

Apparatus for connection to private circuits run by certain public telecommunications operators —

**Part 8: Specification for apparatus for
connection to digital circuits with
interfaces according to ITU-T G-series
Recommendations —**

**Section 8.1: G.703 services at 2 048 kbits/s
and 8 448 kbits/s**

ICS 33.040.50

Committees responsible for this British Standard

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- British Approvals Board for Telecommunications (BABT)
- British Telecommunications plc
- Cable and Wireless Communications plc
- Department of Trade and Industry (Telecommunications and Posts Division)
- Federation of the Electronics Industry
- Oftel (Office of Telecommunications)

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Foreword

This standard has been prepared by Technical Committee TCT/6, Digital networks, and supersedes BS 6328-8.1:1993, which is withdrawn.

The BS 6328 series of standards includes product and facility specifications giving particular requirements for individual items of apparatus and facilities, together with standards covering general requirements for the connection of apparatus to various public telecommunication systems (i.e. any telecommunication system designated as a public telecommunication system by an order made under Section 9 of the Telecommunications Act 1984).

The requirements specified in the standards are intended to ensure that apparatus conforming to them, when connected to public or branch telecommunication systems, will neither adversely affect any public system nor interfere with the service available to other users of public telecommunication systems.

This section of BS 6328 deals with digital circuits according to ITU-T G series Recommendations. The private circuits, to which apparatus conforming to this section of BS 6328 may be connected, operate at several different rates with ITU-T Recommendation G.703 interfaces. For the purposes of defining technical requirements, these data rates and interfaces are grouped into “service categories”. Identical technical requirements apply to all data rates within any one service category.

This section of BS 6328 is presented for designation under the Telecommunications Act 1984. It is stipulated in the Telecommunications Act 1984 that apparatus within the scope of a designated standard may only be approved for connection to a telecommunication system if it conforms to that standard. Exceptions may be determined by or under a designation, that may stipulate variations of, or additions to, the requirements of the standard and may also set conditions that have to be complied with as regards the apparatus, its connections or its use.

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. In particular, attention is drawn to the Telecommunications Act 1994.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 19 and a back cover.

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1 Scope

This section of BS 6328 specifies requirements for apparatus to be connected to particular private digital circuits according to ITU-T G-series Recommendations.

The requirements applicable to apparatus are dependent on the service to which the apparatus is to be connected and on the planning exemption category (see 7.1.7 and Table 8) supported by the apparatus.

NOTE Requirements for the safe operation of public telecommunications systems with respect to electrical conditions originating in the connected apparatus are not specified in this standard.

This section of BS 6328 relates to the connection of digital private circuits offering service data rates according to the ITU-T G-series Recommendations listed in Table 1. References to requirements and tests for conformity to each service data rate within this standard are also given in Table 1. This standard is primarily aimed at the apparatus supplier.

2 Normative references

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

ITU-T Recommendation G.703, *Physical/electrical characteristics of hierarchical digital interfaces*.

ITU-T Recommendation O.151, *Specification for instrumentation to measure error performance on digital systems*.

ITU-T Recommendation O.171, *Specification for instrumentation to measure timing jitter on digital equipment*.

3 Definitions and abbreviations

3.1 Terms and definitions

For the purposes of this section of this standard, the following definitions apply.

3.1.1

apparatus termination

any means associated with the apparatus for making an electrical connection to a particular digital circuit

3.1.2

BNC socket

socket part of a type of connector with bayonet latching

3.1.3

input port

terminations through which an electrical signal from the NTP passes to the apparatus

3.1.4

jitter

short-term non-cumulative variation of the significant instant of a digital signal from its ideal position in time

3.1.4.1

intrinsic jitter

output jitter level when there is no jitter present on any input signal from which the timing of the output signal may be derived

3.1.4.2

jitter gain

twenty times the logarithm of the ratio of the jitter amplitudes of the output and input signals

3.1.5

mask

boundaries of the waveform

3.1.6

non-reactive

having an impedance whose reactive component is a negligible fraction of its resistive component at every frequency within its operational range. Unless otherwise specified, a negligible fraction is taken to mean not exceeding one one-hundredth

3.1.7

output port

terminations through which an electrical signal originating in the apparatus passes to the NTP

3.1.8

particular digital circuit

digital telecommunication circuit for the transfer of digital signals at the data rate of transmission given for the applicable service data rate in Table 1

Table 1 — Services covered

Service data rate kbit/s	ITU-T Recommendation	Reference in BS 6328-8.1:2000 containing requirements	Annex in BS 6328-8.1:2000 describing tests
2 048	G.703	6.1	B
8 448	G.703	6.2	C



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3.1.9**type test**

test or series of tests used to ascertain at the design stage whether an item is capable of meeting the requirements of the product specification

3.1.10**return loss**

ratio of the power level of the incident signal to the power level of the reflected signal expressed in decibels

NOTE Return loss is an indication of the impedance matching of the apparatus to the circuit. A large value of return loss represents a good impedance match.

3.1.11**slip**

loss or gain of a digit position or a set of consecutive digit positions in a digital signal, resulting from an aberration of the timing processes associated with transmission or switching of a digital signal

3.1.12**unit interval**

time required for one element of data

3.1.13**wander**

long-term non-cumulative variation of the significant instant of a digital signal from its ideal position in time

3.2 Abbreviations

The following abbreviations are used in this standard.

HDB3 High density bipolar (3) coding

NTP Network termination point

4 General**4.1 Type testing**

Unless otherwise specified, all tests shall be performed with the apparatus in its normal operating mode as defined by the requirements of 7.1.5 in association with the requirements of 7.2.

Type testing shall be performed at:

- a) the connectors that mate with BNC sockets for apparatus of type defined in 5.1;
- b) the means of connection to the apparatus for apparatus of type defined in 5.2.

NOTE Test conditions are given in annex A.

4.2 Connection to multiple interfaces of a particular service

For apparatus that is capable of being connected to more than one particular digital circuit concurrently, each individual connection shall meet the requirements of this standard.

5 Connections**5.1 Integral connection arrangement**

If the cables that are used for connection of the apparatus to the NTP cannot be detached without the use of tools, the cables shall terminate at connectors capable of being mated with 75 Ω BNC sockets.

NOTE The two connectors at the NTP to which the apparatus is to be connected should be BNC sockets. The physical dimensions necessary for compatibility are specified in BS EN 122120:1996, 2.1.1.

Each cable or associated connection shall carry a means of identification such that:

- a) the apparatus transmit cable or termination (output port) is identified for the forward direction of transmission associated with the network's input port socket;
- b) the apparatus receive cable or termination (input port) is identified for the reverse direction of transmission associated with the network's output port socket.

Conformity shall be determined by inspection.

5.2 Non-integral connection arrangement

If the apparatus is either:

- a) not provided with connecting cables; or
- b) provided with connecting cables that are detachable by the user without the use of tools,

the input and output connections at the apparatus shall have a means of identification in accordance with 5.1a) and 5.1b).

Conformity shall be determined by inspection.

5.3 Earthing of coaxial cable**5.3.1 Connection to apparatus transmit cable**

A facility shall be provided at the apparatus to enable the functional earth of the apparatus to be either isolated from, or connected to, the conductor at the output port. This output port is connected to the outer conductor of a coaxial cable that is to be connected to the NTP.

Conformity shall be determined by inspection.

NOTE Contact between the non-insulated outer bodies of adjacent coaxial cable connectors may cause intermittent earth loops.

5.3.2 Connection to apparatus receive cable

A facility shall be provided at the apparatus to enable the functional earth of the apparatus to be either isolated from, or connected to, the conductor at the input port. This input port is connected to the outer conductor of a coaxial cable that is to be connected to the NTP.

Conformity shall be determined by inspection.

NOTE Contact between the non-insulated outer bodies of adjacent coaxial cable connectors may cause intermittent earth loops.

6 Service requirements

6.1 Requirements of the 2 048 kbit/s service

6.1.1 Apparatus service digital rate

Apparatus ports shall operate at a bit rate of 2 048 kbit/s ± 50 ppm.

Conformity shall be tested in accordance with **B.1** (noting that the waveform of Figure 1 implies a bit rate of 2 048 kbit/s) and **B.7**.

6.1.2 Apparatus input port requirement for minimum return loss

The return loss, as measured at the apparatus digital signal input port, shall be not less than the limits given in Table 2 when referred to 75 Ω . Return loss values for both frequency ranges shall apply.

Table 2 — Minimum return loss for 2 048 kbit/s service

Frequency range kHz	Minimum return loss dB
100 to 3 000	20
50 to 100	15

The return loss shall be determined using the test described in **B.2**.

6.1.3 Apparatus output port operational requirements

6.1.3.1 Coding

Coding of the digital signal appearing at the output port of the apparatus shall be in accordance with HDB3 coding rules as defined in ITU-T Recommendation G.703.

The output port signal coding shall be tested in accordance with **B.3**.

6.1.3.2 Waveform of signal at apparatus output port

The signal waveform at the output port of the apparatus shall have the following characteristics and be in accordance with Figure 1:

- the nominal peak voltage of the mark (pulse) shall be 2.37 V;
- the peak voltage of the space (no pulse) shall be $0 \text{ V} \pm 0.237 \text{ V}$;
- the nominal pulse width shall be 244 ns;
- the ratio of positive to negative pulse amplitudes at the mid-points of the pulse width shall be 0.95:1.05;
- the ratio of positive to negative pulse widths at the nominal half amplitudes shall be 0.95:1.05.

Conformity of the waveform to the waveform specification shall be tested in accordance with **B.4.2**.

6.1.3.3 Maximum jitter at the apparatus output port

NOTE The jitter requirements are dependent on the timing configuration of the apparatus.

6.1.3.3.1 Apparatus with wholly internal timing

The apparatus shall conform to one of the following as appropriate.

- The maximum levels of peak-to-peak jitter present on the digital signal at the apparatus output port shall not exceed the limits given in Table 3 for a service that is not planning exempt.
- The maximum levels of peak-to-peak jitter present on the digital signal at the apparatus output port shall not exceed the limits given in Table 4 for a service that is planning exempt.

Testing of the apparatus internal timing shall be performed as described in Table 3 or Table 4 as appropriate, using instrumentation in accordance with ITU-T Recommendation O.171 and the test configuration indicated in Figure B.1.

6.1.3.3.2 Apparatus that derives the output port timing from the signal on the corresponding input port of the port pair or by reference to a specified external timing source

The apparatus shall conform to one of the following.

- The maximum level of peak-to-peak jitter on the output port shall not exceed the limits given in Table 3 when the timing source has jitter applied at a level as given in Figure 2.
- The maximum level of peak-to-peak jitter on the output port shall not exceed the limits given in Table 3 when the timing source has jitter applied at a level as given in Figure 3.
- The maximum level of peak-to-peak jitter on the output port shall not exceed the limits given in Table 4 when the timing source has jitter applied at a level as given in Figure 3.

Where timing is derived from an external source operating at a rate different from the output bit rate, the level of jitter applied to this timing source shall be the maximum specified in the instructions for use.

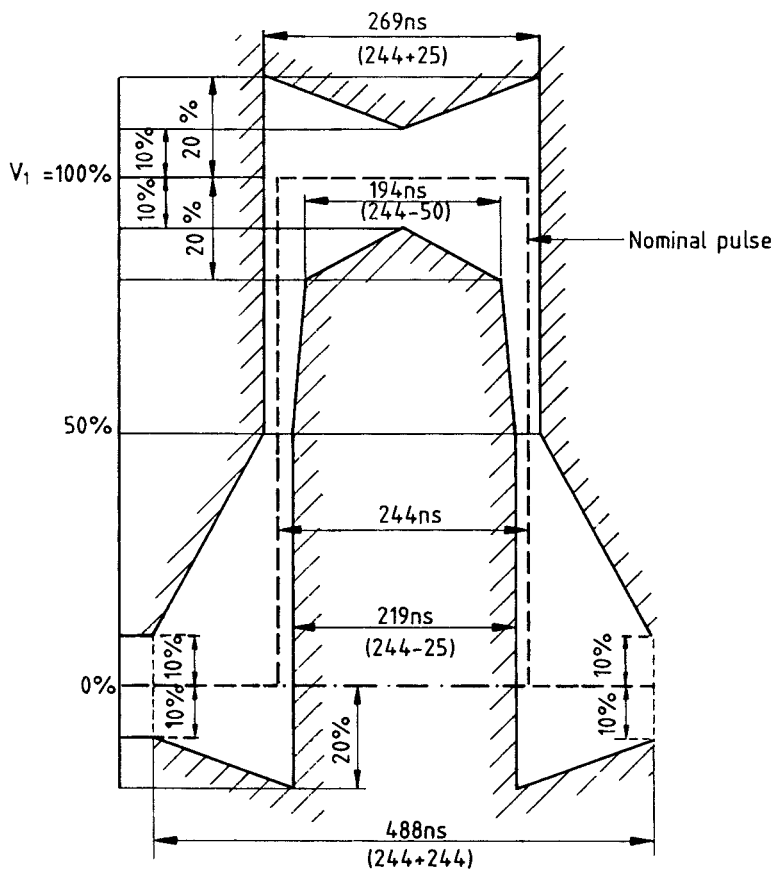
Conformity shall be tested by measurement using instrumentation in accordance with ITU-T Recommendation O.171 and the test configuration indicated in Figure B.2 or Figure B.3 as appropriate for the particular supplier-declared output signal timing as required by **7.1.6**.

6.1.4 Apparatus output port current and voltage limit requirements

6.1.4.1 Current

The output current, with a resistance of not more than 1 Ω applied across the output port, shall not exceed 50 mA r.m.s. averaged over any period of 10 s in any operating state of the apparatus.

The output current shall be determined by measurement.



NOTE 1 V_1 corresponds to the nominal peak value.
NOTE 2 The limits apply to pulses of both polarities.

Figure 1 — Mask of the pulse at the 2 048 kbit/s interface

Table 3 — Limits for maximum peak-to-peak jitter (not planning exempt) for 2 048 kbit/s service

Measurements	Limits
Measured with a jitter measuring instrument that, prior to measurement, filters the jitter with a band-pass filter having a lower cut-off frequency of 20 Hz, an upper cut-off frequency of 100 kHz and filter roll-off of 20 dB/decade.	1.0 unit intervals (488 ns)
Measured with a jitter measuring instrument that, prior to measurement, filters the jitter with a band-pass filter having a lower cut-off frequency of 18 kHz, an upper cut-off frequency of 100 kHz and a filter roll-off of 20 dB/decade.	0.2 unit intervals (97.6 ns)

NOTE A unit interval is equivalent to 488 ns.

Table 4 — Limits for maximum peak-to-peak jitter (planning exempt) for 2 048 kbit/s service

Measurements	Limits
Measured with a jitter measuring instrument that, prior to measurement, filters the jitter with a band-pass filter having a lower cut-off frequency of 20 Hz, an upper cut-off frequency of 100 kHz and filter roll-off of 20 dB/decade.	0.4 unit intervals (195.2 ns)
Measured with a jitter measuring instrument that, prior to measurement, filters the jitter with a band-pass filter having a lower cut-off frequency of 18 kHz, an upper cut-off frequency of 100 kHz and a filter roll-off of 20 dB/decade.	0.2 unit intervals (97.6 ns)

NOTE A unit interval is equivalent to 488 ns.