

Australian Standard[®]

**Electricity metering—Data exchange for
meter reading, tariff and load control**

Part 21: Direct local data exchange



This Australian Standard® was prepared by Committee EL-011, Electricity Metering. It was approved on behalf of the Council of Standards Australia on 25 August 2006. This Standard was published on 19 September 2006.

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- Australian Chamber of Commerce and Industry
 - Australian Electrical and Electronic Manufacturers Association
 - Electrical Regulatory Authorities Council
 - Energy Networks Association
 - Engineers Australia
 - NEMMCO
 - National Measurement Institute
-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through public comment period.

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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 62056.21—2006

Electricity metering—Data exchange for meter reading, tariff and load control

Part 21: Direct local data exchange

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Technical Committee EL-011 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

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NOTES

Australian Standard[®]

Electricity metering—Data exchange for meter reading, tariff and load control

Part 21: Direct local data exchange

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand committee EL-011, Electricity Metering, to supersede AS 1284.10.1, *Electricity metering, Part 10.1: Data exchange for meter reading, tariff and load control—Direct local data exchange via hand-held unit (HHU)—IEC standard interface*. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australia, rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide electricity utilities and manufacturers with minimum requirements for hardware and protocols for local exchange of data between electricity meters and hand-held units.

This Standard is identical with, and has been reproduced from IEC 62056-21, Ed.1.0 (2002), *Electricity metering—Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange*.

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The terms ‘normative’ and ‘informative’ are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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NOTES

STANDARDS AUSTRALIA

Australian Standard**Electricity metering—Data exchange for meter reading, tariff and load control****Part 21: Direct local data exchange**

1 Scope

This part of IEC 62056 describes hardware and protocol specifications for local meter data exchange. In such systems, a hand-held unit (HHU) or a unit with equivalent functions is connected to a tariff device or a group of devices.

The connection can be permanent or disconnectable using an optical or electrical coupling. An electrical interface is proposed for use with a permanent connection, or when more than one tariff device needs to be read at one site. The optical coupler should be easily disconnectable to enable data collection via an HHU.

The protocol permits reading and programming of tariff devices. It is designed to be particularly suitable for the environment of electricity metering, especially as regards electrical isolation and data security. While the protocol is well-defined, its use and application are left to the user.

This standard is based on the reference model for communication in open systems. It is enhanced by further elements such as an optical interface, protocol controlled baud rate switchover, data transmission without acknowledgement of receipt. The protocol offers several modes for implementation in the tariff device. The HHU or equivalent unit acts as a master while the tariff device acts as a slave in protocol modes A to D. In protocol mode E, the HHU acts as a client and the tariff device acts as a server.

As several systems are in practical use already, particular care was taken to maintain compatibility with existing systems and/or system components and their relevant protocols.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

References to international standards that are struck through in this clause are replaced by references to Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is identified as such.

IEC 60050-300:2001, *International Electrotechnical Vocabulary (IEV) – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 62051:1999, *Electricity metering – Glossary of terms*

IEC 62056-42:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 42: Physical layer services and procedures for connection oriented asynchronous data exchange*

IEC 62056-46:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC-protocol*

IEC 62056-53:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM application layer*

ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*

~~ISO/IEC 1155:1978, *Information processing – Use of longitudinal parity to detect errors in information messages*~~

AS 2742, *Information processing—Use of longitudinal parity to detect errors in information messages* (identical to ISO/IEC 1155)

ISO/IEC 1177:1985, *Information processing – Character structure for start/stop and synchronous character-oriented transmission*

~~ISO/IEC 1745:1975, *Information processing – Basic mode control procedures for data communication systems*~~

AS 2749, *Information processing—Basic mode control procedures for data communication systems* (identical to ISO/IEC 1745)

~~ISO/IEC 7480:1991, *Information technology – Telecommunications and information exchange between systems – Start-stop transmission signal quality at DTE/DCE interfaces*~~

AS/NZS 3618, *Information technology—Telecommunications and information exchange between systems—Start-stop transmission signal quality at DTE/DCE interfaces* (identical to ISO/IEC 7480)

ITU-T Recommendation V.24 (2000), *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)*

ITU-T Recommendation V.28 (1993), *Electrical characteristics for unbalanced double-current interchange circuits*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purpose of this part of IEC 62056 the terms and definitions given in IEC 60050-300 and IEC 62051, as well as the following apply:

3.1.1

tariff device

fixed data collection unit, normally linked or combined with an electricity meter, acting as a server

3.1.2**master**

central station. Station which takes the initiative and controls the data flow

3.1.3**slave**

station responding to requests of a master station. The tariff device is normally a slave station

3.1.4**client**

a station, asking for services, normally the master station

3.1.5**server**

a station, delivering services. The tariff device (e.g. the meter) is normally the server, delivering the requested values or executing the requested tasks

3.2 Abbreviations

HHU hand-held unit

4 Physical properties**4.1 Electrical current loop interface**

a) Type of signal

20 mA current loop

Absolute limits:

Open-circuit voltage: max. 30 V d.c.

Loop current: max. 30 mA

Table 1 – Electrical interface

Current	Send (TX)	Receive (RX)
Zero, no loop current, SPACE	$\leq 2,5$ mA	≤ 3 mA
One, 20 mA loop current, MARK	≥ 11 mA	≥ 9 mA
Voltage drop	Send (TX)	Receive (RX)
One, 20 mA loop current, MARK	≤ 2 V	≤ 3 V
Maximum open-circuit voltage during operation		30 V d.c.

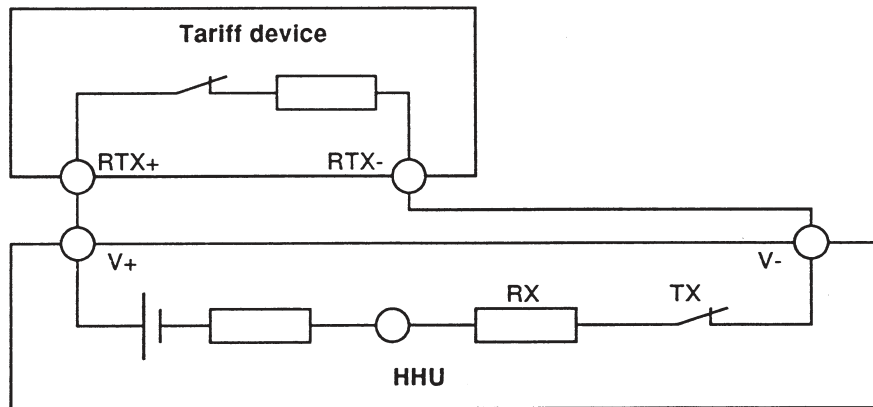
b) Power supply

On the tariff device side the interface is passive. The HHU supplies the necessary power.

c) Connections

Via terminals or suitable connectors. Polarity errors can prevent communication, but shall not harm the devices.

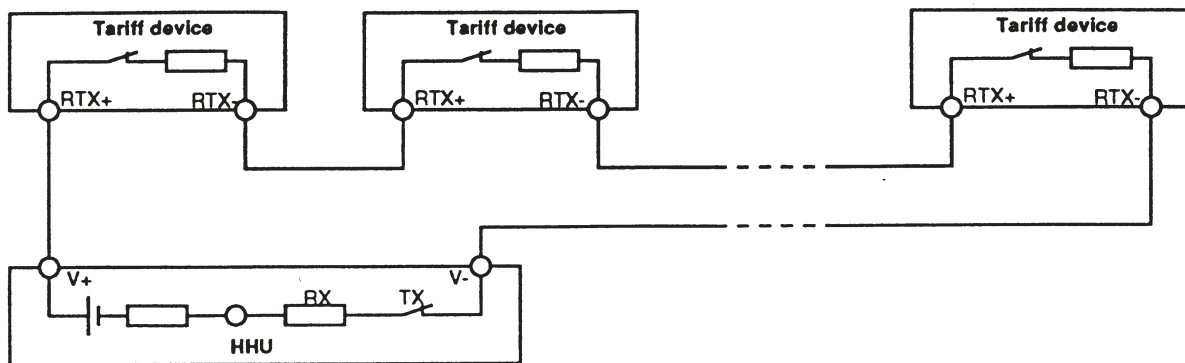
d) Circuit arrangements in two-wire configuration (one slave station)



IEC 722/02

Figure 1a – Circuit diagram of a two-wire single slave configuration

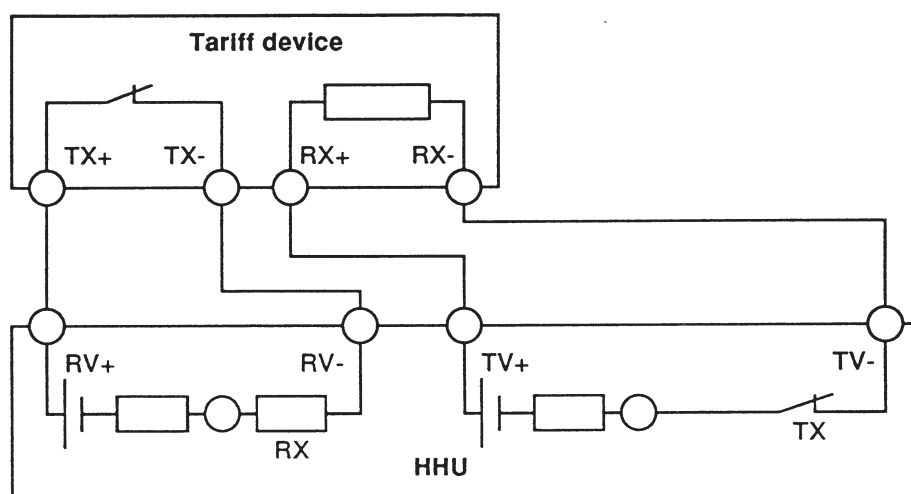
e) Circuit arrangements in two-wire configuration (multiple slave stations)



IEC 723/02

Figure 1b – Circuit diagram of a two-wire multiple slave configuration

f) Circuit arrangements in four-wire configuration (one slave station)



IEC 724/02

Figure 1c – Circuit diagram of a four-wire single slave configuration

g) Circuit arrangements in four-wire configuration (multiple slave stations)

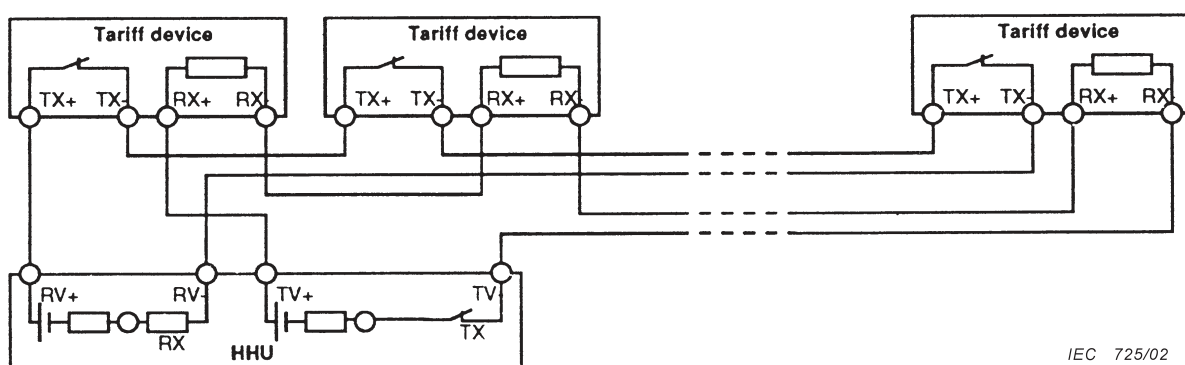


Figure 1d – Circuit diagram of a four-wire multiple slave configuration

Figure 1 – Circuit diagrams

If a nominal voltage of the master station (HHU) of 26 V is assumed, eight slave stations (tariff devices) can be connected in series.

4.2 Electrical interface V.24/V.28

Relevant ITU-T recommendations apply:

ITU-T Recommendation V.24: only circuits No. 102 (Signal ground), 103 (Transmitted data) and 104 (Received data) are used.

ITU-T Recommendation V.28: The electrical characteristics of the interchange circuits shall be according to the ITU-T V.28 Recommendation. These enable signalling rates up to 20 kbit/s.

4.3 Optical interface

4.3.1 Construction of the reading head

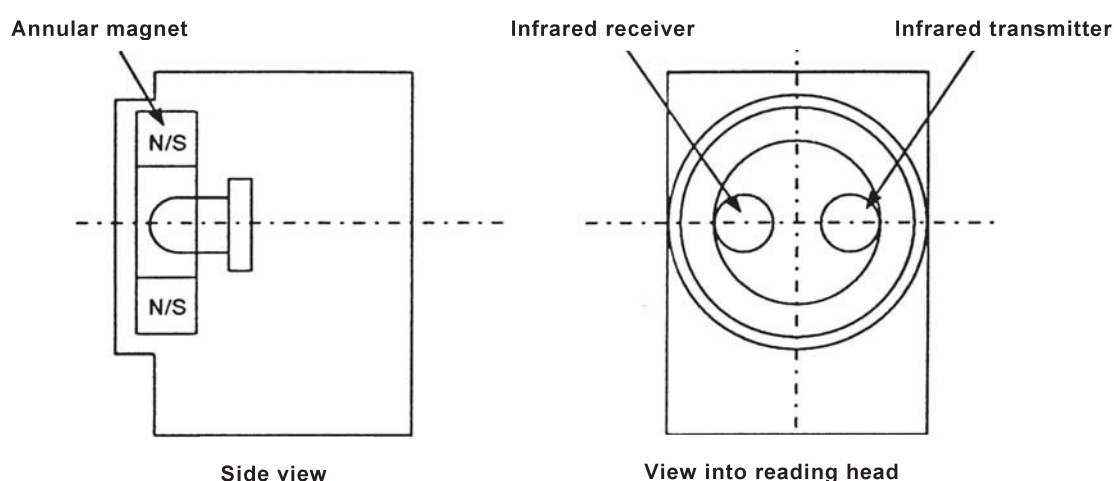


Figure 2a – Arrangement of components

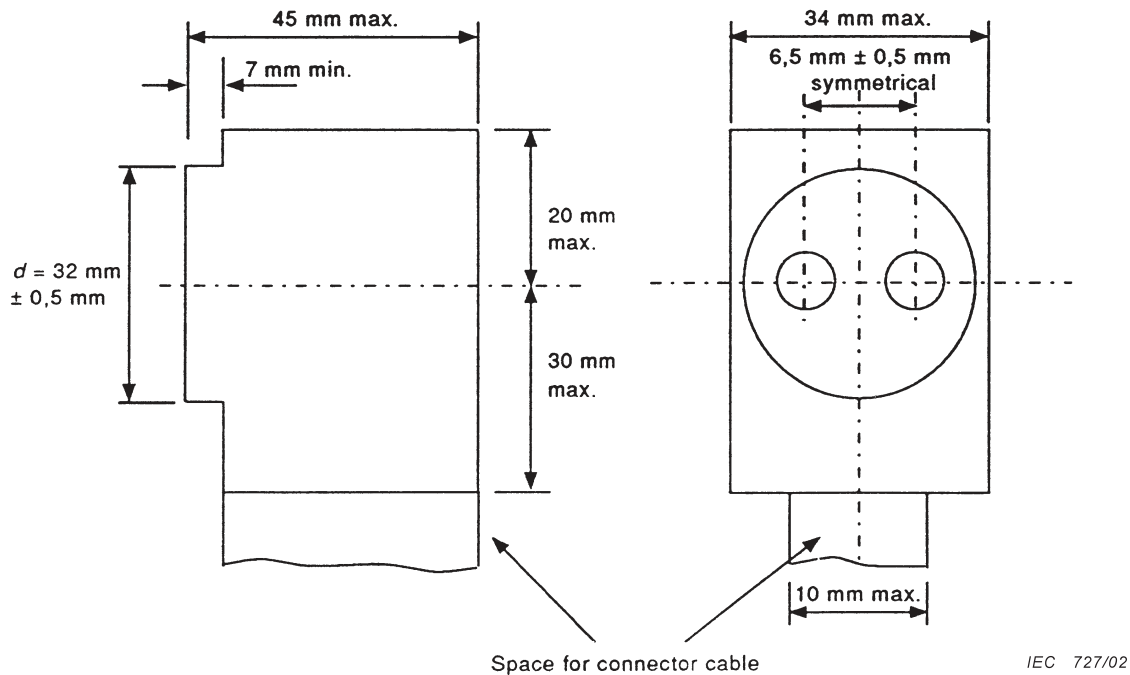


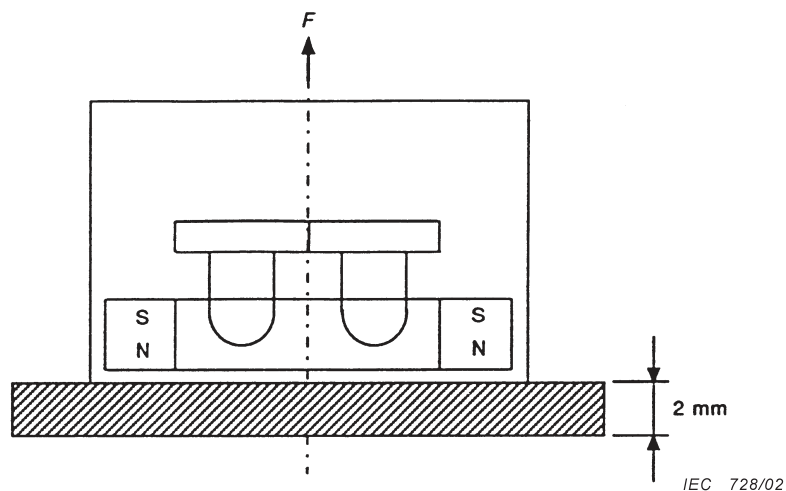
Figure 2b – Dimensions

Figure 2 – Construction of the reading head

4.3.2 Characteristic data of the magnet

Cohesion force

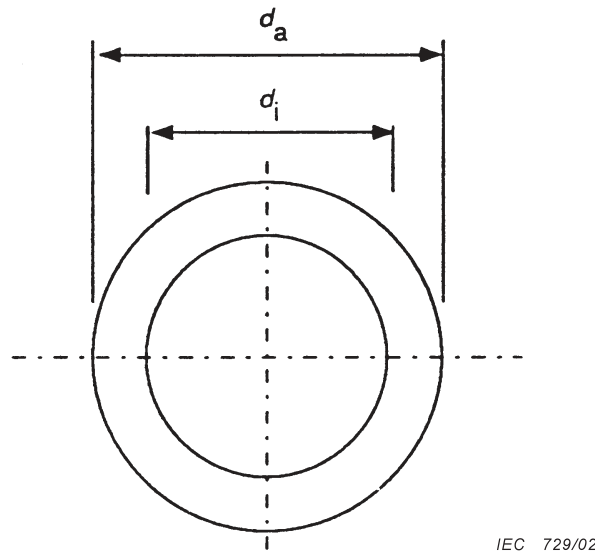
The cohesion force F is defined as the perpendicular pulling force measured when the magnet is positioned on a bright 2 mm thick deep-drawing steel plate St 12, minus the weight of the reading head itself.



Cohesion force

$F \geq 5$ N in contact with the steel plate; $F > 1.5$ N at a distance of 2 mm from the steel plate.

Figure 3a – Cohesion force



Internal diameter $d_i = 13 \text{ mm} \pm 1 \text{ mm}$; External diameter $d_a = 28 \text{ mm}$ minimum

Magnetization: axial, north pole directed towards the tariff device.

Figure 3b – Dimensions

Figure 3 – Characteristic data of the magnet

4.3.3 Arrangement of components in the tariff device

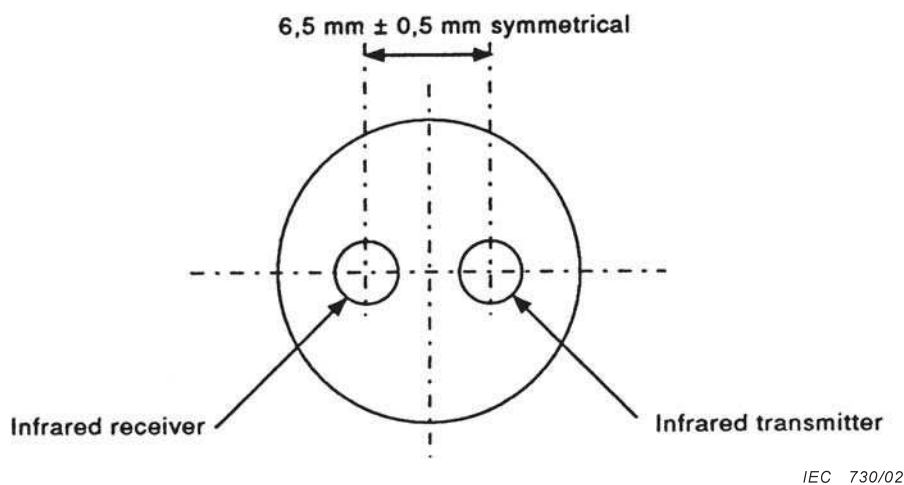


Figure 4 – View into optical port

4.3.4 Alignment

Although no mechanical alignment is specified, optimum data transfer is achieved (under test conditions) when the reading head is in the correct position (cable downwards), the infrared receiver in the tariff device is aligned directly opposite the infrared transmitter in the reading head, and the infrared receiver in the reading head is directly opposite the infrared transmitter in the tariff device.

Slight variations to this position should not affect performance significantly, but for larger variations, degradation of the optical characteristics can occur.

4.3.5 Optical characteristics

4.3.5.1 Wavelength

The wavelength of the radiated signals in both directions is between 800 nm and 1 000 nm (infrared).

4.3.5.2 Transmitter

The transmitter in the tariff device, as well as in the reading head, generates a signal with a radiation strength $E_{e/T}$ over a defined reference surface (optically active area) at a distance of $a_1 = 10 \text{ mm}$ ($\pm 1 \text{ mm}$) from the surface of the tariff device or the reading head.

The following limiting values apply:

ON-condition (ON = SPACE = Binary 0):

$$500 \leq E_{e/T} \leq 5\,000 \text{ } \mu\text{W}/\text{cm}^2$$

OFF-condition (OFF = MARK (quiescent state) = Binary 1):

$$E_{e/T} \leq 10 \text{ } \mu\text{W}/\text{cm}^2$$

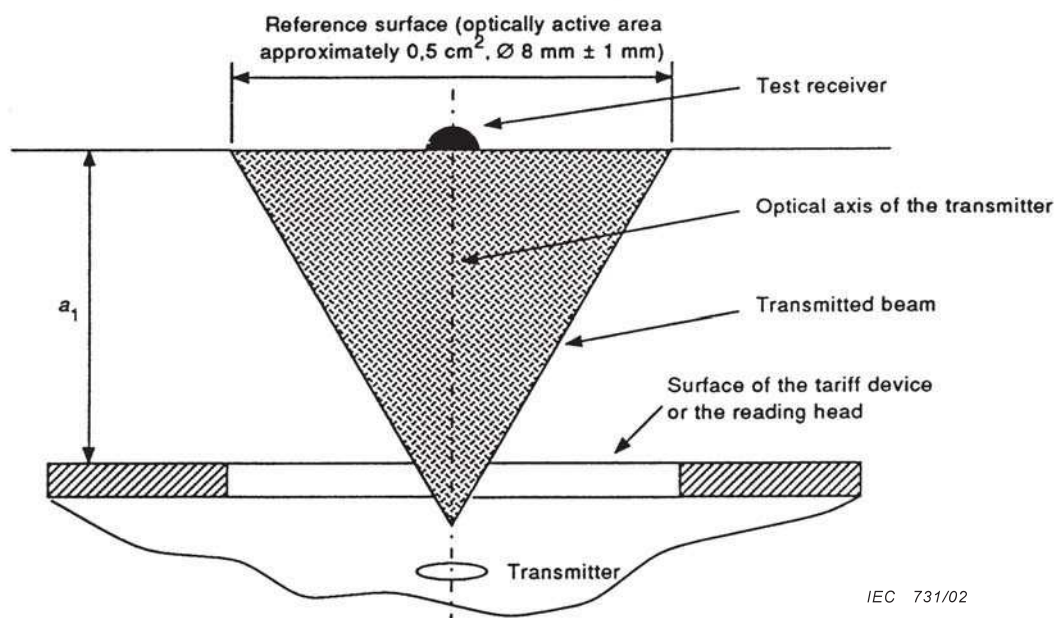


Figure 5 – Test arrangement for the transmitter

4.3.5.3 Receiver

A transmitter which is positioned at a distance $a_2 = 10 \text{ mm}$ ($\pm 1 \text{ mm}$) on the optical axis from the receiver in the tariff device or the reading head generates a signal with a radiation strength $E_{e/R}$ over a defined reference surface (optically active area).

The following limiting values apply:

ON-condition: receiver definitely ON at $E_{e/R} \geq 200 \text{ } \mu\text{W}/\text{cm}^2$ (ON = SPACE = Binary 0)

OFF-condition: receiver definitely OFF at $E_{e/R} \leq 20 \text{ } \mu\text{W}/\text{cm}^2$ (OFF = MARK (quiescent state) = Binary 1)

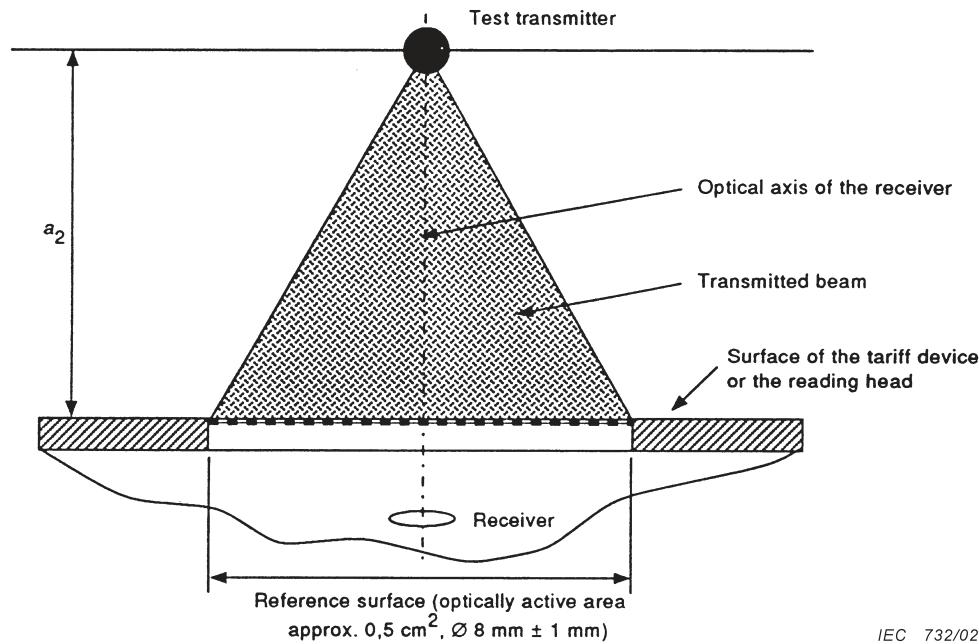


Figure 6 – Test arrangement for the receiver

4.3.5.4 Environmental lighting condition

The optical path (data transmission) shall not be affected by surrounding light with an intensity of up to 16 000 lux (light composition comparable with daylight, including fluorescent light).

4.3.5.5 Environmental temperature condition

The reference temperature is 23 °C ± 2 °C.

5 Character transmission

5.1 Type of transmission

Asynchronous serial bit (Start – Stop) transmission according to ISO/IEC 1177:1985, half-duplex.

5.2 Transmission speed

Initial baud rate – 300

Standard baud rates – 300, 600, 1 200, 2 400, 4 800, 9 600, 19 200

Special baud rate – as desired.

NOTE The maximum speed may be limited by the reading head or the optical port or the ITU-T Recommendation V.28 limitations in the tariff device.

5.3 Signal quality

According to ISO/IEC 7480:1991:

- category 1 for the transmitter;
- category A for the receiver.

5.4 Character format

Character format according to ISO/IEC 1177:1985.

(1 start bit, 7 data bits, 1 parity bit, 1 stop bit).

NOTE Protocol mode E (see 6.4.5) may use byte transparency, 1 start bit, 8 data bits, 1 stop bit (e.g. see Annex E).

5.5 Character code

Character code according to ISO/IEC 646:1991, international reference version. For local use, a national replacement code can be used.

NOTE Protocol mode E (see 6.4.5) may use byte transparency.

5.6 Character security

With parity bit, even parity according to ISO/IEC 1177:1985.

NOTE Protocol mode E (see 6.4.5) may use byte transparency, specific security may be used.

6 Data transmission protocol

6.1 General

The protocol offers five alternative protocol modes, which can be used by the tariff device: A, B, C, D and E. Mode selection is a subset of ISO/IEC 1745, basic mode control procedures.

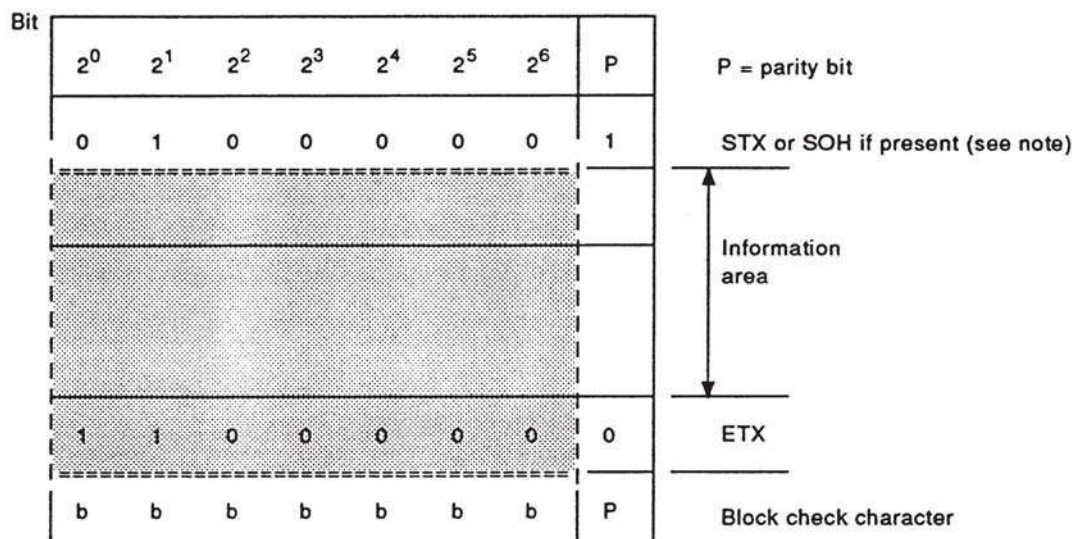
Data exchange is bi-directional in protocol modes A, B, C and E and is always initiated by the HHU with a transmission of a request message. In protocol modes A to C, the HHU acts as a master and the tariff device acts as a slave. In protocol mode E, the HHU acts as a client and the tariff device acts as a server. These protocol modes permit meter reading and programming. Protocol mode E may be a transparent binary mode.

Data exchange is unidirectional in protocol mode D and permits readout only. The information flows from the tariff device to the HHU. Data transmission is initiated, for example by operating a push button or other sensor on the tariff device.

The protocol mode used by the tariff device is indicated to the HHU by the identification message. Protocol modes A to D are identified by the baud rate identification character (see item 13 in 6.3.3) while protocol mode E is identified by an escape sequence (see items 23 and 24 in 6.3.2). Protocol mode E enables to use various protocols, one of them being the METERING HDLC protocol as described in Annex E.

6.2 Calculation of the block check character

The readout of data may be performed without block check character. Whenever used, the block check character shall comply with ISO/IEC 1155:1978.



The block check character is calculated within the shaded area.

IEC 733/02

NOTE The scope of the block check character BCC is as specified in ISO/IEC 1745:1975, and is from the character immediately following the first SOH or STX character detected up to and including the ETX character which terminates the message. The calculated BCC is placed immediately following the ETX.

Figure 7 – Setting up a block check character (example according to ISO/IEC 1155)

6.3 Message definitions

Explanations of message contents see 6.3.14.

6.3.1 Request message

Opening message from the HHU to the tariff device. The device address is optional.

/	?	Device address	!	CR	LF
1)	9)	22)	2)	3)	3)

6.3.2 Identification message

Answer of a tariff device. Fields 23) and 24) are optional, they are part of field 14).

/	X	X	X	Z	\	W	Identification	CR	LF
1)	12)	12)	12)	13)	23)	24)	14)	3)	3)

6.3.3 Acknowledgement/option select message

Negotiation of advanced features (only used in protocol mode C and E).

ACK	V	Z	Y	CR	LF
4)	10)	13)	11)	3)	3)

6.3.4 Data message (except in programming mode)

Normal response of a tariff device, for example the full data set (not used in protocol mode E).

STX	Data block	!	CR	LF	ETX	BCC
5)	15)	2)	3)	3)	6)	8)

6.3.5 Acknowledgement message

If appropriate, see also flow charts in the annexes.

ACK
4)

6.3.6 Repeat-request message

If appropriate, see also flow charts in the annexes.

NAK
16)

6.3.7 Programming command message

Used for programming and block oriented data transfer, see also 6.5.

SOH	C	D	STX	Data set	ETX	BCC
17)	18)	19)	5)	20)	6)	8)

6.3.8 Programming command message using optional partial blocks

Used for long messages, see also 6.5 and flow charts in the annexes (only in protocol mode C).

SOH	C	D	STX	Data set	EOT	BCC
17)	18)	19)	5)	20)	7)	8)

6.3.9 Data message (programming mode)

Used for block oriented data transfer, see also 6.5 and flow charts in the annexes.

STX	Data set	ETX	BCC
5)	20)	6)	8)

6.3.10 Data message (programming mode) using optional partial blocks

Used for long messages of block oriented data transfer, see also 6.5 and flow charts in the annexes (only in protocol mode C).

STX	Data set	EOT	BCC
5)	20)	7)	8)

6.3.11 Error message (programming mode)

Used for block oriented data transfer, see also flow charts in the annexes.

STX	Error message	ETX	BCC
5)	21)	6)	8)

6.3.12 Break message (programming mode)

Used for block oriented data transfer, see also flow charts in the annexes.

SOH	B	0	ETX	BCC
17)	18)	19)	6)	8)

6.3.13 Block message (other protocols)

Block messages are used in conformance with the protocol selected, as specified in "other protocol", see 6.4.5 and Annex E.

6.3.14 Explanations of message contents

- 1) Start character "/" (forward oblique, code 2FH).
- 2) End character "!" (exclamation mark, code 21H).
- 3) Completion character (CR, carriage return, code 0DH; LF, line feed, code 0AH).
- 4) Acknowledge character (ACK, acknowledge, code 06H).
- 5) Frame start character (STX, start of text code 02H) indicating where the calculation of BCC shall start from. This character is not required if there is no data set to follow.
- 6) End character in the block (ETX, end of text, code 03H).
- 7) End character in a partial block (EOT, end of text block, code 04H).
- 8) Block check character (BCC), if required, in accordance with the characters 5) and 6). Items 5) and 6) do not apply when the data block is transmitted without check characters.
- 9) Transmission request command "?" (question mark, code 3FH)
- 10) Protocol control character (see 6.4.5.2).
- 11) Mode control character (see 6.4.5.3).

12) Manufacturer's identification comprising three upper case letters except as noted below:

If a tariff device transmits the third letter in lower case, the minimum reaction time t_r for the device is 20 ms instead of 200 ms. Even though a tariff device transmits an upper case third letter, this does not preclude supporting a 20 ms reaction time.

These letters shall be registered with the administrator: The FLAG Association (see the foreword).

13) Baud rate identification (for baud rate changeover)

The request message, the identification message and the acknowledgement/option select message are transmitted at the initial rate of 300 Bd (except protocol mode D). The baud rate of the data message depends on the baud rate determined by the protocol.

a) Protocol mode A (without baud rate changeover)

Any desired printable characters except "/", "!" and as long as they are not specified for protocol mode B or protocol mode C.

b) Protocol mode B (with baud rate changeover, without acknowledgement/option select message)

A	-	600 Bd
B	-	1 200 Bd
C	-	2 400 Bd
D	-	4 800 Bd
E	-	9 600 Bd
F	-	19 200 Bd

G, H, I - reserved for later extensions.

c) Protocol mode C and protocol mode E (with baud rate changeover, with acknowledgement / option select message or other protocols)

0	-	300 Bd
1	-	600 Bd
2	-	1 200 Bd
3	-	2 400 Bd
4	-	4 800 Bd
5	-	9 600 Bd
6	-	19 200 Bd

7, 8, 9 - reserved for later extensions.

d) Protocol mode D (data transmission at 2 400 Bd)
Baud rate character is always 3.

14) Identification, manufacturer-specific, 16 printable characters maximum except for "/" and "!". "\" is only allowed as an escape character, see 23) and 24).

15) Data block with the measured values (see syntax diagram for normal reading). All printable characters may be used in the data block, as well as line feed and carriage return, except for "/" and "!".

16) Repeat request character (NAK, negative acknowledge, code 15H).

17) Start-of-header character (SOH, start-of-header, code 01H).