

Low speed digital signals for use in coal mines —

Part 1: Specification for optical coupling

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Mining and Quarrying Requisites Standards Committee (MQE/-) to Technical Committee MQE/25 upon which the following bodies were represented:

- Association of British Mining Equipment Companies
- Council for Electrical Equipment for Flammable Atmospheres (BEAMA)
- Health and Safety Executive
- National Coal Board
- National Union of Mineworkers

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Foreword

This Part of BS 6556 has been prepared under the direction of the Mining and Quarrying Requisites Standards Committee.

Control and monitoring activities below ground in coal mines require the transmission of data between items of electrical equipment supplied by different manufacturers. Data can be transmitted in analogue or alternatively digital form. For analogue, BS 5754:1980 "*Specification for electrical analogue and state signals for use in coal mines*" was produced with the purpose of promoting compatibility between transducers, recorders, indicators and data transmission systems of different manufacture and having inputs or outputs, as appropriate, in the form of d.c. voltage analogue signals or signals derived from relay contacts or a mechanical switch. This standard deals with the digital form.

A major disadvantage with control and monitoring systems employing the direct transmission of analogue signals is that since a galvanic connection is necessary between the transmitting and receiving circuits, faults, at different points of the system, particularly to earth, can seriously affect overall performance. The avoidance of such faults, on pit-wide systems, is extremely difficult. The generation of analogue signals within high voltage switchgear, and subsequent transmission for monitoring purposes, also presents difficulty in achieving the required degree of segregation between intrinsically safe and power circuits. A further disadvantage with analogue signals is that the simultaneous transmission of several signals requires either a multicore cable or separate cables.

These disadvantages can largely be overcome if the analogue or state information is transmitted in the form of serially coded digital signals. With such signals complete galvanic isolation between the transmitting and receiving circuits is possible and, within wide limits, only two wires are required for transmission in each direction irrespective of the volume of data.

If full benefit of digital signal data transmission is to be realized it is important that transmission systems of different manufacture conform to a common electrical standard and operate in a uniform manner with identical procedure (or protocol) for handling the data. This standard aims to promote such conformity. It specifies relevant requirements for a low speed digital signal link comprising a master and one or more slaves which interconnects the intrinsically safe circuits of one item of apparatus and the intrinsically safe circuits of other apparatus in such a way that units of different manufacture can be interchangeably coupled at the transmission line terminals.

This standard is published in three Parts as follows:

- *Part 1: Specification for optical coupling;*
- *Part 2: Specification for transformer coupling;*
- *Part 3: Specification for message protocols.*

Parts 1 and 2 of this standard offer alternative methods of achieving galvanic isolation between the intrinsically safe circuits of interconnected apparatus, but the two methods are not compatible.

This Part of this standard specifies a 600 bits/s transmission system which employs optical coupling as the means of achieving galvanic isolation. A system will comprise a master and from 1 to 8 slaves connected in point-to-point or multi-drop modes, with two cable conductors being used for each direction of transmission. Transmission from the master to a slave is achieved by the master acting as a switched current source which activates a light emitter at each slave. Transmission from slave to master is achieved by the master acting as both a current source, which is switched at the slave by a light dependent device, and a current monitor which senses the switched current.

Part 2 of this standard specifies a 600 bits/s transmission system which employs transformer coupling as the means of achieving galvanic isolation. A system will comprise a master and from 1 to 15 slaves connected in point-to-point or multi-drop modes. Transmission between master and slaves is achieved by frequency shift keying (FSK) techniques, one pair of cable conductors being used for each direction of transmission.

Part 3 of this standard defines the message protocols to be used by systems complying with Parts 1 or 2. It does not, however, place any restrictions on the application data contained in transmitted messages, although industry standards may exist to regulate this.

It is envisaged that for high voltage applications optical coupling will be employed due to the relative ease of meeting segregation requirements. The optical system, however, has a limit of 8 slaves and a range of 2 km while the transformer method has a greater range and can handle up to 15 slaves. For intermediate applications either system may be suitable.

In Parts 1 and 2 of this standard slaves are the physical interface between the transmission line and one or more addressable logical slaves specified in Part 3 of this standard.

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. Attention is drawn to the Health and Safety at Work etc. Act 1974, the Mines and Quarries Act 1954, the Regulations made under these Acts, and also any other appropriate statutory requirements or byelaws. These place responsibility for complying with certain specific safety requirements on the manufacturer and the user. The address of the recognized certification authority in the United Kingdom for Group 1 (coal mining) apparatus for intrinsic safety purposes is as follows:

Health and Safety Executive
HSE (M) Certification Support Unit
Harpur Hill, Buxton, Derbyshire SK 17 9JN.

Summary of pages

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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.