 1,2 mA
Pull-up resistor	-	50 kΩ to 2 MΩ	50 kΩ to 2 MΩ	562 Ω to 1 kΩ	562 Ω to 1 kΩ
Pulse length	≥ 30 ms	≥ 100 ms	≥ 0,1 ms	≥ 2 ms	≥ 0,04 ms
Pulse frequency	≤ 5 Hz	≤ 5 Hz	≤ 5 kHz	≤ 200 Hz	≤ 12,5 kHz

8.2.7 Compatibility

Table 9 shows how the different input and output devices can be used together.

Table 9 — Compatibility

Input Devices	**Class IA**	**Class IB**	**Class IC**	**Class ID**	**Class IE**
Output Devices					
Class OA	yes	yes	no	yes	no
Class OB	yes	no	no	yes	yes
Class OC	no	yes	yes	no	no
Class OD	no	no	yes	no	no
Class OE	no	no	no	no	yes

9 Marking and security seals

9.1 Marking

9.1.1 General

If complete information about measuring range and other limitations cannot be clearly printed on the marking plate, a warning sign shall be placed immediately after the incomplete information.

9.1.2 Temperature sensor pairs

The following information shall appear in legible and indelible characters or as symbol on the head or a separate security sealed plate:

a) name of the manufacturer, or his trade mark;

b) type - inclusive Pt-designation (e. g. Pt 100), year of manufacture and serial number;

c) limits of the temperature range (Θ_{min} and Θ_{max}). An additional set of limits for the cooling range may be specified for heating/cooling meters;

d) limits of temperature differences ($\Delta\Theta_{min}$ and $\Delta\Theta_{max}$). An additional set of limits for the cooling range may be specified for heating/cooling meters;

e) maximum admissible working pressure;

f) if needed, identification of inlet and outlet temperature sensors.

9.1.3 Pockets

The pockets following this European Standard shall be marked with "EN 1434".

9.1.4 Flow sensor

The following information shall appear in legible and indelible characters or as symbol on the sensor or a security sealed plate:

a) name of the manufacturer, or his trade mark;

b) type, year of manufacture, serial number;

c) meter factor;

d) limits of temperature (Θ_{min} and Θ_{max}). An additional set of limits for the cooling range may be specified for heating/cooling meters;

e) limits of flow rate (q_i, q_p and q_s). Different sets of q_i and q_s may be given depending on mounting orientation and type of liquid;

f) one or two arrows to indicate the direction of the flow;

g) maximum admissible working pressure, PS in bar;

h) nominal pressure, PN;

i) accuracy class; may differ depending on mounting orientation and on type of liquid;

j) environmental class;

k) heat conveying liquid if other than water;

l) voltage level for external power supply.

9.1.5 Calculator

The following information shall appear in legible and indelible characters or as symbol on the casing or a security sealed plate:

a) name of the manufacturer, or his trade mark;

b) type, year of manufacture, serial number;

c) type of temperature sensors (e.g. Pt 100, Pt 500);

d) limits of the temperature (Θ_{min} and Θ_{max}). An additional set of limits for the cooling range may be specified for heating/cooling meters;

e) Limits of temperature differences ($\Delta\Theta_{min}$ and $\Delta\Theta_{max}$). An additional set of limits for the cooling range may be specified for heating/cooling meters;

f) meter factor for the flow sensor;

g) flow sensor to be operated at the inlet or outlet temperature;

h) environmental class;

i) heat conveying liquid if other than water;

j) voltage level for external power supply.

9.1.6 Complete meter

The following information shall appear in legible and indelible characters or as symbol:

a) name of the manufacturer, or his trade mark;

b) type, year of manufacture and serial number;

c) limits of the temperature (Θ_{min} and Θ_{max}). An additional set of limits for the cooling range may be specified for heating/cooling meters;

d) limits of temperature differences ($\Delta\Theta_{min}$ and $\Delta\Theta_{max}$). An additional set of limits for the cooling range may be specified for heating/cooling meters;

e) limiting values of the flow rate (q_i, q_p and q_s). Different sets of q_i and q_s may be given depending on mounting orientation and type of liquid;

f) meter to be installed in the inlet or outlet;

g) one or more arrows to indicate the direction of the flow;

h) maximum admissible working pressure, PS in bar;

i) nominal pressure, PN;

j) accuracy class; may differ depending on mounting orientation and on type of liquid;

k) environmental class;

l) heat conveying liquid if other than water;

m) voltage level for external power supply.

9.2 Sites for marking

Sites shall be provided for marks (e.g. legal status marks) to be sited on that part of the heat meter indicating the quantity of heat for a complete meter or on each sub-assembly for combined meters.

All parts of the heat meter that might be separated after calibration and testing shall have sites for placing an identity mark.

The sites for these marks shall be situated so that the marks are clearly visible when attached.

9.3 Security seals

Sites for security seals shall be provided so that the provisions of EN 1434-1:2015, 6.4 are met.

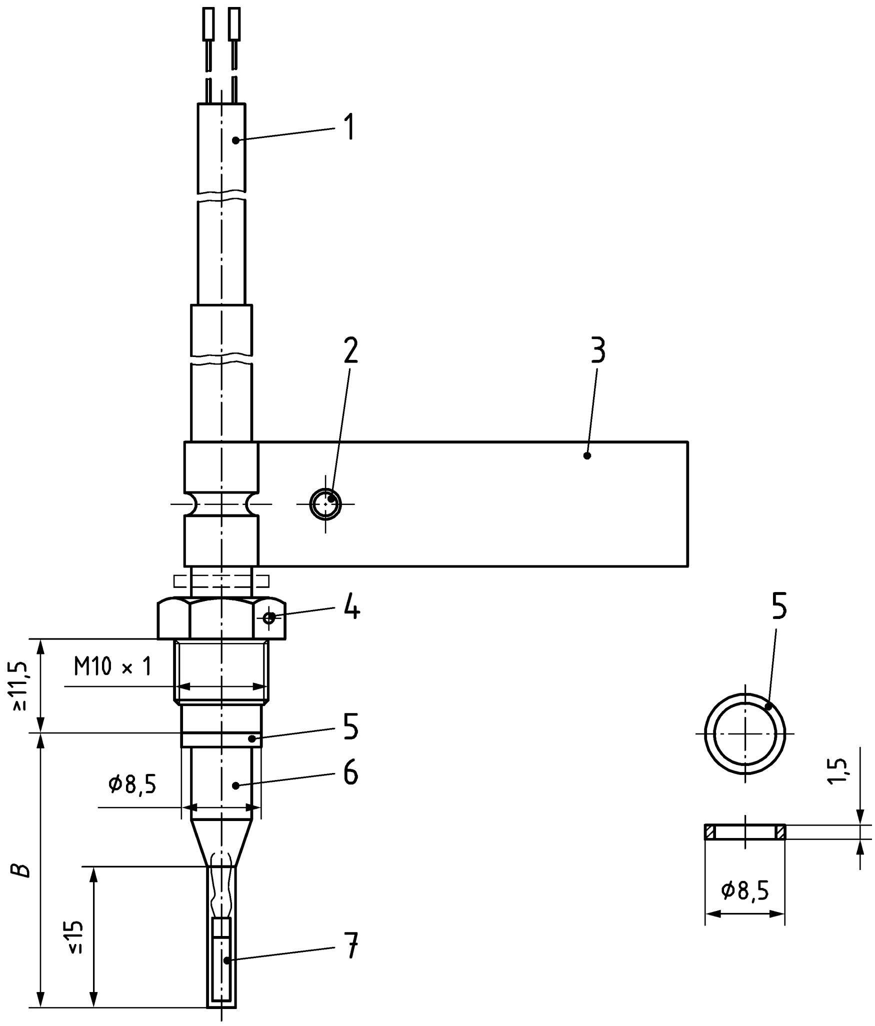
Annex A
(informative)
Examples of temperature sensors

This annex deals with examples of temperature sensor design and installation (Figures A.1 to A.12).

NOTE 1 In the figures in this annex, all dimensions are given in millimetres.

NOTE 2 All pipe threads (e. g. G1/2B) are meant to be in accordance with EN ISO 228-1.

Dimensions in millimetres

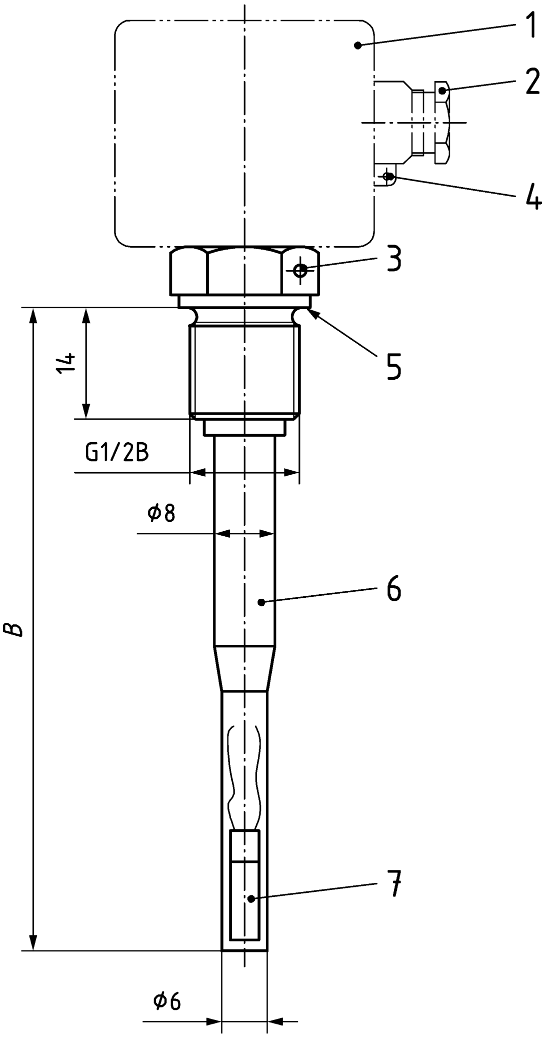


Key

1 connected lead
2 provision for security sealing (example)
3 identification plate (example)
4 provision for locking wire
5 sealing ring – material e. g. copper or PTFE
6 protective sheath
7 temperature sensing element

Figure A.1 — Temperature probe - direct mounted - short - type DS-cable

Dimensions in millimetres



Key

1 outline of head

2 signal cable inlet

3 provision for locking wire

4 provision for security sealing

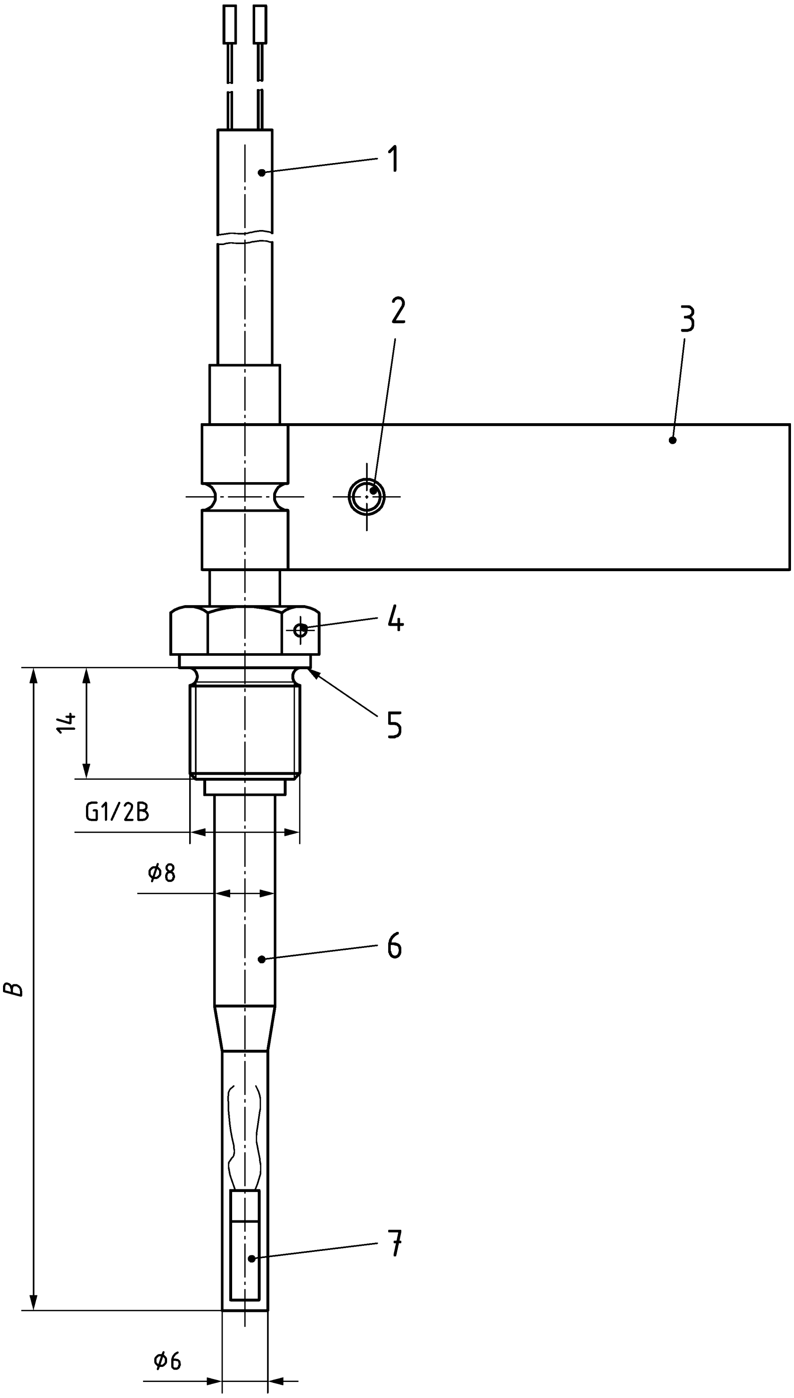
5 sealing face

6 protective sheath

7 temperature sensing element

Figure A.2 — Temperature probe - direct mounted - long - Type DL-head

Dimensions in millimetres

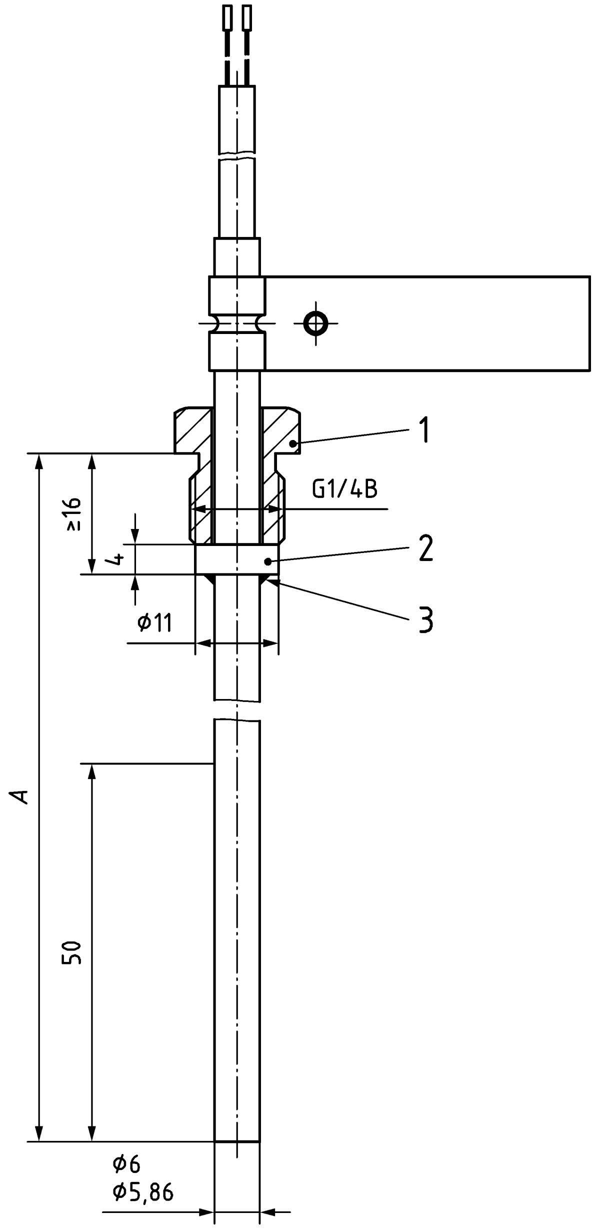


Key

1 connecting lead
2 provision for security sealing (example)
3 identification plate (example)
4 provision locking wire
5 sealing face
6 protective sheath
7 temperature sensing element

Figure A.3 — Temperature probe - direct mounted - Type DL-cable

Dimensions in millimetres



Key

1 screw

2 flange

3 welded

Figure A.4 —Type PL G1/4

Dimensions in millimetres

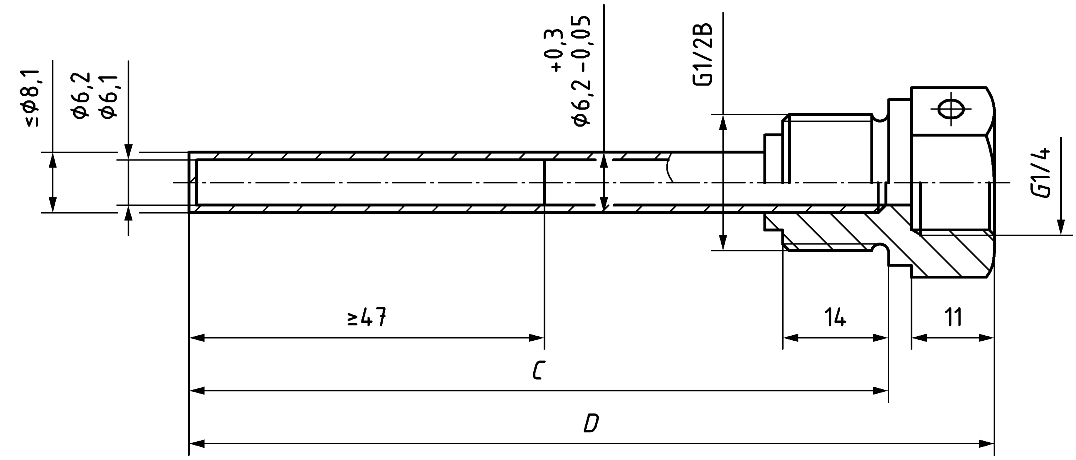


Figure A.5 — Pocket with G1/4 connection thread

Dimensions in millimetres

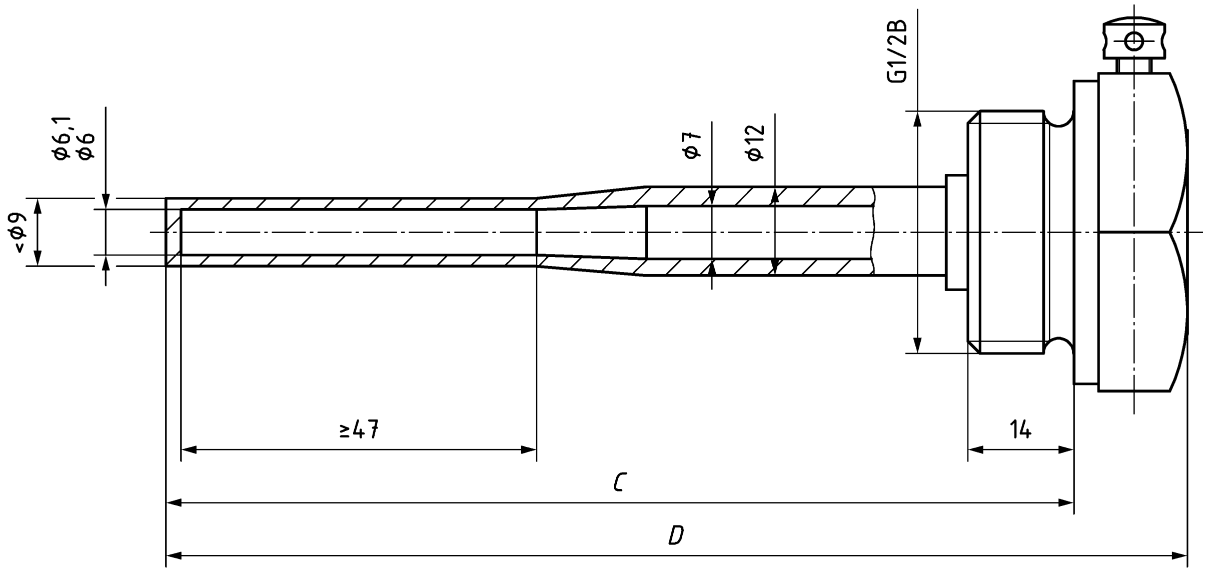
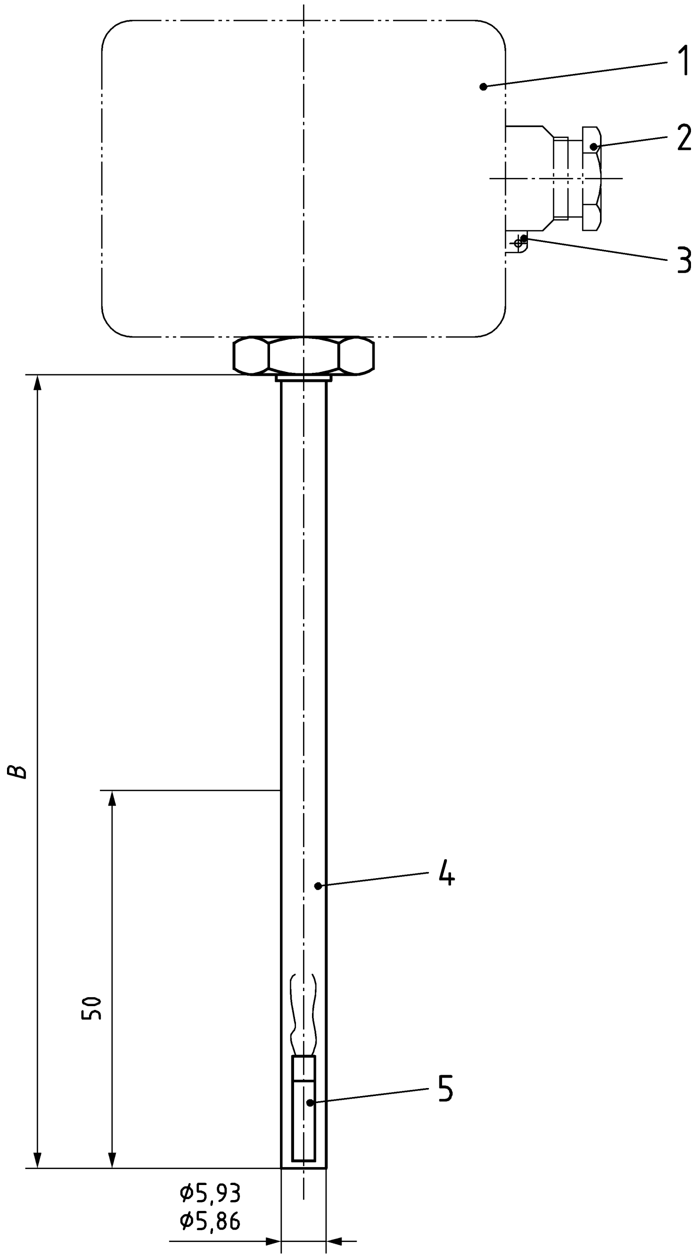


Figure A.6 —Reinforced pocket

Dimensions in millimetres



Key

1 outline of head

2 inlet for signal cable

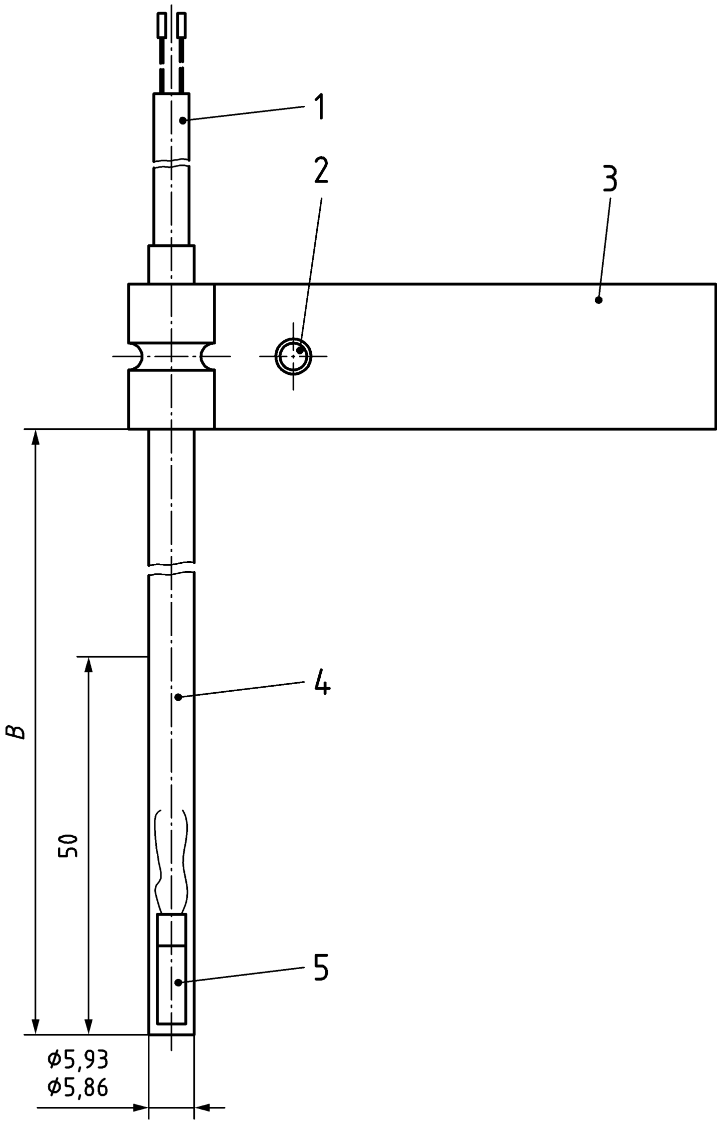
3 provision for security sealing

4 protective sheath

5 temperature sensing element

Figure A.7 — Temperature probe - pocket mounted - Type PL-head

Dimensions in millimetres



Key

1 connecting lead

2 provision for security sealing (example)

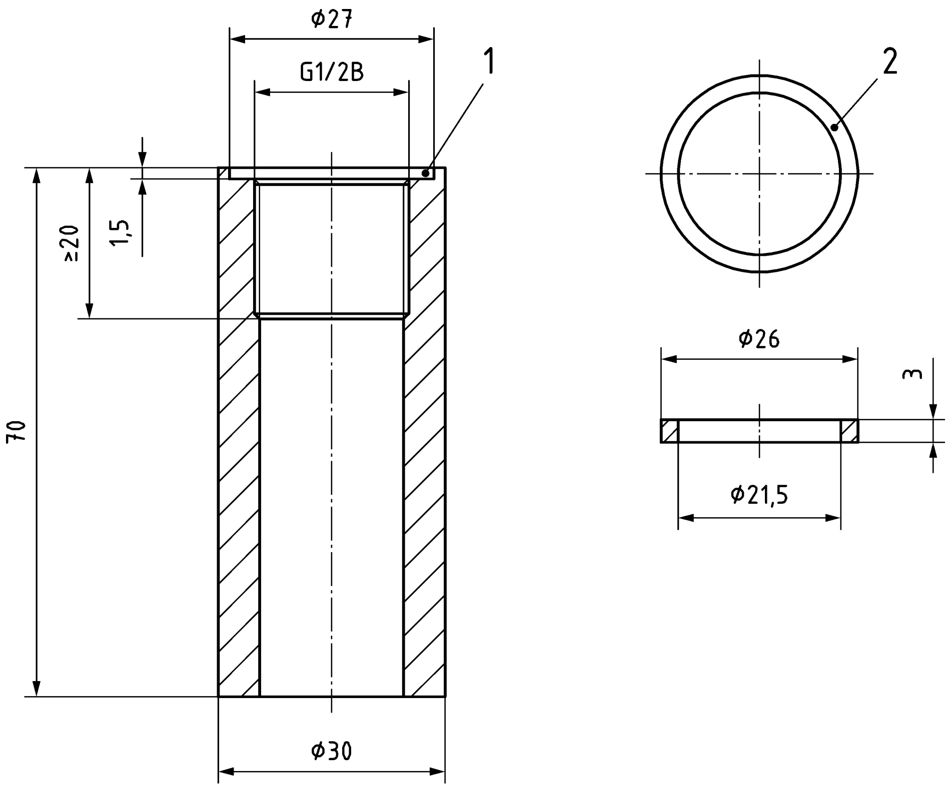
3 identification plate (example)

4 protective sheath

5 sealing face

Figure A.8 — Temperature probe - pocket mounted - Type PL-cable

Dimensions in millimetres



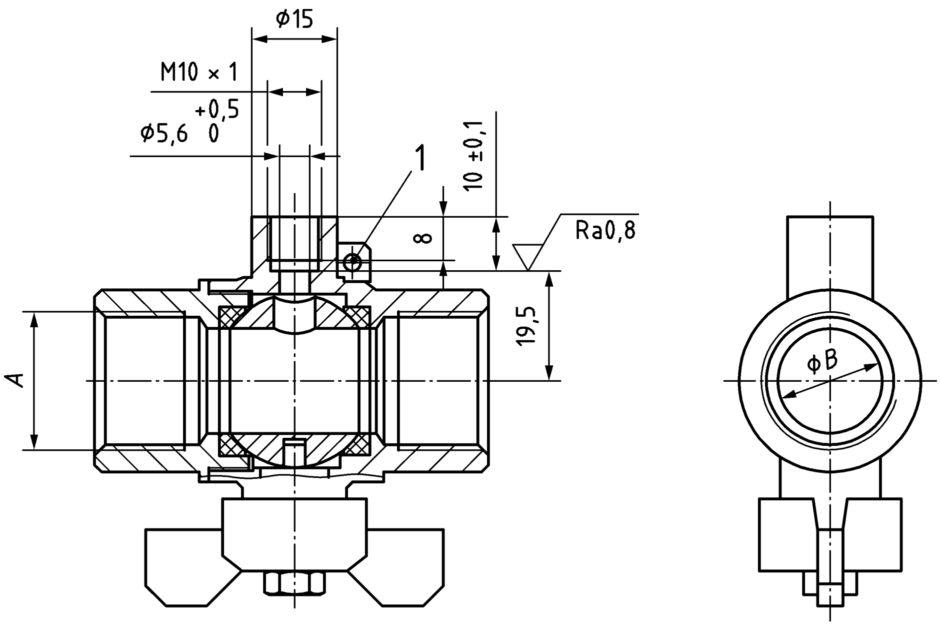
Key

1 recess for sealing ring

2 copper sealing ring for use with both types of boss

Figure A.9 — Temperature boss and sealing ring

Dimensions in millimetres



Key

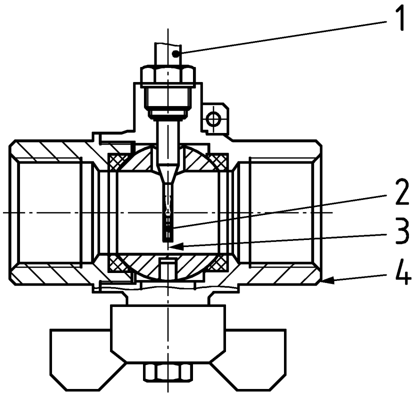
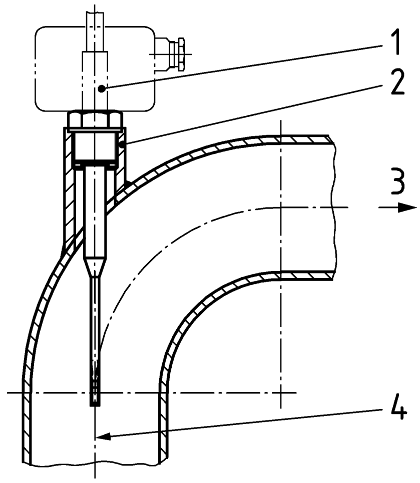
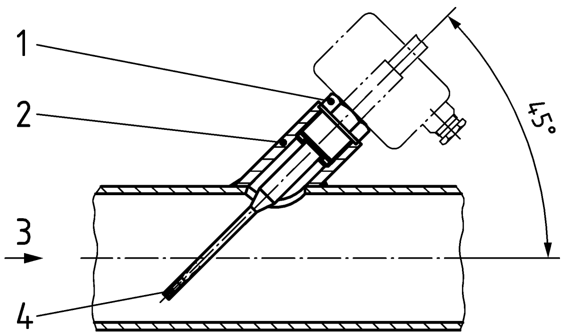
Threaded connection size A	Tapping bore size B
G1/2B	18,5 mm
G3/4B	24 mm
G1B	30,5 mm
G1 1/4B	39 mm
G1 1/2B	45 mm

NOTE Tolerance on machined dimensions = ± 0,1 mm.

Pipe fittings for use with probe Type DS: see Figure A.11 a).

1 provision for security sealing

Figure A.10 — Threaded pipe fitting G1/2B, G3/4B, G1B, G1 1/4B and G1 1/2B sizes

Type of probe installation	Pipe size	Installation recommendations		Key
A In threaded pipe fitting	DN 15 DN 20 DN 25 DN 32 DN 40	 **Figure A.11 a)**	1 2 3 4	For probe type DS only Temperature sensing element inserted to axis of fitting or beyond Probe axis perpendicular to axis of fitting and in the same plane Pipe fitting, see Figure A.10
B In bend	≤ DN 50	 **Figure A.11 b)**	1 2 3 4	Either probe type DL or temperature pocket plus type PL Boss, see Figure A.9 Flow Probe axis coincident with pipe axe
C Angled probe	≤ DN 50	 **Figure A.11 c)**	1	Either probe type DL or temperature pocket plus type PL
			2 3 4	Boss, see Figure A.9 Flow Temperature sensing element inserted to pipe axis or beyond

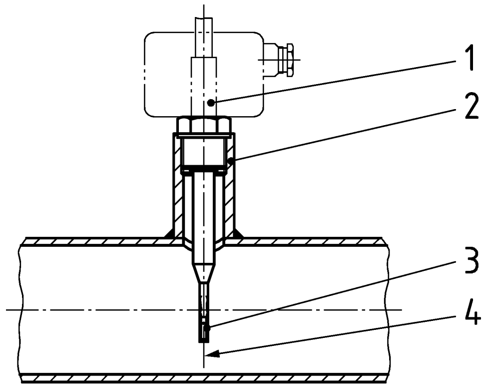
Type of probe installation	**Pipe size**	**Installation recommendations**		**Key**
D Perpendicular probe	DN 65 to DN 250	 **Figure A.11 d)**	1 2 3 4	Either probe type DL or temperature pocket plus type PL Boss, see Figure A.9 Temperature sensing element inserted to pipe axis or beyond Probe axis perpendicular to pipe axis and in the same plane

Figure A.11 — Installation recommendations

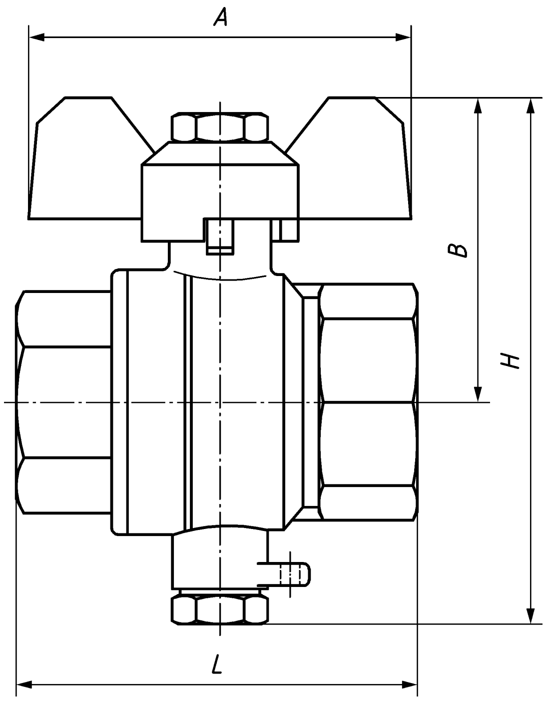


Figure A.12 — Typical ball valve

Annex B
(normative)
Input and output test signals

This annex deals with specifications for the input and output signals of the EUT as described in Table B.1 - see EN 1434-1 — where the EUT is to be tested by high resolution pulses as described in 5.3, 6.5 and Clause 7.

For this method of testing the flow sensor and/or calculator shall have the input and output signals shown in Table B.2, by means of an additional assembly (adapter) if necessary, offered by the manufacturer, with input and output signals according to Table B.3.

The input and output signals provided shall allow rapid and precise testing without influencing the meter performance when connected to a suitable test device with input and output signals according to Table B.3, where the signals are interpreted with the signal UR - see Table B.2 - as reference.

Table B.1 — Signal flow diagram

EUT	Adaptor	Standardized test device
EUT delivers standardized signals (with help of an adapter if necessary)		
		Standardized test equipment accepts and delivers standardised signals
EUT accepts standardized signals (with help of an adapter if necessary)		
	15 pin D-SUB female connector; male shell	15 pin D-SUB male connector; female shell

Table B.2 — Input and output test signals for the EUT

Signal ID	Signal description		Function
+U	Input	Positive supply voltage	Power for adapter
-U	Input	Negative supply voltage	Reference for all signals
UR	Output	Reference level	EUT logic supply voltage level
Referring to flow-sensor			
FH	Output	High resolution volume pulses	Test output of flow sensor
FO	Output	Volume output signal	E.g. from contact mechanism
Referring to calculator			
CH	Output	High resolution energy pulses	Test output from calculator
CE	Output	Energy counter pulses	E.g. from energy counter
CV	Output	Volume counter pulses	E.g. from volume counter

Signal ID	**Signal description**		**Function**
CI [a]	Input	Trigger signal for the calculation cycle	Simulated pulses, from contact mechanism
CT [a]	Input	Test input for volume proportional pulses	Simulated pulses, e.g. FH from flow sensor
CS	Output	Status signal	Active = measurement running
_ Underlined signals are compulsory			
[a] Only one of the signals CI and CT shall be available.			

Table B.3 — Electrical and mechanical specifications for standardized test device

Signal ID	**Adaptor contact no.**	**Electrical specification**	**Remarks**
+U	7 + 8	8 V ± 0,5 V – Load max. 125 mA	Power supply for adapter
-U	1 + 2		
UR	6	1 V < UR < 12 V – Load max. 0,1 mA	
FH	3	f ≤ 10 kHz TH ≥ 1 ms	f: frequency in Hertz TH: time at high level in seconds
FO	4	f ≤ 5 Hz TH ≥ 1 ms	
CH	15	f ≤ 2 MHz TH ≥ 200 ms	
CV	11	TH ≥ 30 ms	
CV	12	TH ≥ 30 ms	
CI	13	f ≤ 1 Hz TH/TL = 1 ± 0,1	TL: time at low level in seconds
CT	14	f ≤ 10 kHz TH/TL = 1 ±0,1	
CS	10	f ≤ 5 Hz TH ≥ 1 ms	
All signals shall be CMOS with levels higher than 0,6 UR interpreted as logical 1 and lower than 0,4 UR as logical 0. All inputs on the test device shall have an impedance of 100 kΩ or higher. All outputs on the test device shall be able to be loaded with 10 kΩ. Connector from adapter to test device 15 pin Sub-D connector shall be in accordance with ISO 4903.			

Annex C
(informative)
Low voltage Power Supply for heat meters and their sub-assemblies

C.1 Remote supply

C.1.1 Voltage (DC or AC)

Recommended nominal voltages 24 V.

Tolerance DC: 12 V to 42 V.

If the remote supply lines are also used for data transmission (e.g. M-Bus, see EN 1434-3) these values shall be maintained during any data transmission.

Tolerance AC: ± 50 %

C.1.2 Current available

Peak value	to be specified by the manufacturer
Long term mean value	to be specified by the manufacturer
Total available energy	to be specified by the manufacturer

C.1.3 Cabling requirements

Max. cable length	> 10 m – restricted only by voltage drop
Shielded cable	a possible requirement to be specified by the manufacturer
Twisted cable	a possible requirement to be specified by the manufacturer

C.2 Local external DC supply

C.2.1 Voltage

Recommended nominal voltages 6 V, 3,6 V, 3 V.

C.2.2 Other data

Table C.1 — Standardized levels for external powering

Nominal voltage	6 V	3,6 V	3 V
Max. average current	100 mA	10/20/50/100/200 µA	10/20/50/100/200 µA
Tolerance at average current	5,4 V to 6,6 V	3,4 V to 3,8 V	2,8 V to 3,3 V
Peak current	100 mA	10 mA	5 mA
Min. voltage at peak current	5,4 V	3,2 V	2,7 V

C.3 Power supply specifications

The manufacturer should make available data sheets containing at least the following information:

— manufacturer;

- type identification;
- external or remote power supply;
- nominal voltage level;
- available current (peak and long term mean value);
- total available energy (if battery);
- cabling requirement (maximum cable length and possible requirements for shielded or twisted cable).

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2004/22/EC, MID

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2004/22/EC, MID.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive2004/22/EC, MID

Clause(s)/sub-clause(s) of this EN	**Essential Requirements (ERs) of Directive 2004/22/EC, MID**	**Qualifying remarks/Notes**
	Annex I, Essential Requirements, Definitions:	
Scope	Measurand	In scope of standard defined.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

[2] EN ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts (ISO 286-2)*

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