BRITISH STANDARD

BS EN 1434-3:2008

Heat Meters

Part 3: Data exchange and interfaces

ICS 17.200.10,

British Standards

National foreword

This British Standard is the UK implementation of EN 1434-3:2008. It supersedes BS EN 1434-3:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/894, Remote meter reading.

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

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Foreword

This document (EN 1434-3:2008) has been prepared by Technical Committee CEN/TC 294 “Communication systems for meters and remote reading of meters”, the secretariat of which is held by DS.

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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by April 2009.

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 1434-3:1997.

EN 1434 consists of the following parts, under the general title "Heat meters":

— *Part 1: General requirements*

— *Part 2: Constructional requirements*

— *Part 4: Pattern approval tests*

— *Part 5: Initial verification tests*

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

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and 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 readout device (POINT / POINT communication). For these applications using the optical readout head, the EN 62056-21 protocol is recommended.

For direct or remote local readout of a single or a few meters via a battery driven readout device, the physical layer of EN 13757-6 (local bus) is recommended.

For bigger networks with up to 250 meters, a master unit with AC mains supply according to EN 13757-2 is necessary to control the M-Bus. For these applications the physical and link layer of EN 13757-2 and the application layer of EN 13757-3 is required.

For wireless meter communications, EN 13757-4 describes several alternatives of walk/drive-by readout via a mobile station or by using stationary receivers or a network. Both unidirectionally and bidirectionally transmitting meters are supported by this standard.

2 Normative references

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

EN 13757-1, *Communication system for meters and remote reading of meters — Part 1: Data exchange*

EN 13757-2:2004, *Communication systems for and remote reading of meters — Part 2: Physical and link layer*

EN 13757-3:2004, *Communication systems for and remote reading of meters — Part 3: Dedicated application layer*

EN 13757-4:2005, *Communication systems for meters and remote reading of meters — Part 4: Wireless meter readout (Radio meter reading for operation in the 868 MHz to 870 MHz SRD band)*

EN 13757-5, *Communication systems for meters and remote reading of meters — Part 5: Wireless relaying*

EN 13757-6, *Communication systems for meters and remote reading of meters — Part 6: Local Bus*

EN 62056-21:2002, *Electricity metering — Data exchange for meter reading, tariff and load control — Part 21: Direct local data exchange (IEC 62056-21:2002)*

3 Meter interfaces and protocols overview

Table 1 — Possible combinations of interfaces and standards

Hardware interface type	Recommended standard	Alternative standards
Optical EN 62056-21:2002, 3.2	EN 13757-2	EN 62056-21:2002, Subclause 4.1
M-Bus	EN 13757-2	No alternative
Wireless	Modes S or T of EN 13757-4:2005	Mode R2 of EN 13757-4:2005 Relaying EN 13757-5
Current loop	EN 62056-21:2002, 3.1	No alternative
Local Bus	EN 13757-6	No alternative
Application layer (All interfaces)	EN 13757-3	EN 13757-1

4 Physical layer

4.1 General

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.

4.2 Physical layer 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 heat meter and the data is read out, one heat meter at a time. The physical properties of the optical interface are defined in EN 62056-21.

4.3 Physical layer M-Bus

The physical layer of the M-Bus is described in EN 13757-2. It can be used for "point to point" or for "multi-point" communication in bus systems. If a heat meter presents more than one unit load to the bus, the number of unit loads has to be shown on the meter documentation as “xUL” where x is the number of unit loads. Only integer values are allowed. Especially in extended installation, meters with an M-Bus interface might need additional protection against surge and lightning. Annex E shows various techniques for either constructing meters with an M-bus interface and integrated enhanced protection elements. In addition it shows how to construct external protection elements for meters with a standard (unprotected) M-Bus interface. Two variants are given: one (preferred) for situation where a ground connection is available and a variant with weaker protection if no ground connection is available. An enhanced version of the protection additionally protects the meter and its interface from destruction if mains power is connected to the M-Bus terminals of the meter. If the readout frequency of the meter is limited either by software or by the battery capacity, the meter documentation shall signal the readout frequency as “x per day”, “y per h” or “z per min” where x, y or z are the number of readouts within the corresponding period allowed by the software without impairing the battery lifetime. Heat meters with unlimited readout frequency do not need such information.

4.4 Physical layer wireless interface

The modes T or S of EN 13757-4:2005 are recommended. They describe uni- or bidirectional communication in the 868 MHz bands optimized for mobile (T-modes) or stationary (S-modes) meter communication. The mode R2 of EN 13757-4:2005 and the optional relaying for this mode according to EN 13757-5 may also be used.

4.5 Physical layer current loop interface

Type of signal: 20 mA (CL interface in accordance with EN 62056-21:2002, 4.1 with galvanic separation).

Power supply: on the heat meter side, the interface shall be passive. The readout device supplies the necessary power.

Connections: via terminals or suitable connectors.

4.6 Physical layer Local Bus

The Local Bus is an alternative to the M-Bus. It is restricted to small installations (Minibus installation according to EN 13757-2:2002, Annex E.6.1 type E) and optimized for special battery-driven masters. It does not support meter power supply from the bus. Note that this interface is not compatible with M-Bus masters according to EN 13757-2. Its physical layer is described in EN 13757-6.

5 Link layer

5.1 Link layer optical interface

5.1.1 Link layer optical interface with the EN 13757-2 protocol

If the optical interface is used with the EN 13757-2 protocol, a wake-up message can be sent after every idle time of > 330 bit times to the heat meter. The wake up message consists of zeroes and ones alternating at the desired baud rate for a duration of (2,2 ± 0,1) s. After an idle time of 33 bit times to 330 bit times, the communication can start.

5.1.2 Link layer optical interface with the EN 62056-21 protocol

According to EN 62056-21.

5.1.3 Link layer optical interface with automatic protocol recognition

If the user or the handheld unit does not know which of the two alternative protocols a meter uses, it is suggested to use a combined wake-up and recognition sequence as described in the Informative Annex C.

5.2 Link layer of M-Bus and Local Bus

The link layer of the M-Bus and the Local Bus is described in EN 13757-2. All required functions shall be implemented in a heat meter with an M-Bus or Local Bus connector.

If the readout frequency of the meter is limited either by software or by the battery capacity, the meter documentation shall signal the readout frequency as “x per day”, “y per h” or “z per min” where x, y or z are the number of readouts within the corresponding period allowed by the software without impairing the battery lifetime. Heat meters with unlimited readout frequency do not need such information.

5.3 Link layer wireless interface

According to EN 13757-4.

5.4 Link layer current-loop interface

According to EN 62056-21:2002, Clause 4 to 5.

6 Application layer

6.1 Application layer optical interface

6.1.1 Protocol modes according to EN 13757-3 for heat meters

Further details are given in the section on the application layer of the M-Bus.

6.1.2 Protocol modes according to EN 62056-21 for heat meters

6.1.2.1 General

This protocol may be used for the optical interface.

The basic rules of the protocol are defined in EN 62056-21. Annex B of that document deals with battery operated devices (i.e. some heat meters).

The manufacturer ID (identification) mentioned in EN 62056-21 (three upper case letters) is used for heat meters using this protocol in the same manner. For heat meter manufacturers using the data transmission protocol of EN 13757-3, the EN 62056-21 ID is also used to calculate the ID number described in Clause 6 of this standard. The formula stated in 6.6.1 shall be used (see also Annex B).

EN 62056-21 describes various modes of operation. All main modes "A", "B", "C" and "D" are allowed for heat meters.

6.1.2.2 Restrictions for heat meters

The EN 62056-21 protocol shall be used with some restrictions. In some cases, EN 62056-21 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 62056-21.

6.1.2.3 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.

6.1.2.4 Syntax diagram

The syntax described in EN 62056-21:2002, 5.5 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 end with the ETX and BCC sequence;

— the data block consists of one or more data lines;

— each data line may contain up to 78 characters and ends with a CR and LF.

6.1.2.5 Data presentation for heat meter

EN 62056-21 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 62056-21 protocol. In mode C, it is only used for 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.

The normative Annex B describes the data set and the coding for the readout application of heat meters using this alternative protocol.

6.2 Application layer M-Bus and Local Bus

6.2.1 General

This protocol of EN 13757-3 is recommended for the M-Bus and the Local Bus interface. It can be used for the optical interface alternatively and in this case, the heat meter shall be marked with a label “M-Bus” identifying the protocol. Alternatively the application layer of EN 13757-1 may also be used.

6.2.2 Coding of data records

Of EN 13757-3 only the variable data structure with low byte first multibyte-elements (CI = 72 h) shall be used.

7 Application

7.1 General

The application layer (Clause 6) describes how to code telegrams and data elements. The quoted standards contain many different options for different applications. This clause describes which minimum function of the quoted standards shall be implemented in a heat meter according to this standard.

7.2 Physical layer

As a minimum, two baud rates of 300 baud and 2 400 baud shall be implemented. If the heat meter does not support automatic baud rate detection, the commands for baud rate switching and fallback shall be implemented.

7.3 Link layer

A heat meter shall support both the primary and the secondary addressing via the link layer. The application shall support the assignment of primary addresses via the M-Bus. All application layer command for managing the secondary addressing mode (including the functions of extended secondary addressing) shall be supported. All application layer commands for managing the secondary address shall be supported. When the user is able to change the secondary address of the meter, the commands for the extended secondary addressing mode shall be supported as well.

7.4 Application layer

All readout telegrams shall contain at least the standard header with the meter-ID. The minimum variable data element list shall contain the actual accumulated energy. The default unit shall be the unit on the meter display. The minimum resolution of the accumulated energy shall be the same as on the meter display. The minimum value actuality shall be 15 min. The minimum readout frequency is the readout of up to 250 meters in a segment once per day.

7.5 Control applications

Meter suitable for control applications shall fulfil, in addition to the minimum requirements of 7.4, the requirements of Annex D. The suitability of a heat meter with M-Bus interface for such applications may only be declared (“Suitable for control applications" according to prEN 1434-3:2007, Annex D) in the meter description if all these requirements are met.

Annex A
(informative)

Recommendation for heat meter test interface

Modern heat meters are mainly equipped with CMOS microprocessors with a very low power consumption, allowing battery operation. Testing and adjusting of this type of meters needs a completely different approach. Until now, almost every meter type needed its own test equipment to handle the manufacturer's specific requirements. This is a very complicated and expensive way for users of several types of meters and for initial verification institutes. The more different types of heat meters a user has installed, the more testing equipment he may need. An economical testing of several meters should be possible and an easy adaptation to the existing test bench is of great interest.

Since this problem came up, experts have been researching an acceptable solution to it. Details of one example of an acceptable solution are given in AGFW FW 203, "Normierter Wärmezähler-Adapter" [1].

Annex B
(informative)

Additional information for heat meters

B.1 Additional information regarding the EN 62056-21 protocol

List of "T" group codes.

Overview on values in use:

— "0" = identification (only in connection with value type 0);

— "1" = reserved for electrical energy active;

— "2" = reserved for electrical energy reactive;

— "3" = reserved for electrical energy reserve;

— "4" = not used;

— "5" = reserved for energy;

— "6" = heat meters;

— "7" = gas meters;

— "8" = water meters;

— "9" = reserved for specific identification number or status information;

— "F" = error identification for meters.

NOTE This list is taken from "VEÖ Pflichtenheft für Tarifgeräte" [2].

B.2 Data set

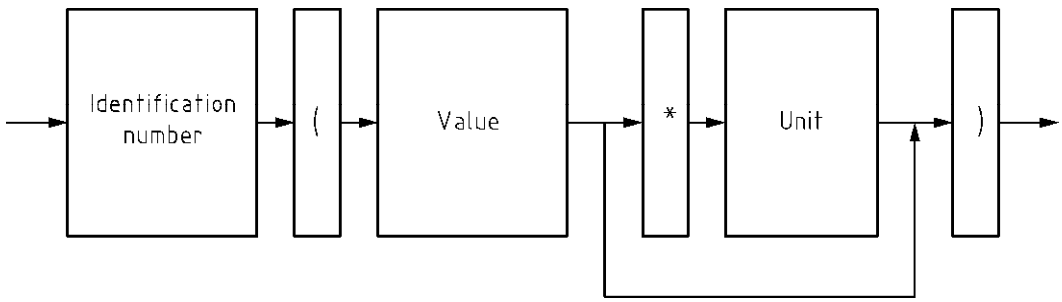


Figure B.1 — Signal direction

As recommended in EN 62056-21:2002, 5.7 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.

B.3 Coding of the data set identification number

B.3.1 Schematic structure

```
1 2 3  4 5  6   7
T . UU . W */& VV
```

Key

1 Group code, 1 digit

2 Separator, decimal point

3 Type of register, 1 or 2 digits

4 Separator, decimal point

5 Number of the tariff, 1 digit
e.g. 1 = tariff 1; 2 = tariff 2
...9 = tariff 9

6 Separator, 1 character only to be used if the following value is a stored value:

* Separator: if reset is triggered automatically (e.g. RCR, RTC)

& Separator: if reset is done manually (e.g. by push button)

7 Number of pre-stored values, 2 digits, to be used only if the following value is a stored value

Figure B.2 — Schematic structure

B.3.2 Values for “T” group code

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 refer to Annex B.3.7.

B.3.3 Values for "UU", register codes

The "UU" consists of a one or two digit number to identify the measured values. The following numbers shall be used for heat meters.

The heat meter shall at least transmit the values for 0, 8 and 26.

0 In connection with group code "0" for identification

The value may consist of maximum 20 characters.

1 Reset number (storage number), two digits from 00 to 99

4 Instantaneous power

The numerical value may consist of maximum 6 characters.

6 Peak value of instantaneous power

The numerical value may consist of maximum 6 characters.

8 Energy

The numerical value may consist of maximum 9 characters.

10 Date and/or time of last reset

Time format may consist of maximum 19 characters.

26 Volume

The numerical value may consist of maximum 9 characters.

27 Flow

The numerical value may consist of maximum 6 characters.

28 Return temperature

The numerical value may consist of maximum 5 characters.

29 Flow temperature

The numerical value may consist of maximum 5 characters.

30 Temperature difference

The numerical value may consist of maximum 6 characters.

31 Operation time

Time format may consist of maximum 19 characters.

32 Fault time

Time format may consist of maximum 19 characters.

33 Peak flow rate

The numerical value may consist of maximum 6 characters.

34 Date and/or time of occurrence

Time format may consist of maximum 19 characters.

35 Integration time

Time format may consist of maximum 19 characters.

36 Date and/or time of storage

Time format may consist of maximum 19 characters.

37 Peak flow temperature

The numerical value may consist of maximum 5 characters.

38 Peak return temperature

The numerical value may consist of maximum 5 characters.

39 Average return temperature during peak power

The numerical value may consist of maximum 5 characters.

40 Average return temperature during peak flow

The numerical value may consist of maximum 5 characters.

41 Instantaneous additional temperature

The numerical value may consist of maximum 5 characters.

42 Additional temperature during peak power

The numerical value may consist of maximum 5 characters.

43 Additional temperature during peak flow

The numerical value may consist of maximum 5 characters.

44 Average power during peak flow

The numerical value may consist of maximum 5 characters.

45 Average flow during peak power

The numerical value may consist of maximum 5 characters.

50 M-Bus primary address

The numerical value may consist of maximum 3 characters.

51 M-Bus secondary address

The numerical value may consist of maximum 8 characters.

52 Device address

The numerical value may consist of maximum 32 characters without unit.

53 Serial number

The numerical value may consist of maximum 12 characters.

54 Meter type

The numerical value may consist of maximum 32 characters without unit.

55 Type of billing

The numerical value may consist of maximum 32 characters without unit.

56 Display mode

The numerical value may consist of maximum 32 characters without unit.

57 Readout mode

The numerical value may consist of maximum 32 characters without unit.

60 Installation site

The numerical value may consist of one character without unit: value F (flow) or R (return).

61 Measurement range

The numerical value may consist of maximum 6 characters.

62 System time

Time format may consist of maximum 19 characters.

63 System date

Time format may consist of maximum 19 characters.

64 Fixed yearly date for storage

Time format may consist of maximum 19 characters.

65 Fixed monthly day for storage

Time format may consist of maximum 19 characters.

66 Setup date

Time format may consist of maximum 19 characters.

67 Reset counter

The numerical value may consist of maximum 8 characters.

68 Readout counter

The numerical value may consist of maximum 8 characters.

69 Pulse value

The numerical value may consist of maximum 8 characters.

70 Test mode volume

The numerical value may consist of maximum 9 characters.

71 Test mode flow

The numerical value may consist of maximum 6 characters.

72 Test mode return temperature

The numerical value may consist of maximum 5 characters.

73 Test mode flow temperature

The numerical value may consist of maximum 5 characters.

74 Test mode temperature difference

The numerical value may consist of maximum 6 characters.

75 Test mode power

The numerical value may consist of maximum 6 characters.

76 Test mode energy

The numerical value may consist of maximum 9 characters.

77 Test mode mass

The numerical value may consist of maximum 9 characters.

78 Test time

Time format may consist of maximum 19 characters.

B.3.4 Values for "W", number of the tariff

The "W" consists of one digit. If the heat meter has only one tariff, the leading separator (decimal point) and the digit shall be omitted. A heat meter can have up to 9 tariffs (1 to 9).

B.3.5 Use of "*/&" and "VV" for prestored values

This sequence of the data set coding is used for prestored values. The meaning of the numbers is to be agreed between the supplier of the heat meter and the user.

The sequence can also be used to document the relationship between a time stamp and one or more values of the heating process. If a heat meter stores some values at a specific time, it shall transmit the corresponding time of storage, occurrence, etc. with the same value of "VV".

— "*" is used as a leading separator if the reset of the prestored value is triggered automatically;

— "&" is used as an alternative leading separator if the reset of the prestored values is done manually;

— "VV" is the number of the prestored value; a heat meter can have up to 99 prestored values.

If the heat meter has no prestorage facilities, the whole sequence shall be omitted.

B.3.6 Coding of the unit in the data set

If the transmitted value has a unit, it is separated by a "*" and shall be coded as follows:

Energy: Temperature:

— "J" Joule

— "C" Degree Celsius

— "kJ" Kilojoule

— "MJ" Megajoule Power:

— "GJ" Gigajoule

— "Wh" Watt hours - "W" Watt

— "kWh" Kilowatt hour - "kW" Kilowatt

— "MWh" Megawatt hour - "MW" Megawatt

— "GWh" Gigawatt hour - "GW" Gigawatt

— Volume: Time and/or Date:

— "ml" Millilitre - "s" Second

— "l" Litre - "m" Minute

— "m3" Cubic metre - "h" Hour

Time and/or Date:

— "D" Day

— "M" Month

— "Y" Year

Flow: Mass flow:

— "lps" Litre per second / "kgps" Kilogram per second

— "lpm" Litre per minute / "kgpm" Kilogram per minute

— "lph" Litre per hour / "kgph" Kilogram per hour

— "m3ph" Cubic metre per hour

B.3.7 Coding of the value in the data set

The value represents the measured or calculated value. It can contain manufacturer specific status information, an error message or a date and/or time stamp.

B.3.8 Coding of the measured value

The measured value is represented by 1 to 32 numeric characters. For heat meters, the maximum number of characters depends on the register code.

B.3.9 Coding of the error message

The following numbers represent the indicated errors:

— "0" no error;

— "1" only external error;

— "2" external and internal error simultaneously;

— "3" only internal error;

— "4" reserved for later use;

— "5" flow error;

— "6" flow temperature probe interrupted;

— "7" flow temperature probe short circuit;

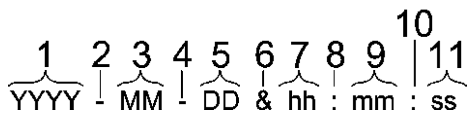
— "8" return temperature probe interrupted;

— "9" return temperature probe short circuit.

Several errors can be packed in one message by "&" as a separator. The error message has no unit.

B.3.10 Coding of the date and/or time stamp

The date and time stamp has the following general structure:



Key

1	year (e.g. 1991)	7	hour, 00 to 23
2	“-“ as a separator	8	“:” as a separator
3	month, 01 to 12	9	minute, 00 to 59
4	“-“ as a separator	10	“:” as a separator
5	day, 01 to 31	11	second, 00 to 59
6	“&” as a separator		

Figure B.3 — Coding of the date and/or time stamp

Some examples of data sets containing date and/or time stamp:

— a relative time elapsed since any last event (reset or start-up, etc.):

6.31 (4 711 * h) = operation time 4 711 hours;

6.35 (15 * m) = integration time 15 minutes.

In this case only one unit shall be used. The unit shall be indicated. Any time unit can be used.

— an absolute time of day:

6.34 (11:55:00) = time of occurrence (of a peak value, etc.).

The ":" separator marks the value as a time. There is no need for a unit. The value shall consist at least of hours and minutes. The second ":" separator and the value of the seconds are optional.

— an absolute date:

6.36 (1991-12-24) = time of storage.

The "-" separator marks the value as a date. There is no need for a unit. This is the only date format allowed for a date stamp.

— an absolute date and time stamp:

6.10 (1991-12-24&11:55:00) = time of last reset.

The "&" separator marks the value as a date and time stamp. The date in standard format is in front of the "&" character, the time follows behind it. The last ":" separator and the seconds are optional. There is no need for a unit.

B.3.11 Presentation of related values

If it is not possible to document the relationship between time or date and values of the heating process with the value of "VV", the protocol offers an alternative mode to code it.

In this case, the heat meter shall send the datasets in the following sequence:

a) first, all current datasets of the time of read out and unrelated data sets shall be sent;

b) then a field with related datasets can be opened by sending one or more time stamps (time of reset and time of storage or only the time of storage, etc.);

c) then all datasets which are related to those time(s) shall be sent;

d) the field ends with a new time stamp to open a new field of related datasets, or ends with the ETX and BCC character to end the transmission of data.

Annex C
(informative)

Automatic protocol detection and wake-up for the optical interface

C.1 Introduction

This annex describes a way to communicate with a heat meter over the optical interface under the following conditions:

— the heat meter has an active optical interface;

— the data protocol over this optical interface is unknown;

— the data protocol is one of the following protocols: EN 62056-21 or EN 13757-2;

— the transmission speed is either 300 or 2 400 baud. Other transmission baud rates are allowed if the meter has the implementation of automatic speed detection.

Separate subclauses describe the use of EN 13757-2 and EN 62056-21 respectively.

Using the search procedure given below, it is guaranteed that the readout device is capable of detecting the meter:

C.2 Trying EN 13757-2 protocol

a) Perform parameterization of the readout device to the EN 13757-2 protocol (8E1) and 2 400 baud transmission speed;

b) Perform the transmission of wake-up message according to Clause 5.2;

c) Perform the transmission of a SND _NKE;

d) The outcome of this is either that:

   1) an ACKN is received from the meter (E5h), or

   2) there is a time out condition at the readout device.

   In case of d) 1), the search procedure is finished. In order to speed up communication, it is recommended to test for higher baud rates, for example repeating the steps a) through d) with higher baud rates.

   In case of d) 2), it is mandatory to repeat step a) through d) with a 300 baud transmission speed.

If there is a failure at 300 baud transmission speed as well, then it is mandatory to try the EN 62056-21 protocol as specified in C.3.

C.3 Trying the EN 62056-21 protocol

a) Perform a parameterization of readout device to the EN 62056-21 protocol (7E1) and 2 400 baud transmission speed;

b) Perform the transmission of wake-up message according to Annex B of EN 62056-21:2002;

c) Perform the transmission of a request message without addressing option: / ? ! <CR> <LF>;

d) The outcome of this is either that:

   1) an identification message of meter (/ XXX Z W … <CR> <LF>) is received from the meter, or,

   2) there is a time out condition at the readout device.

   In case of d) 1), then the search procedure is finished.

   In case of d) 2), then it is mandatory to repeat steps a) through d) with a 300 baud transmission speed.

e) The outcome of this is either that:

   1) an identification message of meter (/ XXX Z W … <CR> <LF>) is received from the meter, or,

   2) there is a time out condition at the readout device.

   In case of e) 1), then the search procedure is successfully finished;

   In case of e) 2), then the search procedure is finished with failure, i.e. no meter is connected to the readout device.

Annex D
(informative)

Usage of heat meters in control applications

D.1 Heat meter

D.1.1 General

Heat meters for control applications shall meet all standard requirements for normal heat meters. This is especially true for all requirements of measurement accuracy. In addition, they should meet the requirements of M-Bus communication according to this standard. All valid SND_UD telegrams should be acknowledged even if they are functionally not supported. SND_NKE telegrams should be acknowledged. The readout frequency should not be limited.

D.1.2 Application layer: data records

Each RSP_UD telegram of the heat meter should contain at least the following data records:

a) inlet temperature: resolution better or equal to 0,1 °C;

b) outlet temperature: resolution better or equal to 0,1 °C;

c) flow: resolution better or equal to 0,2 % of q_n;

d) power: resolution better or equal to 0,2 % of PNom;

e) status: at least general status byte of EN 13757-3:2004, Clause 5.9;

f) additional values are allowed.

The other data might vary. The sequence of the data records is arbitrary. Heat meters with sequential multibyte telegrams should transmit these required data records in each telegram. Heat meters which can fulfil all these requirements may ignore the function of an application reset (CI = 50 h) and the following subcode, but must still acknowledge its reception.

Heat meters which cannot always automatically meet these requirements must support the function of "application reset with subcode“ at least for the combination of CI = 50 h (application reset) with subcode 51 h (following in the next byte) indicating that the heat meter is used in control application and that all its RSP_UD telegrams must contain the control relevant data described above.

D.1.3 Application: actuality of the data

a) Temperature information: ≤ 30 s;

b) Flow information: limiter applications: ≤ 30 s;

c) Flow information for regulation: for flow values between Q_i and Q_s: ≤ 5 s;

d) Status information: ≤ 2 min.

D.1.4 Application layer: acceptable data types (DIFs)

a) Binary: 8, 16, 24 or 32 bit;

b) BCD: max. 2, 4, 6 or 8 digits;

c) ASCII, String-Data: not allowed;

d) Function type: always 0 (actual);

e) The required data records shall use no DIF-Extension, other data records with DIF-Extensions are allowed;

f) Thus the following DIF-types for the required data records should be supported: 1, 2, 3, 4, 9, 0 Ah, 0 Bh, 0 Ch;

g) It is strongly recommended that for new developments of control applications, the controller should also support the 32-bit floating point data type (Data type H, DIF = 5).

D.1.5 Application layer: acceptable units (VIFs)

a) Temperature: all acceptable units ≤ 0,1 °C;

b) Flow: all acceptable powers of ten of l/h for which the resolution is better than or equal to 0,2 % of $Q_{p;}$

c) Power: all acceptable powers of ten of Watt for which the resolution is better than or equal to 0,2 % of PNenn;

d) For the required data records, VIF-Extensions are not allowed. Other data records may contain VIF-Extensions.

D.2 Controller

D.2.1 Start until first answer

After each power fail or other hard reset, the controller should use the following sequence:

a) activate bus voltage to mark state;

b) wait ≥ 5 seconds;

c) transmit at 300 baud to each meter used: SND_UD with CI = 0 BBh to set bus baud rate to 2 400 baud. If not acknowledged, repeat up to 2 times, then continue at 300 baud;

d) otherwise all following communication at 2 400 baud;

e) send SND_NKE. If not acknowledged, repeat up to 2 times, then continue regardless of acknowledgement;

f) application reset with subcode “Control“ via SND_UD with CI = 50 h followed by 51 h. The application reset must not be executed by the meter, unless the meter has been activated, for this purpose by password protection. If not acknowledged, repeat up to 2 times, then continue regardless of acknowledgement;

g) periodic readout of each heat meter using REQ_UD2 to its (primary) address. Up to two retries if heat meter does not answer with a correct telegram;

h) if still not successful make up to three total restart attempts starting from step c;

i) if still no answer or no useful telegram received branch to system error handling.

D.2.2 Start until first successful readout

a) Check Link Layer (Parity, Checksum, etc.);

b) Check frame, length, start/end bytes, address, C-field, CI-field = 72 h;

c) Check heat meter status bits;

d) Segment data records: take into account possible DIF- und VIF-Extensions;

e) Consider all allowed data lengths of data records;

f) Extract required records according their DIF and VIF;

g) Convert data to internal data format;

h) Extract unit and power of ten from VIF and convert to internal controller units.

Annex E
(informative)

Protection techniques for M-Bus meters against surge/lightning

According to,general requirements for surge testing test pulses with a duration of 50 µs and low source impedance are assumed. The components and values are calculated from worst case data sheet values. It is assumed that the protection elements can stand at least 100 shots of the stated peak voltage. Note that not all resistors are guaranteed for the required pulse load.

For an acceptable performance, some ground reference for the protection elements is strongly recommended. Without such a ground reference only purely differential surges would be allowed. Systems without ground reference are only acceptable for terminal devices which have an extremely good ground isolation and low and symmetrical capacitance between each bus line and ground.

Partly a pulse tolerance of up to 200 V with a source impedance of 200 Ohm and a pulse duration of 50 µs is required for the TSS721. These data can only be met by future devices of this family.

With external elements, true lightning conditions (up to 1 000 µs pulse duration) can be tolerated for up to several kV.

All examples are designed with metal oxide varistors as protection elements. More expensive (semiconductor type) protection elements could provide better performance, especially at the second protection level. With such devices also the standard TSS721 might be acceptable. However, at the moment no sufficient data for long (50 µs/1 000 µs) over voltage pulses at the BUSL-inputs of the TSS721 are available and therefore such systems cannot be worst case calculated at the moment.

The suggestions and calculations are done for the following cases:

a) Integrated protection within device, low cost, small size (SMD), improved TSS721 suggested (200 V, 200 Ω, 50 µs):

   1) Without reversible mains protection:

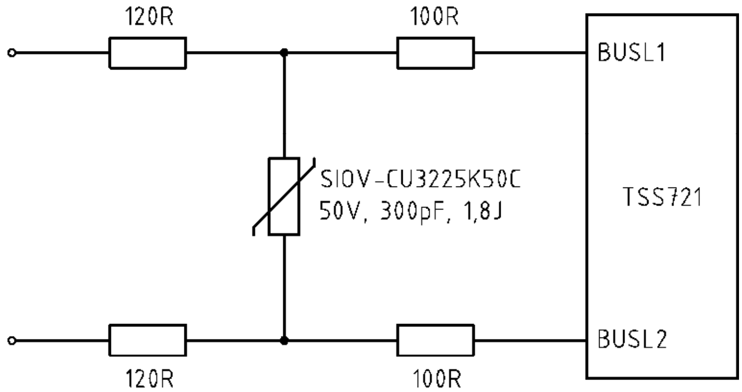


Figure E.1 — Without ground reference (100 x 6 kV x 50 µs)

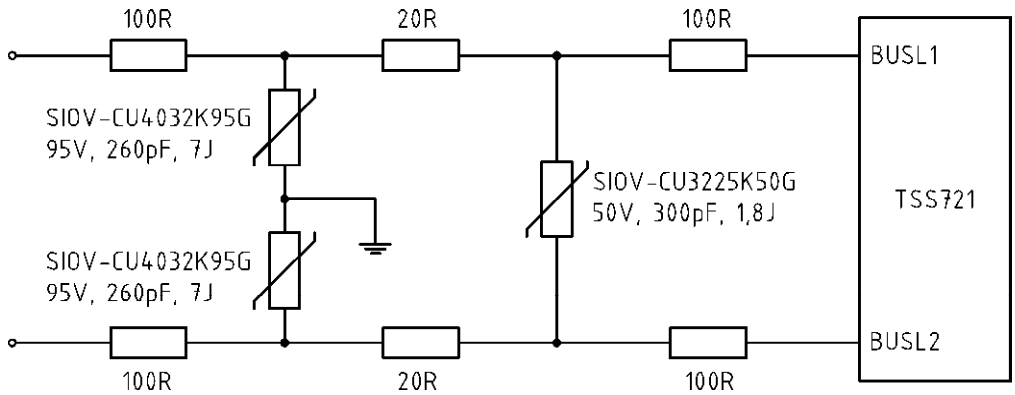


Figure E.2 — With ground reference (100 x 6 kV x 50 µs)

2) With reversible mains protection and standard TSS721:

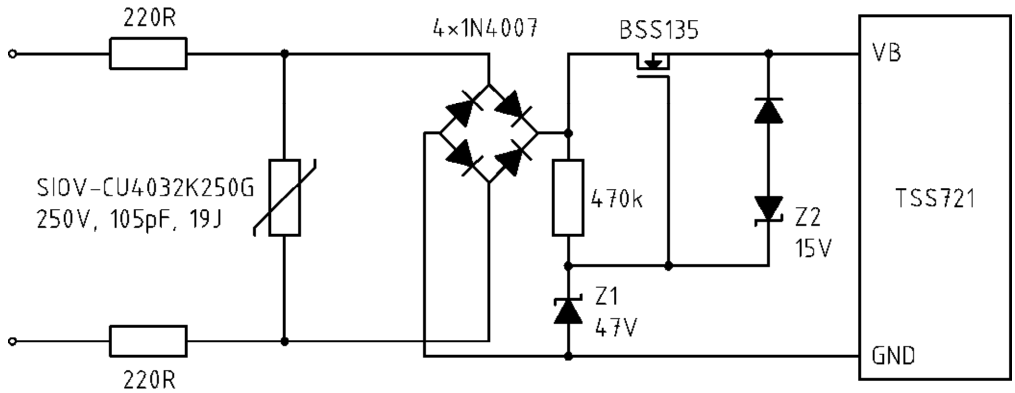
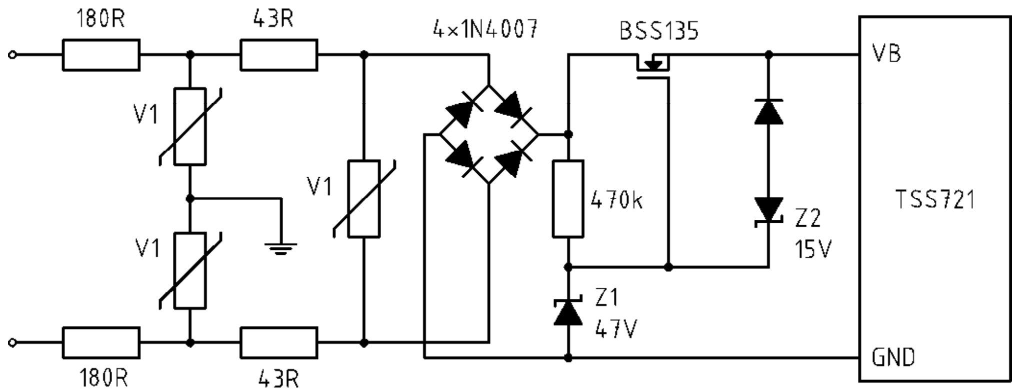


Figure E.3 — Without ground reference (100 x 10 kV x 50 µs, max. 250 Vrms)



Key

V1 SIOV-CU4032K250G
250 V, 105 pF, 19 J

Figure E.4 — With ground reference (100 x 10 kV x 50 µs)

b) Additional external protection element:

1) Restricted surge protection, no reversible mains protection, full segment load, improved TSS721 suggested:

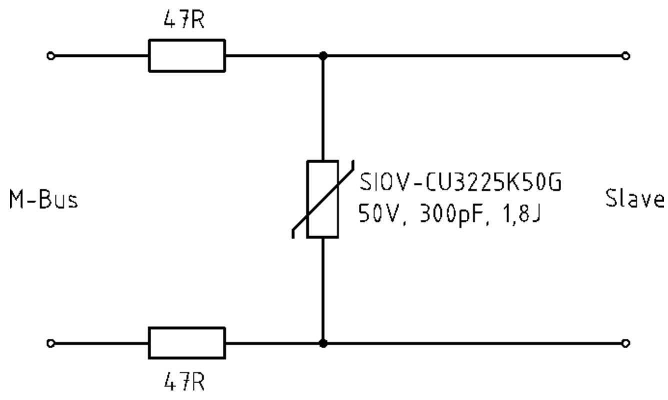


Figure E.5 — Without ground reference (100 x 2 kV x 50 μs)

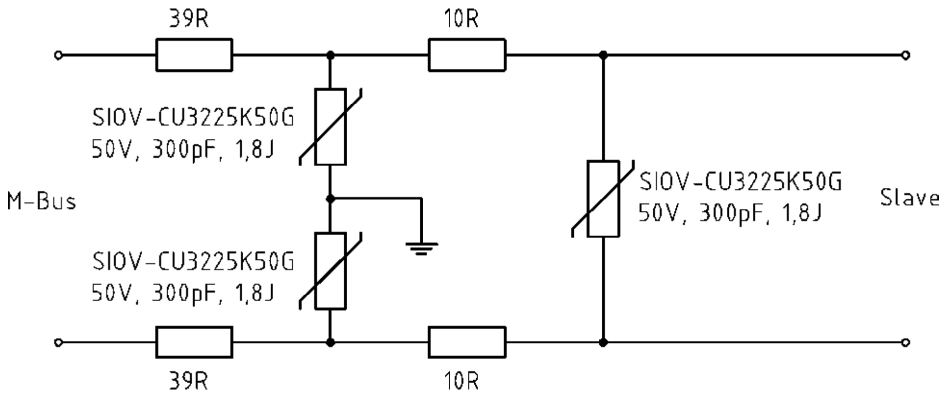


Figure E.6 — With ground reference (100 x 2 kV x 50 μs)

2) Full surge protection, no reversible mains protection, improved TSS721 suggested, limited segment load. Each device must be counted as twice its "normal" unit load to compensate for the increased voltage drop in the protection elements:

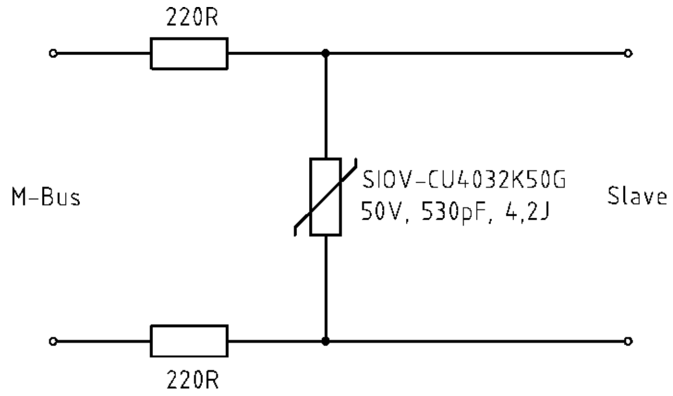


Figure E.7 — Without ground reference (100 x 10 kV x 50 µs or 100 x 2 kV x 1 000 µs)

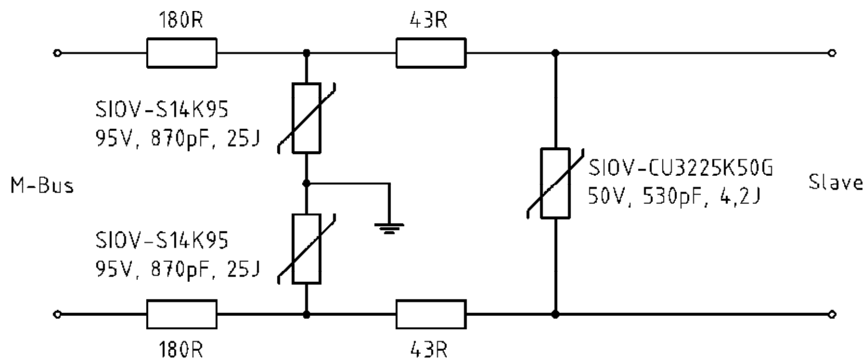


Figure E.8 — With ground reference (100 x 10 kV x 50 µs or 100 x 3 kV x 1 000 µs)

3) Full surge protection, reversible mains protection, standard TSS721, limited segment load. Each device must be counted as twice its "normal" unit load to compensate for the increased voltage drop in the protection elements. In addition only level converters with $U_{Space} \geq 24$ V ($U_R \geq 12$ V) are allowed:

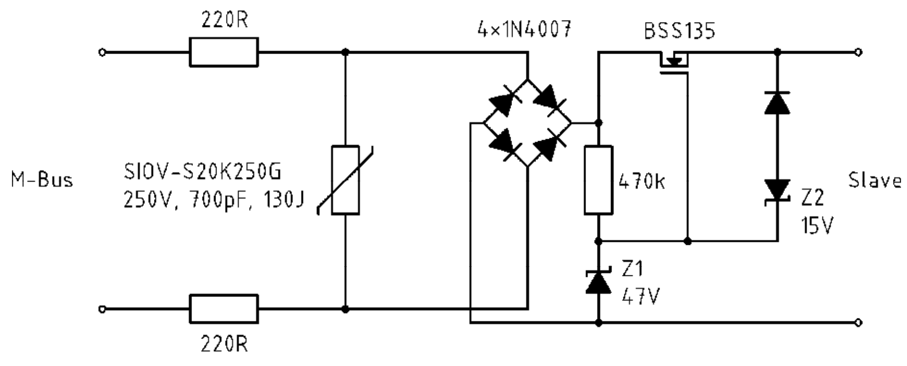
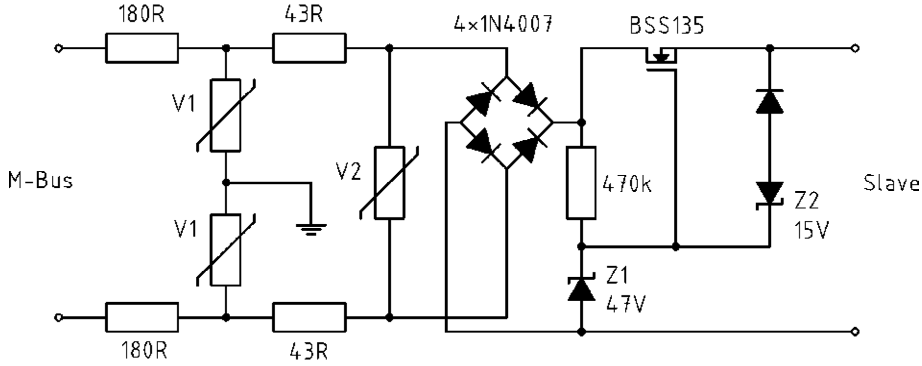


Figure E.9 — Without ground reference (100 x 8 kV x 1 000 µs)



Key

V1 SIOV-S20K385
385 V, 450 pF, 140 J

V2 SIOV-S20K250
250 V, 700 pF, 130 J

Figure E.10 — With ground reference (100 x 6 kV x 1 000 µs)

Annex F
(informative)

Additional information about the master-unit for the M-Bus

F.1 Master side interface to the M-Bus

The master side interface for the M-Bus should fulfil the following requirements:

— power supply for 1 to N (250) unit loads;

— mark state voltage of (24 V + $R_C \cdot I_{MAX}$) up to 42 V;

— space state voltage = mark state voltage minus (≤ 12 V);

— data rates of 300 Bd to 9 600 Bd;

— detect and provide slowly varying quiescent current;

— receive space state data if data current > 6 mA to 8 mA;

— provide a dynamic impedance of 50 Ω to 60 Ω;

— protection against short circuit;

— protection against EMC and ESD disturbances;

— galvanic isolation of data lines from ground;

— ground symmetrical line drive for low RF-emission.

The circuits in Figures F.1 and F.2 show principles of possible implementations and are only presented for didactic purposes. No functional or parametric guarantee is implied.

F.2 Master side interface for local data read out

The requirements can be reduced if the cable length is less than 100 m and only three slaves are temporarily connected:

— mark state voltage > 25 V;

— no separation of quiescent current;

— no isolation of data lines.

A simple circuit diagram for a level converter from V24-levels to M-Bus is shown in Figure F.1.

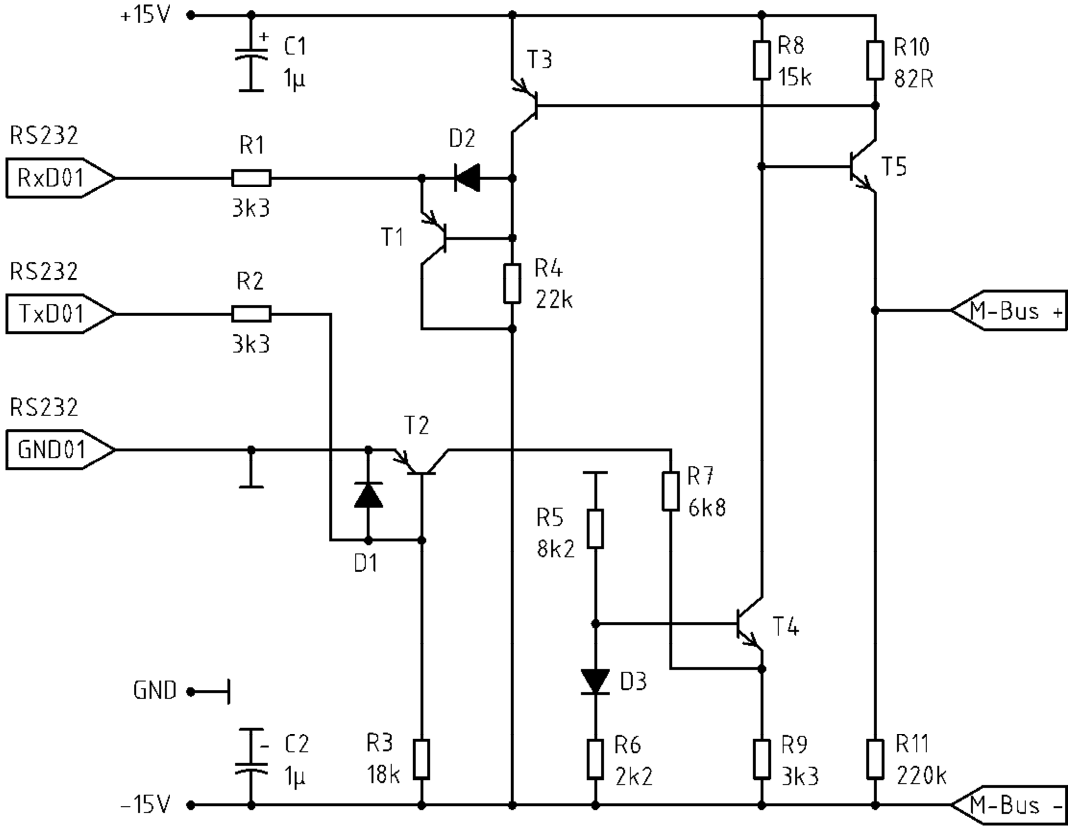
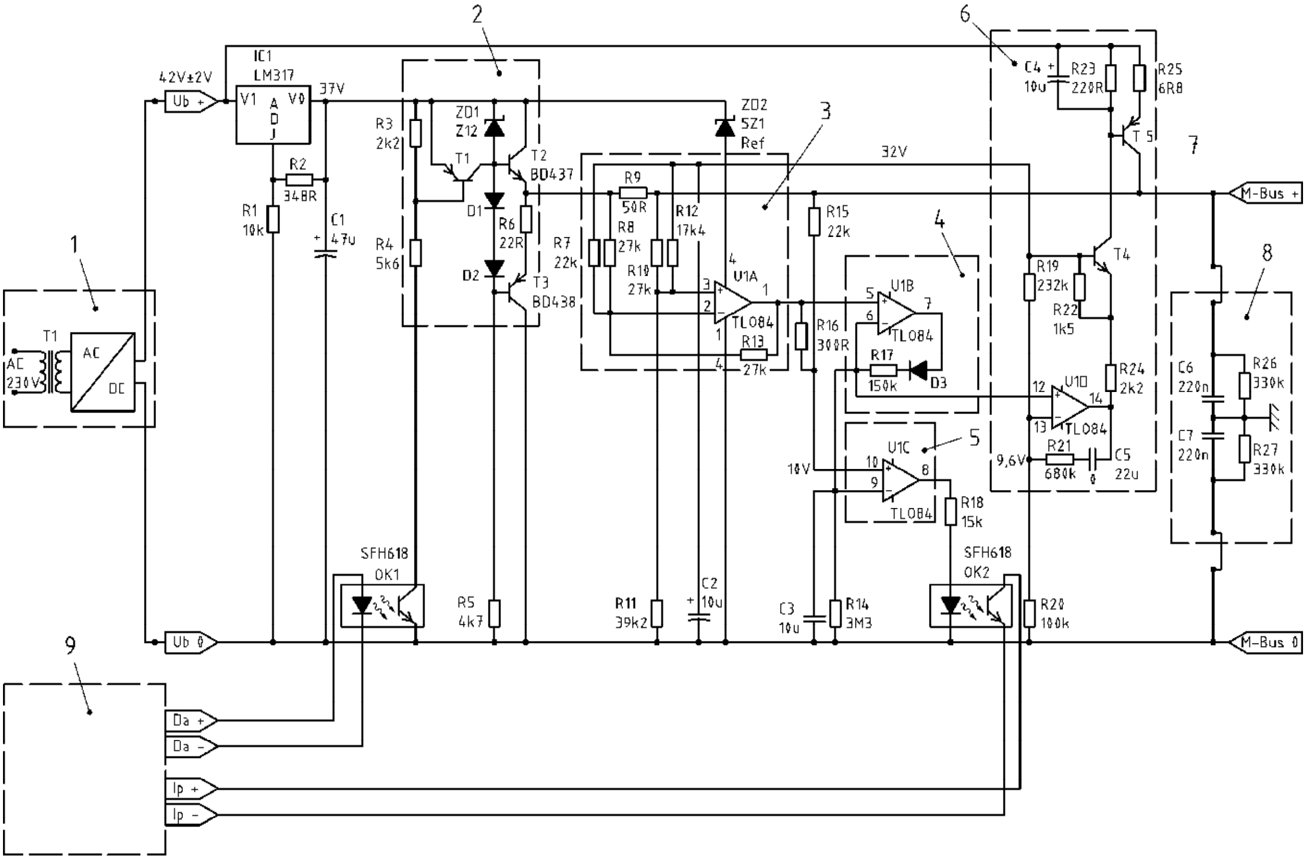


Figure F.1 — Master side interface for local data read out

F.3 Full size level converter

For up to 250 slaves (quiescent current < 380 mA) for a maximum installation (RL < 120 Ω), a circuit with the function blocks of Figure F.2 is required. It should be noted that – for clarity – provisions for protection against overcurrent, short circuit and overvoltage have been omitted.



Key

1 Galvanic isolated power supply
2 Program voltage source
3 Level shift
4 Peak voltage detect
5 Data current detect
6 Quiescent current source max. 400 mA
7 High beta heat sink
8 Symmetry network
9 Protected control

Figure F.2 — Full size level converter

Bibliography

[1] AGFW FW 203, NOWA Version 1.5 - *Normierter Wärmezähler-Adapter*[1)]

[2] VEÖ Pflichtenheft für Tarifgeräte[2)]

[1)] Document can be obtained at: AGFW, Stresemannallee 28, 60596 Frankfurt/Main, Germany.

[2)] Document is withdrawn from the list of publications of VEÖ, Brahmsplatz 3, A-1040 Vienna, Austria.

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