

# Telecontrol equipment and systems —

Part 3: Specification for interfaces  
(electrical characteristics) —

(Implementation of CENELEC  
HD 546.3 S1)

# Committees responsible for this British Standard

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- Association of Consulting Engineers
- BAMEMA (BEAMA)
- BEAMA Ltd.
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electricity Supply Industry in United Kingdom
- GAMBICA (BEAMA Ltd.)
- North of Scotland Hydro-Electric Board
- Telecommunication Engineering and Manufacturing Association
- Transmission and Distribution Association (BEAMA Ltd.)

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# National foreword

This Part of BS 7404 has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee and is identical with IEC Publication 870-3:1989 “*Telecontrol equipment and systems — Part 3: Interfaces (electrical characteristics)*”, published by the International Electrotechnical Commission (IEC) which has been endorsed by CENELEC as HD 546.3 S1:1991.

The International Standard does not give the up-to-date relation between this Part of the IEC standard and the other published and envisaged Parts and Sections. Other Parts and Sections of this British Standard are as follows.

- *Part 1: General considerations;*
- *Section 1.1: General principles;*
- *Section 1.2: Guide for specifications;*
- *Section 1.3: Glossary;*
- *Section 1.4: Basic aspects of telecontrol data transmission<sup>1)</sup>;*
- *Part 2: Operating conditions;*
- *Section 2.1: Specification for classes of environmental conditions and power supplies;*
- *Section 2.2: Specification for electromagnetic compatibility and erosive and corrosive influences<sup>2)</sup>;*
- *Part 3: Specification for interfaces (electrical characteristics);*
- *Part 4: Specification for performance;*
- *Part 5: Transmission protocols;*
- *Section 5.1: Specification for transmission frame formats;*
- *Section 5.2: Specification for transmission procedures<sup>3)</sup>;*
- *Section 5.3: Specification for structure of application data<sup>4)</sup>;*
- *Section 5.4: Specification for coding specifications of application data<sup>5)</sup>;*
- *Part 6: Specification for telecontrol protocols compatible with ISO and CCITT standards<sup>2)</sup>.*

## Cross-references

| International Standard | Corresponding British Standard                                                                                       |
|------------------------|----------------------------------------------------------------------------------------------------------------------|
| IEC 625                | BS 6146 <i>An interface system for programmable measuring instruments (byte serial, bit parallel)</i><br>(Identical) |
| IEC 870-4:1990         | BS 7404 <i>Telecontrol equipment and systems</i><br><i>Part 4:1991 Specification for performance</i><br>(Identical)  |

The Technical Committee has reviewed the provisions of IEC 50(371), IEC 225-4 and IEC 495, to which reference has been made in the text, and has decided that they are acceptable for use in conjunction with this British Standard.

<sup>1)</sup> Will be published after IEC 870-1-4 has been published.

<sup>2)</sup> Not yet published, envisaged as future work by IEC.

<sup>3)</sup> Will be published after IEC 870-5-2 has been published.

<sup>4)</sup> Will be published after IEC 870-5-3 has been published.

<sup>5)</sup> Will be published after IEC 870-5-4 has been published.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.



## 1 Scope

This series of standards applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and controlling geographically widespread processes.

## 2 Object

This part defines electrical interface characteristics (e.g. signals, impedances, etc.) which have to be met at the shared boundaries (see Figure 1) between:

- telecontrol equipment and external equipment connected to:
  - process equipment (e.g. sensors, actuators);
  - operator's equipment;
- telecontrol equipment and transmission line (channel) where "data circuit terminating equipment" (i.e. DCE-MODEM) is packaged as an integral part of the telecontrol equipment, or telecontrol equipment and "data circuit terminating equipment", where the latter is not packaged as an integral part of the telecontrol equipment;
- different parts of the equipment within the telecontrol system and other data processing equipment.

The interfaces shall be defined independently from the functional layout of the system or its subsystems.

Information in this part refers only to operating conditions.

The following subjects are outside the object of this part:

- interface between external power source and the telecontrol equipment;
- logical interfaces and interface protocols;
- interface testing conditions and procedures.

## 3 Types of information

Two basic types of information are presented to the interfaces: digital and analog. Both types are conveyed over the interfaces by means of signals which are in parallel, serial or stand alone form.

Examples of the relationship between these signals and types of information are given in Table 1.

Each of these signals can be used as either an input or an output. An input is a signal representing information generated outside the specific equipment involving the interface being considered. Otherwise, it is an output.

### 3.1 Digital information

Digital information is used for characterizing states which vary in discrete modes. The information may pass the interface in parallel or serial form.

#### 3.1.1 Types of digital information (examples)

##### 3.1.1.1 Single-point information

A single-point information (see IECV 371-02-07<sup>6</sup>) emanates from a one bit binary information source, for example from an alarm contact with two determined states. This information is presented to the interface by a stand alone binary signal.

##### 3.1.1.2 Double-point information

Two bit information sources such as circuit breakers or isolator contacts represent double-point information (see IECV 371-02-08). They are presented to the interface by a pair of binary signals.

Two states, represented by the bit pairs 01 and 10 characterize two determined states (OFF/ON and ON/OFF), while the bit pairs 00 and 11 characterize two indeterminate states (OFF/OFF and ON/ON) which indicate either an intermediate state (see IECV 371-02-09), a faulty state (see IECV 371-02-10) or a failure in the circuitry.

##### 3.1.1.3 Multipoint information — coded information

Digital information sources which require coded information (e.g. transformer tap positions, meter readings and set point commands).

The information can be transferred by associated signals in parallel or serial form.

#### 3.1.2 Representation of digital information

Digital information is represented by individual binary signals with two distinct exclusive levels.

##### 3.1.2.1 Signal levels

The signal level can assume different ranges (Figure 2):

- range (1): nominal range.

The normal operating condition of the equipment;

- range (2): intermediate range.

A transitory area between the upper and lower limits of the nominal range (1). If the signal persists for longer than a predetermined time in this area, a failure condition is said to exist;

- range (3): fault state range.

Anomalous operating conditions which may cause malfunction of the equipment. If the signal level exceeds upper or lower damaging limits, a persistent malfunction could be caused.

<sup>6</sup>) International Electrotechnical Vocabulary (IEV) [IEC 50(371)].

In order to ensure correct equipment interfacing, the nominal range of the outputs should be smaller than the nominal range of the inputs.

### 3.1.2.2 *Signal duration*

The duration of binary signals can be divided into two categories:

- a) When the binary information source controls the duration of the associated two discrete nominal signal levels:

For example: generator in operation = signal level H (high);  
generator out of operation = signal level L (low).

- b) When a status change in the binary information source triggers a pulse signal:

The pulse signal assumes one of the two nominal levels for a predetermined time. It is used to characterize incremental or transient types of information sources.

For example: acquisition of fleeting information (see IEV 371-02-11) or incremental information (see IEV 371-02-06) or output of pulse command (see IEV 371-03-04).

### 3.1.3 *Dynamic characteristics of signals*

These are defined in terms of duration, recovery time and transition time (Figure 3).

### 3.1.4 *Specifications*

Specifications for binary signals are given in clauses 4 to 7. The main items are:

- nominal levels (voltage or current);
- location and impedance of generating circuit (in or out of the equipment);
- shape of pulse (level, transition time, duration, polarity, residual ripple);
- type of galvanic isolation and interference voltages limits (normal mode, common mode).

## 3.2 *Analog information*

### 3.2.1 *Representation of analog information*

An analog signal is associated with a quantity which may vary between predetermined values.

For example: The signal range 0 mA to 10 mA may represent a variable source information within the range 0 kV to 130 kV.

### 3.2.2 *Single/double polarity*

Two types of analog signals are to be considered:

- unipolar:

A variable quantity with one polarity only (e.g. a voltage).

The signal magnitude assumes one polarity only (e.g. 0 mA to 5 mA or 4 mA to 20 mA);

- bipolar:

A variable quantity which can assume either positive or negative polarity (e.g. load flow).

The signal magnitude can assume either positive or negative polarity (e.g. – 5 mA to + 5 mA).

### 3.2.3 *Signal levels*

The magnitude of an analog signal can assume two ranges (Figure 4):

- range (1): nominal range.

Normal operating conditions of the equipment, including the eventual operational overload;

- range (2): malfunction range.

Anomalous operating conditions which may cause a malfunction of the equipment. If the signal level exceeds upper and lower damaging limits, a persistent malfunction could be caused.

### 3.2.4 *Specifications*

Specifications for analog signals are given in clauses 4 to 7. The main items are:

- range limits (voltage or current);
- load impedances (maximum for current, minimum for voltage);
- type of galvanic isolation and interference voltages limits (normal mode, common mode).

Neither accuracy nor signal bandwidth (e.g. rate of change) are specified, since they are performance characteristics (IEC 870-4 [in preparation]).

## 4 *Interface between telecontrol equipment and process equipment*

This interface is the boundary line where information passes between telecontrol equipment and process equipment in the controlled station (Figure 1).

The information is exchanged by means of binary or analog signals.

The information transferred from the process equipment to the telecontrol equipment represents the “input”. The information transferred in the opposite direction represents the “output”.

Four categories of signals require to be considered:

- binary input signals;
- binary output signals;
- analog input signals;
- analog output signals.

### 4.1 *General characteristics*

The following information refers to inputs as well as outputs.