SLOVENSKI STANDARD
SIST EN 1434-3:1997

01-junij-1997

Toplotni števci - 3. del: Izmenjava podatkov in vmesniki

Heat meters - Part 3: Data exchange and interfaces

Wärmezähler - Teil 3: Datenaustausch und Schnittstellen

Compteurs d'énergie thermique - Partie 3: Echanges de données et interfaces

Ta slovenski standard je istoveten z: EN 1434-3:1997

ICS:

17.200.10 Toplota. Kalorimetrija Heat. Calorimetry

SIST EN 1434-3:1997 en

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1434-3

February 1997

ICS 17.200.10

Descriptors: measuring instuments, thermal energy meters, heat exchangers, interfaces, information interchange, data transfer, protocoles, data bus, physical properties, data display, codification

English version

Heat meters - Part 3: Data exchange and interfaces

Compteurs d'énergie thermique - Partie 3: Echanges de données et interfaces

Wärmezähler - Teil 3: Datenaustausch und Schnittstellen

This European Standard was approved by CEN on 1997-01-27. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Ref. No. EN 1434-3:1997 E

Contents

Page

Foreword . . . 3

1 Scope . . . 3

2 Normative references . . . 4

3 Meter interfaces and protocols overview . . . 5

4 Physical properties . . . 7
4.1 M-Bus interface . . . 7
4.2 Optical interface . . . 9
4.3 Inductive interface . . . 9
4.4 CL interface . . . 10

5 Heat meter communication using the data transmission protocol of EN 61107 . . . 11
5.1 Protocol modes according to EN 61107 for heat meters . . . 11
5.2 Restrictions for heat meters . . . 11
5.3 Data presentation for heat meter . . . 12
5.4 Coding of the unit in the data set . . . 15
5.5 Coding of the value in the data set . . . 16
5.6 Presentation of related values . . . 17

6 Heat meter communication using the data transmission protocol of EN 60870-5 . . . 18
6.1 Protocol modes according to EN 60870 for heat meters . . . 18
6.2 Frame formats used . . . 19
6.3 Communication between requesting device (master) and heat meter (slave) . . . 20
6.4 Coding of data records . . . 23
6.5 Fixed data structure . . . 27
6.6 Variable data structure . . . 33

Annex A (informative) Additional information using M-Bus . . . 41
A.1 Arrangement for test of signal quality-sending . . . 41
A.2 Arrangement for test of signal quality-receiving . . . 41

Annex B (informative) Worst case calculation for M-Bus system . . . 42
B.1 Assumptions . . . 42
B.2 All slaves are at the end of the M-Bus line . . . 43
B.3 The slaves are equally distributed over the M-Bus line . . . 44

Annex C (informative) Additional information about the master-unit for the M-Bus . . . 45
C.1 Master side interface to the M-Bus . . . 45
C.2 Master side interface for local data read out . . . 45
C.3 Medium size level converter . . . 45
C.4 Full size level converter . . . 45

Annex D (informative) Description of inductive interface, primary part . . . 49
D.1 Transmission principle . . . 49
D.2 Construction of inductive reading head . . . 49
D.3 Electrical characteristic values . . . 50

Annex E (informative) Additional information for heat meters . . . 51
E.1 Recommendation for heat meter test interface . . . 51
E.2 Registration of manufacturers ID . . . 51
E.3 Additional information regarding EN 61107 Protocol . . . 52
E.4 Additional information regarding the M-Bus . . . 52

Foreword

This draft European Standard has been prepared by Technical Committee CEN/TC 176 "Heat meters", the secretariat of which is held by DS.

The other parts are:

Part 1 - General requirements

Part 2 - Constructional requirements

Part 4 - Pattern approval tests

Part 5 - Initial verification tests

Part 6 - Heat meter installation, commissioning, operational monitoring and maintenance

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 August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European standard applies to heat meters, that is to instruments intended for measuring the heat which, in a heat-exchange circuit, is absorbed or given up by a liquid called the energy-conveying liquid. The meter indicates heat in legal units.

Electrical safety requirements are not covered by this standard.

Part 3 specifies the data exchange between a meter and a read-out device (POINT / POINT communication). For these applications using the optical readout head and the CL interface, the EN 61107 protocol is recommended.

Further stipulations are set out for the data communication between several meters and one master unit in a local network (MULTI-POINT communication). This can be done with a few meters with a hand held master unit by using the inductive interface on the Meter-Bus (in the following called the M-Bus).

For bigger networks with up to 250 meters, a master unit with AC mains supply is necessary to control the M-Bus. For these applications a protocol according to EN 60870-5 is recommended.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred do apply.

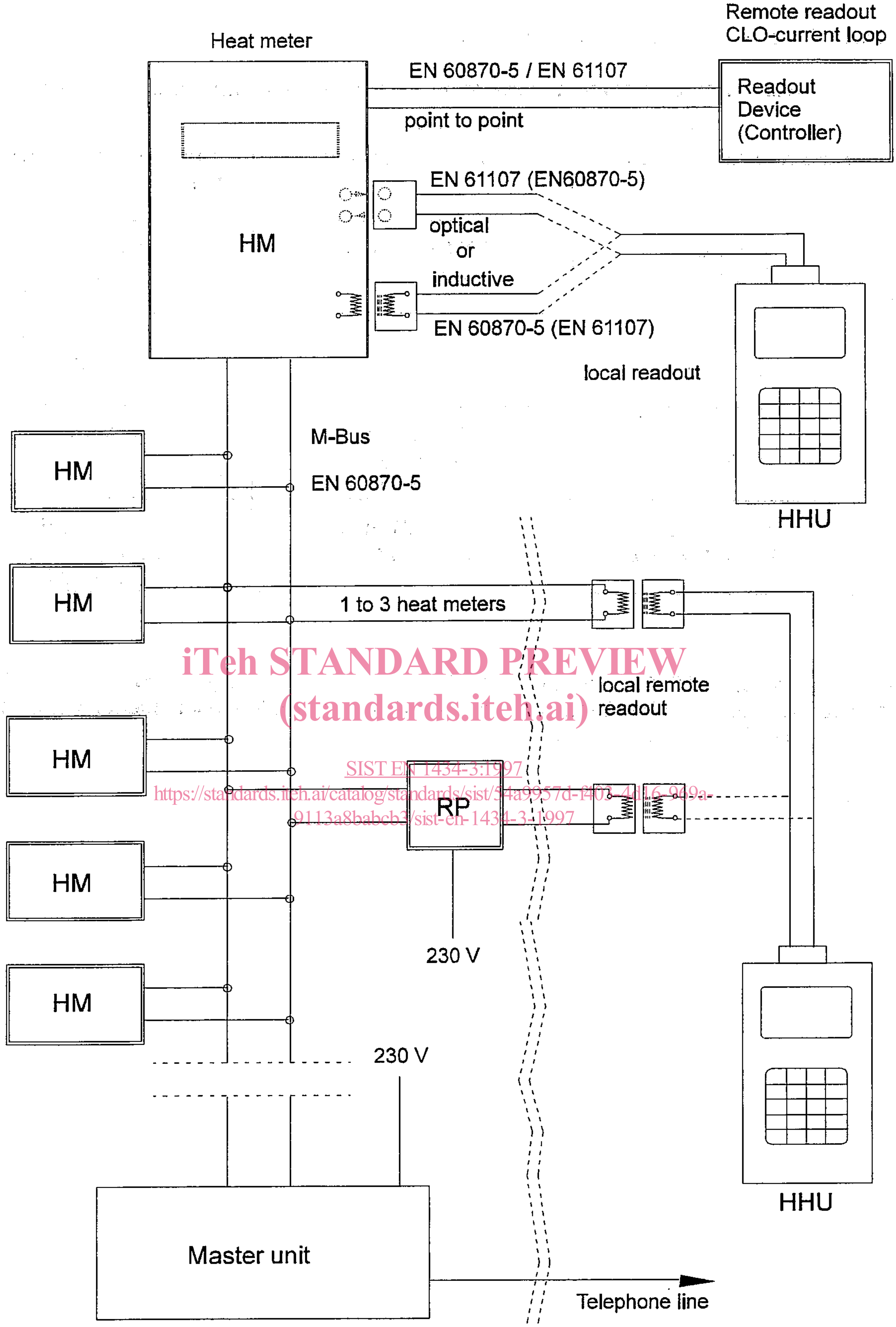
EN 60870-5-1	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 1: Transmission frame formats (IEC 870-5-1:1990)
EN 60870-5-2	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 2: Link transmission procedures (IEC 870-5-2:1992)
EN 60870-5-4	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 4: Definition and coding of application information elements (IEC 870-5-4:1993)
EN 61107:1992	Data exchange for meter reading, tariff and load control. Direct local data exchange.(IEC 1107:1992)
ISO/IEC 646	Information technology - ISO 7-bit coded character set for information interchange
ISO/IEC 7480:1991	Information technology - Telecommunications and information exchange between systems - Start/stop transmission signal quality at DTE/DCE interfaces
ISO/IEC 7498-1	Information technology - Open Systems Interconnection - Basic reference Model: The Basic Model

3 Meter interfaces and protocols overview

Table 1: Possible combinations of hardware interfaces and protocol standards

Hardware interface type	Protocol standard	Protocol alternative with label om meters only
Optical 3.2 of EN 61107:1992	EN 61107:1992 clause 4 to 5	EN 60870-5-1 EN 60870-5-2 EN 60870-5-4
Inductive	EN 60870-5-1 EN 60870-5-2 EN 60870-5-4	EN 61107:1992 clause 4 to 5
M-Bus	EN 60870-5-1 EN 60870-5-2 EN 60870-5-4	No alternative
Current loop CL 3.1 of EN 61107:1992	EN 61107:1992 clause 4 to 5	EN 60870-5-1 EN 60870-5-2 EN 60870-5-4

For both protocols EN 61107 and EN 60870-5 (see Table 1), the design of layer 7 of the ISO/OSI model (application layer) has been given an open definition. For the requirements of heat meters the layer 7 is described in this document.



HM Heat meter
HHU Handheld unit
RP Repeater

Figure 1: Heat meter communication interfaces

4 Physical properties

A meter can have either none or a number of interfaces to communicate with the outside world. If a meter has an interface in accordance with this standard, it shall fulfil at least one of the following requirements for the physical layer.

4.1 M-Bus interface

The M-Bus can be used for "point to point" or for "multi-point" communication in bus systems. The Annex B shows some examples of worst case installations: One with 250 slaves connected to 380 m wire length of normal standard telephone cable (0,5 mm²). The other one shows how 64 meters can be connected to 3600 m cable length (1,5 mm²). Both versions are applicable in any wiring topology (as tree, ring, star or line).

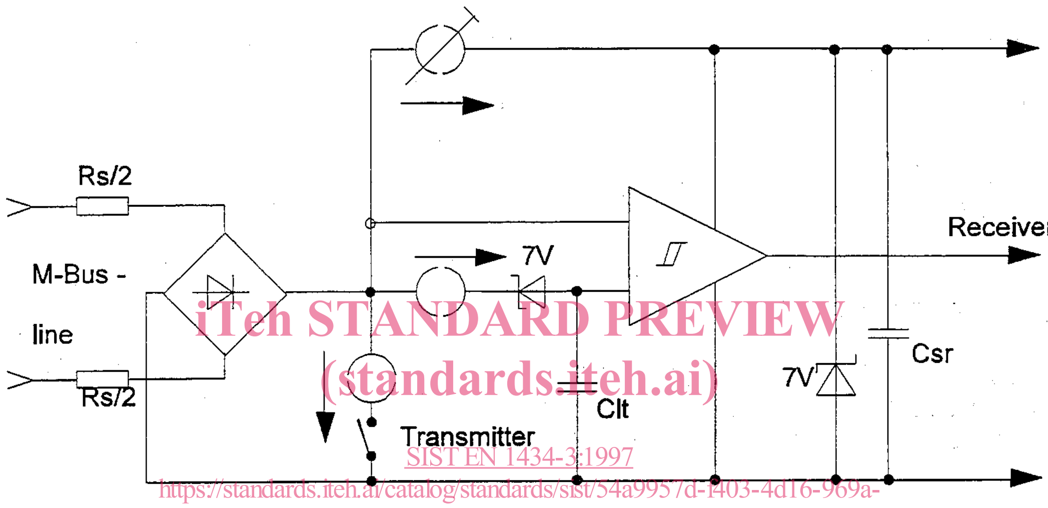


Figure 2: Circuit arrangement for M-Bus configuration

4.1.1 Transmission states

Only one master unit can be connected temporarily or permanently to a M-Bus. When the master unit is in its active mode it shall provide the energy for the bus. All interfaces of the connected meters (slave units) are passive.

- Transmission from master to slave

The master shall send the bit-information by shifting the voltage level.
At the meter terminals the levels shall be:

MARK :	H ≈ SPACE voltage + ≥ 10 V (but ≤ 42V)
SPACE :	L ≈ ≥ 12 V

- Transmission from slave to master

The slave shall send the bit information by current pulses.

MARK :	L = 0 mA to 1,5 mA (1 unit load UL = 1,5 mA)
SPACE :	H = (11 mA to 20 mA) + MARK current

- Idle mode

The master unit is active but no communication takes place.

master unit :	(MARK)	voltage level `H`
meter :	(MARK)	current level `L`

In order to protect the master from the illusion of invalid communication caused by the sum of current variations from up to 250 slaves, the idle current, L-level, shall not vary - with master voltage, time and temperature - by more than stated below.

L = L ± 0,002 • L (per 1V change)
L = L ± 10µA (over 10 s)
L = L ± 10 % (over time and temperature)

4.1.2 Internal detector level of meter receiver

All voltage levels shall be referred to the mark voltage via a maximum voltage detector. The maximum voltage detector shall have an asymmetrical time constant. The discharge time constant shall be at least 30 times larger than the charge time constant.

LIMIT for	L ≤	UMark – 8,2 V
LIMIT for	H ≥	UMark – 5,7 V

4.1.3 Galvanic isolation

The M-Bus connectors shall be galvanically separated from the housing ground. If there are additional connectors on the meter, they shall also be galvanically separated from the M-Bus connectors. The minimum isolation resistance shall be 1 MΩ.

4.1.4 Polarity of M-Bus wires

The M-Bus wires shall be interchangeable on the two M-Bus connectors.

4.1.5 Worst case conditions

Voltages up to ± 50 V without time limits and short circuiting the M-Bus lines shall not destroy the interface circuit. If the interface is destroyed by any external event, the meter shall work without malfunction.

4.1.6 Capacitance of M-Bus interface

The maximum input capacitance of the interface, including all protection units, shall be 0,5 nF.

4.1.7 Transmission speed

The M-Bus interface shall be designed for baud rates of 300 to 9600 Bd.

4.1.8 Startup time after power down on M-Bus

In case of power loss on the M-Bus for more than 0,1 s, the startup time shall be less than 3 s.

4.1.9 Serial resistance of meter interface

Two serial resistors (2 x Rs/2 - see figure 2) of (215 ± 5) Ω each shall be provided to avoid the shut down of the M-Bus in case of a short circuit in a defective interface circuit. It is also useful for detection of defective units.

4.2 Optical interface

The optical interface is used for local data readout. A hand held unit, equipped with an optical readout head, is temporarily connected to one meter and the data is read out, one meter at a time.

The physical properties of the optical interface are defined in EN 61107.

4.3 Inductive interface

The inductive interface is used for local data readout and remote data readout in small M-Bus systems. The mechanical dimensions are similar to those of the optical interface. Therefore a hand held unit can have a readout head with an optical interface on the one side and an inductive interface on the other side.

4.3.1 Arrangement of components inside the meter

All dimensions in mm

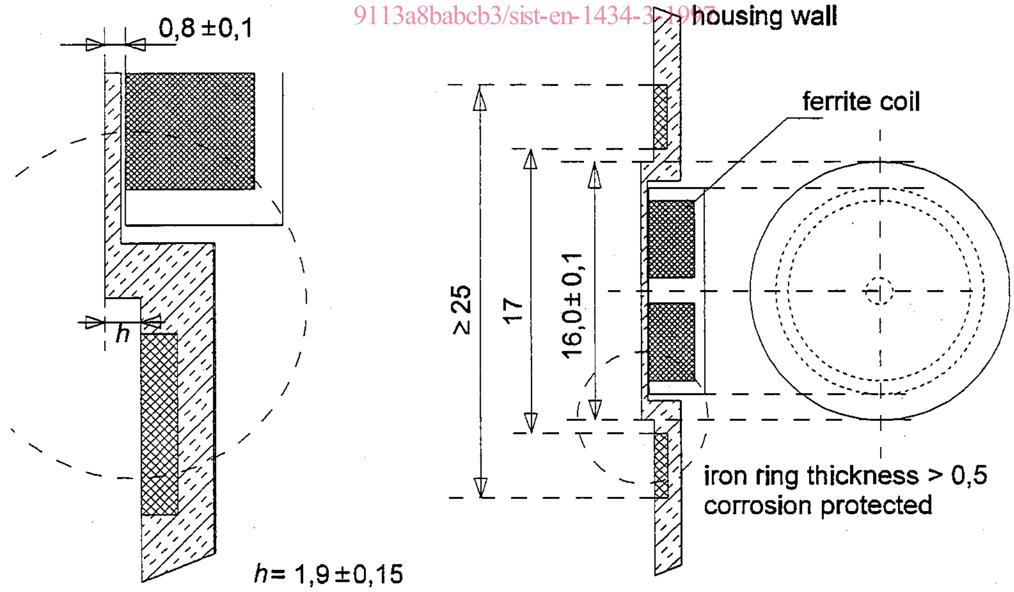


Figure 3: Dimensions of the inductive interface inside the heat meter

For further information, see annex D, figure D.1.

4.3.2 Inductive characteristic quantities

To fulfil the requirements of data transmission up to 2400 Baud, the carrier frequency shall be > 100 kHz.

Specification of the inductive interface, secondary part:

coil: 200 turns, diameter of 0,1 mm wire

ferrite core: initial permeability μ_i = 750 ± 150
flux density B (H=3000A/m) = 450 mT, no air gap
diameter 14 mm, height 5,3 mm

Secondary current mA	Voltage V
5	≥ 12
0	≤ 42

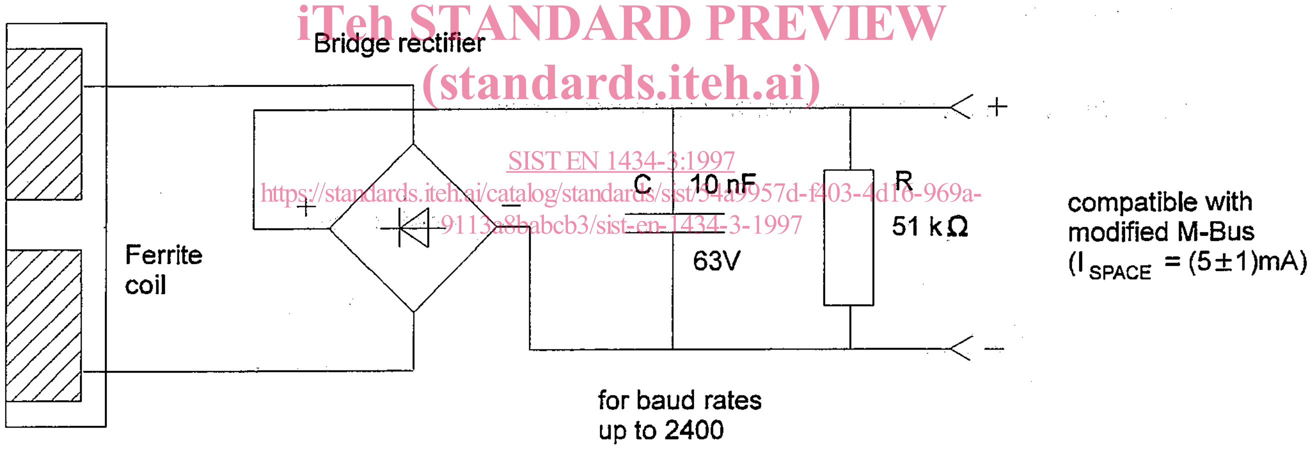


Figure 4: Electronic components inside the heat meter

The interface shall be directly connectable to the M-Bus, with the following restrictions:

– no more than 3 unit loads (1,5 mA) can be directly connected

– data stream of the answer of the meter is heard by all other M-Bus members

If there is already one inductive interface built directly into the meter housing, it is possible to connect a second one to the M-Bus interface by adding a decoupling diode between the M-Bus interface and the inductive interface.

4.4 CL interface

Type of signal: 20 mA current loop (CL interface in accordance with ISO/IEC 7498-1 with galvanic separation).

Power supply : On the meter side the interface shall be passive (type CL to ISO/IEC 7498-1). The readout device supplies the necessary power.

Connections : Via terminals or suitable connectors.

5 Heat meter communication using the data transmission protocol of EN 61107

This protocol is used for the optical and the CL interface. It can be used alternatively for the inductive interface and in this case the meter shall be marked with a label identifying the protocol. This protocol cannot be used for the M-Bus.

The basic rules of the protocol are defined in the EN 61107. Annex B of that document deals with battery operated devices (i.e. some heat meters).

The manufacturer ID (identification) mentioned in EN 61107 (three upper case letters) is used for heat meters using this protocol in the same manner. For heat meter suppliers using the data transmission protocol of EN 60870-5, the EN 61107 ID is also used to calculate the ID number described in clause 6 of this document. The formula stated in 6.6.1 shall be used (see also annex E).

5.1 Protocol modes according to EN 61107 for heat meters

EN 61107 describes various modes of operation. All main modes "A","B","C" and "D" are allowed for heat meters.

5.2 Restrictions for heat meters

The EN 61107 protocol shall be used with some restrictions. In some cases EN 61107 offers more than one possibility to perform the communication. For communication with heat meters only the selection described in the following subclauses shall be used. The selection is consistent with EN 61107.

5.2.1 Calculation of block check character

The calculation of the block check character shall always be used for the data message sent from the heat meter to the readout device.

5.2.2 Syntax diagram

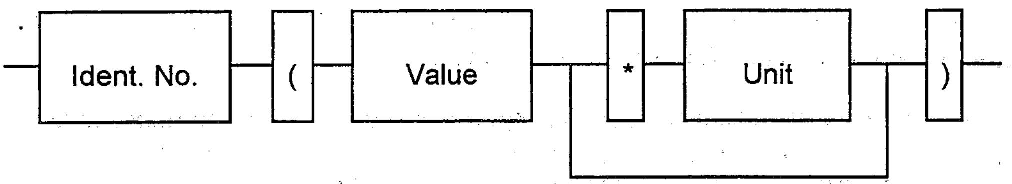
The syntax described in 5.5 of EN 61107:1992 document shall be used for heat meters as follows:

- The wake up message can be sent from the hand held unit to the heat meter to activate the communication facilities in the heat meter.
- The data message for heat meters shall start with the STX character and ends with the ETX and BCC sequence.
- The data block consists of one or more data lines.
- Each data line can contain up to 78 characters and ends with a CR and LF.

5.3 Data presentation for heat meter

EN 61107 does not describe the data presentation of the data message. For users of heat meters from different suppliers, the data coding for data readout application is defined. This data coding shall be used for all modes (A,B,C and D) of the EN 61107 protocol. In mode C, it is only used for the submode a) "Data readout". The data coding for the other submodes b) "Programming mode" and c) "Supplier specific operation" are a matter of special agreement between supplier and user.

5.3.1 Data set



Signal direction —— >

As recommended in 5.7 of EN 61107:1992, each data set (shown diagrammatically above) consists of:

- An identification number with the schematic structure "T" . "UU" . "W" * "VV" or "T" . "UU" . "W" & "VV"

- "(" as a front boundary character for the value and unit information

- "Value" 32 printable characters maximum with the exception of "(", ")", "*", "/" and "!". Decimal points (not commas) shall be included where applicable

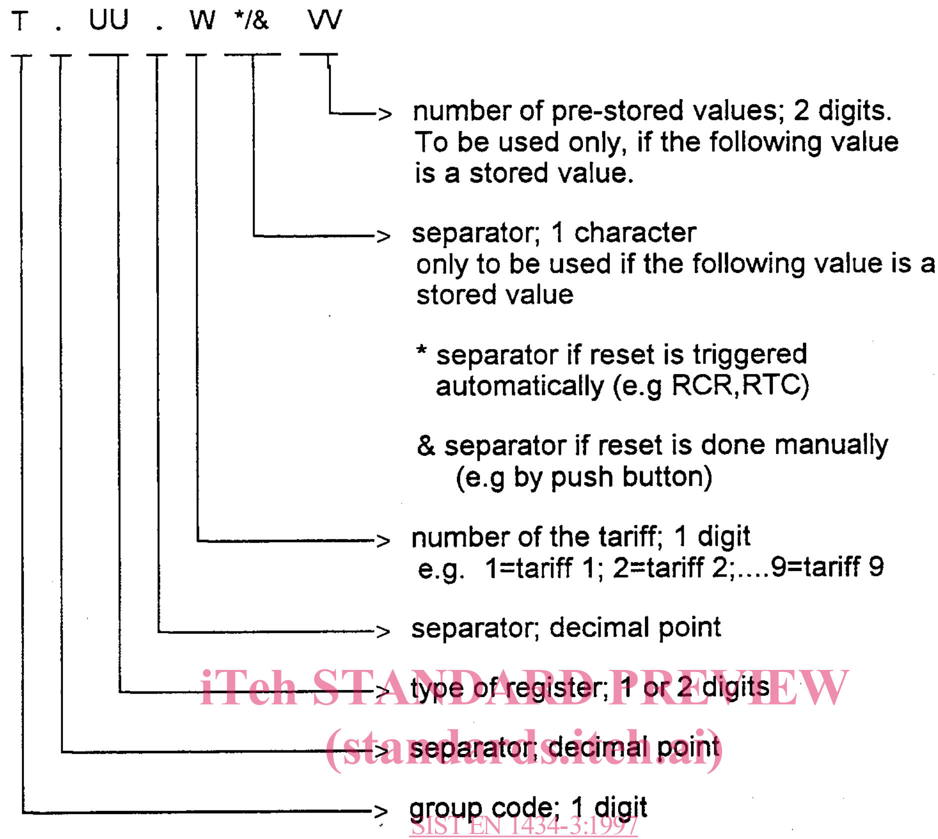
- "*" as a separator character between value and unit. This separator is not required if there are no units.

- "Units" 16 printable characters maximum, with the exception of "(", ")", "/" and "!"

- ")" as a rear boundary character for the value and unit information.

5.3.2 Coding of the data set identification number

Schematic structure



5.3.3 Relevant values for heat meters

Relevant values for heat meters are:

"0" for the identification, "6" to identify a heat meter and "F" to identify an error message. The code "9" can be used for manufacturer specific status information.

For additional information see E.3.