BRITISH STANDARD

BS 7951:2000

Specification for

Electricity meters — Alternating-current single-phase static watt-hour telemeters of accuracy class 1 or 2

ICS 17.220.20

Committees responsible for this British Standard

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BCEMA
BEAMA Metering Association (BMA)
Electricity Association
Electricity Pool of England and Wales
Energy Systems Trade Association
Flag Association
Institution of Electrical Engineers
Office of Electricity Regulation (OFFER)
Co-opted members

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Foreword

This British Standard has been prepared by Technical Committee PEL/13.

As far as possible, the clause numbering of this standard has been structured to correspond with that of BS EN 61036:1997.

SI units in accordance with the relevant parts of BS 5775:1993 are used throughout this standard.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 5 and a back cover.

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Introduction

BS 7647 describes a radio-controlled switch (radio teleswitch) which is used with an electricity meter to provide facilities for implementing a multiple-rate tariff. Technological development now allows the functions of a radio teleswitch to be integrated within a static electricity meter as specified in BS EN 61036. This obviates the need for two separate devices. Such an integrated device is known as a (radio) telemeter.

A telemeter may incorporate output switches and local communications facilities via an optical port, and is intended for use in those locations in domestic, industrial or commercial premises where it is custom and practice to install electricity meters, and tariff and load control devices.

The telemeter has energy registers associated with each metrological element for the registration of controlled and/or uncontrolled energy usage. Timing for effect of such registers is provided by an internal clock, synchronized from time signals decoded by the radio teleswitch module.

1 Scope

This British Standard specifies requirements for alternating-current single-phase static watt-hour telemeters of accuracy class 1 or class 2, with one or two measuring elements. It applies to telemeters of protective class I or class II.

NOTE Accuracy classes and protective classes are as applied in BS EN 61036:1997.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 7647:1993, *Specification for radio teleswitches for tariff and load control.*

BS 7856:1996, *Code of practice for design of alternating current, watt-hour meters for active energy (classes 1 and 2).*

BS EN 55022:1995, *Limits and methods of measurement of radio disturbance characteristics of information technology equipment.*

BS EN 60068-2-6:1996, *Environmental testing — Test methods — Test Fc — Vibration (sinusoidal).*

BS EN 60068-2-27:1993, *Environmental testing — Test methods — Environmental testing procedures — Tests — Test Ea and guidance — Shock.*

BS EN 60529:1992, *Degrees of protection provided by enclosures (IP code).*

BS EN 61036:1997, *Alternating current static watt-hour meters for active energy (classes 1 and 2).*

BS EN 61107:1996, *Data exchange for meter reading, tariff and load control — Direct local data exchange.*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply, together with relevant definitions given in BS 7647:1993 and BS EN 61036:1997.

3.1

telemeter

electricity meter incorporating a radio teleswitch module for tariff and load control

3.2

radio teleswitch module

part of the telemeter which receives and decodes the radio teleswitch signals and transmits appropriate information to its output circuits

3.3

local communication port

infra-red input/output communications facility as specified in BS EN 61107:1996

3.4

output switch

switch controlled by information from the radio teleswitch module

NOTE Output switches include physical switches, with outputs accessible externally, and internal logic switches, which set parameters such as tariff rate within the telemeter.

3.5

load switch

physical output switch for controlling space-heating and/or water-heating equipment

3.6

auxiliary switch

physical output switch for signalling changes of rate to external equipment

4 Requirements

4.1 Rated electrical values

4.1.1 *Rated voltage* (U_n)

The telemeter shall be rated for a nominal supply voltage of 230 V.

4.1.2 *Rated current*

Measuring elements shall be rated at 20 A basic (I_b) and 100 A maximum (I_{max}).

NOTE The total current which a two-element telemeter passes will not in practice exceed 120 A, irrespective of the sum of the I_{max} rating of each measuring element. This is because the meter will be controlled by a supplier's fuse rated at up to 100 A, which will operate to break the circuit at about this level, depending on the fusing factor.

4.1.3 *Standard frequency*

The telemeter shall be suitable for a standard supply frequency of 50 Hz.

4.2 Mechanical requirements

4.2.1 *General*

The telemeter shall conform to BS EN 61036:1997, **4.2.1**.

4.2.2 *Case*

The telemeter shall conform to BS EN 61036:1997, **4.2.2**.

4.2.3 *Window*

If the cover is not transparent, one or more windows shall be provided for reading the display(s) and observation of the operation indicator(s), if fitted; see **4.2.11**. The window(s) shall be made of a transparent material, which cannot be removed undamaged without breaking a seal.

4.2.4 *Terminals and terminal block(s)*

Terminal block(s) shall conform to BS EN 61036:1997, **4.2.4**.

If the telemeter does not have double insulation, it shall have a protective earth terminal as specified in BS EN 61036:1997, **4.2.4**.

The dimensions of the telemeter and the spacing of fixing holes and terminals shall conform to BS 7856:1996, Table 1 and Figure 1.

Terminals related to the primary measuring element(s), offering unrestricted supply, shall conform to BS 7856:1996, Figures 2 and 3 in respect of the arrangement of line and neutral.

NOTE A telemeter may have terminals additional to those shown in BS 7856:1996.

4.2.5 *Terminal covers*

Terminal covers shall conform to BS EN 61036:1997, **4.2.5**.

4.2.6 *Clearance and creepage distances*

Clearance and creepage distances as described in BS EN 61036:1997, **4.2.6**, shall conform to the values specified for indoor meters for a voltage phase-to-earth of 300 V in BS EN 61036:1997, Table 3a or Table 3b as appropriate.

4.2.7 *Supplementary insulation for insulating encased telemeters of protective class II*

Insulating encased telemeters of protective class II (see BS EN 61036:1997, **3.4.6**) shall conform to BS EN 61036:1997, **4.2.7**.

4.2.8 *Resistance to heat and fire*

The telemeter shall conform to BS EN 61036:1997, **4.2.8**.

4.2.9 *Protection against penetration by dust and water*

When tested in accordance with BS EN 61036:1997, **5.2.5**, the telemeter shall conform to the degree of protection IP51 as specified in BS EN 60529:1992, but without suction in the meter.

4.2.10 *Resistance to impact, shock and vibration*

4.2.10.1 After testing in accordance with BS 7647:1993, **10.2.1**, the case and terminal cover of the telemeter shall sustain no damage which could affect the function of the telemeter, and it shall not be possible to touch any live part.

NOTE Slight damage which does not impair the protection against indirect contact or the penetration of solid objects, dust and water, is acceptable.

4.2.10.2 After testing in accordance with BS EN 60068-2-27:1993 under the conditions given in BS 7647:1993, **10.2.2**, the telemeter shall show no damage and shall operate correctly, and the position of the switches shall be unchanged.

4.2.10.3 After testing in accordance with BS EN 60068-2-6:1996 under the conditions given in BS 7647:1993, **10.2.3**, the telemeter shall show no damage and shall operate correctly, and the position of the switches shall be unchanged; components and wiring shall remain fastened and secure.

4.2.11 *Display*

Display of the values measured by the telemeter shall conform to BS EN 61036:1997, **4.2.11**.

The display of a two-element telemeter shall indicate the consumption of both elements.

NOTE The consumption of the two elements need not be indicated simultaneously.

4.2.12 *Output device(s)*

The telemeter shall have at least one test output device accessible from the front and capable of being monitored by suitable testing equipment.

Operation indicator(s), if fitted, shall be visible from the front and shall indicate operation of each measuring element.

If a local communications port is fitted, it shall conform to BS EN 61107:1996.

4.2.13 *Output switches*

4.2.13.1 *General*

Up to two load switches shall be associated with each measuring element.

4.2.13.2 *Indication of switch states*

The state of each load switch shall be indicated.

4.2.13.3 *Number of operations*

Switches shall conform to BS 7647:1993, **5.8.3**, with respect to the number of operations.

4.2.13.4 *Non-automatic operation of output switches*

For test purposes only, there shall be a safe means of setting each output switch to the on or off condition.

4.2.13.5 *Acoustic noise levels*

Acoustic noise levels of the output switches shall conform to BS 7647:1993, **5.8.5**.

4.2.14 *Marking*

4.2.14.1 *Nameplate*

The nameplate of the telemeter shall conform to BS EN 61036:1997, **4.2.13.1**, with the addition of the following:

1) the designation "Telemeter to BS 7951:2000"[1)];

2) the rated breaking currents of the output switches to which external access is possible;

3) the aerial position, A or B as indicated in BS 7647:1993, Figure 2, where a fixed aerial is fitted.

If appropriate, the marking of the number of phases and the number of wires [item c) of BS EN 61036:1997, **4.2.13.1**] shall be presented in a manner which indicates that the telemeter has two elements.

The marking shall be indelible, distinct and readable from outside the telemeter.

4.2.14.2 *Connection diagrams and terminal marking*

The telemeter shall be indelibly marked with a diagram of connections. If the terminals of the telemeter carry a marking, the corresponding marking shall appear on the diagram.

4.3 Ambient conditions

The telemeter shall conform to BS EN 61036:1997, **4.3** for an indoor meter. When tested in accordance with BS EN 61036:1997, **5.3.1** to **5.3.3**, the telemeter shall show no damage or change of information and shall operate correctly.

4.4 Electrical requirements

NOTE The requirements given in **4.4.2** to **4.4.6** apply to each measuring element of the telemeter

4.4.1 *Power consumption*

The total power consumption of the telemeter, including all measuring elements, electronic circuits and output switches, shall not exceed the values given in Table 1.

Table 1 — Power consumption

Number of elements	Power consumption	
	W	V·A
One	3	10
Two	4	15

The power consumption in each voltage circuit and in each current circuit shall conform to BS EN 61036:1997, **4.4.1**, when tested in accordance with BS EN 61036:1997, **5.4.1**.

4.4.2 *Output switches*

4.4.2.1 *Rated voltage*

Output switches shall be designed for a rated voltage of 230 V.

4.4.2.2 *Rated current*

Each switch shall be able to break under the values of current given in Table 2.

Table 2 — Switch breaking current

Values in amperes

Load condition	Switch breaking current			
	Switch rating			
	2	25	80	100
Linear ohmic load $\cos\theta = 1$: current	2	25	80	100
Inductive load $\cos\theta = 0.4$: current	1	10	10	10

4.4.3 *Effect of supply variations*

4.4.3.1 *Voltage range*

A telemeter, including its output switches, shall have a specified operating range for supply voltage from $0.9U_n$ to $1.1U_n$, where U_n is the rated supply voltage (see **4.1**). The limit range of operation shall be from 0 to $1.15U_n$.

NOTE The terms "specified operating range" and "limit range of operation" are defined in BS EN 61036:1997.

4.4.3.2 *Voltage dips and short interruptions*

When the telemeter is tested in accordance with BS EN 61036:1997, **5.4.2**, there shall be no change of more than 0.01 kW·h in any of its registers, and the test output shall not produce a signal equivalent of more than 0.01 kW·h.

NOTE For requirements relating specifically to the radio teleswitch module, see **4.7.6**.

4.4.3.3 *Effect of short-time over-currents*

After a short-time over-current of 200 A has been passed for 500 s through any terminal of the telemeter designed to supply power at 230 V, no flashover, disruptive charge or puncture shall occur when the telemeter is tested in accordance with BS EN 61036:1997, **5.4.6.3**.

A short-time over-current of up to 3 kA for one half-cycle at rated frequency shall not cause a variation of error greater than 0.3 A in any measuring circuit, with a power factor of unity.

The short-time over-current shall be applied in accordance with BS EN 61036:1997, **5.4.3**.

[1)] Marking BS 7951:2000 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

4.4.4 *Effect of self-heating*

When tested in accordance with BS EN 61036:1997, **5.4.4**, with all switches in the closed position, each measuring element of the telemeter shall conform to BS EN 61036:1997, **4.4.4**, for a class 1 or class 2 meter as appropriate.

4.4.5 *Effect of heating*

When tested in accordance with BS EN 61036:1997, **5.4.5**, the telemeter shall conform to BS EN 61036:1997, **4.4.5** and **5.4.5**.

4.4.6 *Insulation*

The telemeter shall conform to BS EN 61036:1997, **4.4.6**.

4.5 Electromagnetic compatibility (EMC)

4.5.1 *Immunity*

When tested in accordance with BS EN 61036:1997, **5.5.1** to **5.5.4**, the telemeter shall conform to BS EN 61036:1997, **4.5.1**.

4.5.2 *Radio interference suppression*

When tested in accordance with BS EN 55022:1995, for class B equipment, the telemeter shall conform to BS EN 61036:1997, **4.5.2**.

4.6 Accuracy

4.6.1 *General*

When tested in accordance with BS EN 61036:1997, **5.6**, each element of the telemeter shall conform to BS EN 61036:1997, **4.6** for class 1 or class 2 meters as appropriate.

4.6.2 *Interaction between elements*

In a two element telemeter, there shall be no interaction between elements which affects accuracy or causes emission of spurious output pulses as measured by the tests specified in **5.2** and **5.3**.

4.7 Radio teleswitch module

4.7.1 *Signal reception*

4.7.1.1 *Aerial*

The aerial shall be enclosed within the telemeter case. Any directional aerial shall be capable of being mounted in either of two positions such that nulls in the polar diagram in one position are filled by reception in the other position, as shown in BS 7647:1993, Figure 2.

Any mechanism for adjusting the aerial shall be secure against tamper.

NOTE 1 The position of the aerial may be adjustable from outside the telemeter without the need to break any metrological seal.

NOTE 2 An omnidirectional aerial may be used.

4.7.1.2 *Sensitivity*

The telemeter shall conform to BS 7647:1993, **8.1.2**.

4.7.1.3 *Signal frequency*

The telemeter shall be designed to receive signals superimposed on the national broadcast carrier frequency of 198 kHz.

4.7.1.4 *Signal modulation and data format*

Signal modulation and data format shall conform to BS 7647:1993, **8.1.4** and BS 7647:1993, annex A.

4.7.1.5 *Code setting*

The telemeter shall have a secure method of changing the group code to which it will respond. If the user identifier can be changed, this shall be by a similarly secure method.

4.7.1.6 *Signal indication*

The telemeter shall indicate that signals are being received and decoded.

4.7.2 *Message format*

The telemeter shall conform to BS 7647:1993, **8.2**.

NOTE Other data formats exist and may be set out in other specifications.

4.7.3 *Control of output switches*

4.7.3.1 *Normal operation*

Normal operation of output switches shall conform to BS 7647:1993, **8.3.1**.

4.7.3.2 *Fallback mode*

The telemeter shall have a fallback programme which ensures that it continues to function if programme data is not received.

4.7.3.3 *Response of output switches*

After testing in accordance with BS 7647:1993, **10.4.2**, the number of "on" and "off" signals sent to the switch shall correspond with the number of actual switch opening and closing operations, and the switch shall show no evidence of sticking.

4.7.4 *Effect of loss of signal*

The telemeter shall conform to BS 7647:1993, **8.4**.

4.7.5 *Start-up procedure*

There shall be a controlled and repeatable start-up procedure.

NOTE The start-up procedure should be agreed between the manufacturer and purchaser. BS 7647:1993, **8.5** gives an example of a start-up procedure.

4.7.6 *Functional effect of supply voltage dips and interruptions*

If supply voltage is lost totally or partially for any length of time, the telemeter shall retain all data without change.

If supply voltage is lost for up to 3 s, the time/calendar clock shall maintain synchronization.

When the supply voltage is restored, operation shall resume in accordance with the start-up procedure.

NOTE The start-up procedure following restoration of supply voltage may take into account the latest programme information received by the telemeter and held in memory.

4.8 Other requirements

4.8.1 *Internal timekeeping*

The telemeter shall conform to BS 7647:1993, **8.7**.

4.8.2 *Time synchronization*

The time synchronization shall conform to BS 7647:1993, Figures A.8 and A.9.

4.8.3 *Memory support*

Stored data, programmes and tariff information, with the exception of real time, shall not be lost or corrupted in any manner by the interruption or loss of supply voltage.

4.8.4 *Anti-fraud provisions*

The telemeter shall provide indication of reverse energy flow.

5 Tests

NOTE Other test procedures are given by cross-reference to other standards within the relevant requirements specified in clause **4**.

5.1 General

Testing procedures shall conform to BS EN 61036:1997, **5.1**.

5.2 Interaction affecting accuracy

Both elements shall be connected to the reference voltage at the reference frequency (see BS EN 61036:1997, **3.5.3** and **3.5.4**). The error of one element at a current of 2 A ($0.1I_b$) shall be established when there is zero current in the current circuit of the other element. This error shall change by no more than 1.5 % after the current in the other element is increased to 100 A (I_{max}).

This test shall be repeated for the other element.

5.3 Interaction causing emission of spurious pulses

Both elements shall be connected to reference voltage at reference frequency (see BS EN 61036:1997, **3.5.3** and **3.5.4**). A current of 100 A (I_{max}) shall be applied to one element and zero current in the other. The element with zero current shall emit no more than one output pulse during a period, in minutes (min), of not less than:

$$\frac{60\,000}{k}$$

where k is the meter constant in pulses per kilowatt hour.

This test shall be repeated for the other element.

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London
W4 4AL