

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

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

**Section 8.1 G.703 services at 2048 kbit/s
and 8448 kbit/s**

Committees responsible for this British Standard

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- British Approvals Board for Telecommunications
- British Facsimile Industry Consultative Committee
- British Gas plc
- British Telecommunications plc
- Department of Trade and Industry (Telecommunications and Posts Division)
- EEA (The Association of Electronics, Telecommunications and Business Equipment Industries)
- Electricity Association
- Mercury Communications Ltd.
- National Computing Centre Ltd.
- OFTEL (Office of Telecommunications)
- Telecommunications Users' Association (TUA)

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Foreword

This Section of BS 6328 has been prepared under the direction of the Telecommunications Standards Policy Committee. It forms one of a series of British Standards that is being produced following the commencement of liberalization in October 1981 of the supply of certain telecommunications apparatus within the United Kingdom. This edition supersedes BS 6328-8.1:1990 which is withdrawn.

This edition introduces technical changes but it does not reflect a full review or revision of the standard, which will be undertaken in due course. The changes have been made in order to maintain alignment of the standard with the changing and developing aspects of the UK liberalized telecommunications environment, rectify errors and remedy deficiencies discovered during application of the standard.

This 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). At the present time, these systems include the public switched telephone networks, the telex networks, the packet switching network, and leased private circuits run by British Telecommunications plc, Kingston Communications (Hull) plc and Mercury Communications Ltd.

The requirements specified in the standards are intended to ensure that apparatus complying with 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.

Private circuits run by British Telecommunications plc, Kingston Communications (Hull) plc and Mercury Communications Ltd. are classified into the following groups:

- a) speechband circuits;
- b) baseband circuits;
- c) direct current circuits;
- d) telegraph circuits using SCVF signalling;
- e) wideband (FDM) circuits;
- f) programme circuits;
- g) digital circuits.

This Part of BS 6328 deals with digital circuits according to CCITT G-series Recommendations and is published in Sections dealing with the different services. BS 6328-7 deals with digital circuits with interfaces according to CCITT Recommendation X.21 bis.

Other Parts of this standard cover apparatus for connection to other private circuits.

Information on the circuits of British Telecommunications plc, Kingston Communications (Hull) plc and Mercury Communications Ltd. is available from those organizations.

The private circuits, to which apparatus complying with this Part of BS 6328 may be connected, operate at several different rates with CCITT 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 the data rates within any one service category. British Telecommunications plc, Kingston Communications (Hull) plc and Mercury Communications Ltd. do not necessarily offer services at all the data rates within a particular service category. Users should consult these operators for appropriate details of the services offered by each.

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 complies with that standard. Exceptions may be determined by or under the designation, which 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, or its connection, or its use.

A copy of any designation will be included when available with all copies of this standard. Any further information on, or details of the designation can be obtained from the Office of Telecommunications (OFTEL), Export House, 50 Ludgate Hill, London EC4M 7JJ.

Some apparatus may incorporate facilities for which a mandatory standard is necessary, but for which no standard has yet been designated for approval purposes under the Telecommunications Act 1984. Other apparatus may incorporate innovative features not foreseen when the relevant standard was written and designated and for which that standard is not fully appropriate. The British Approvals Board for Telecommunications (BABT) can sometimes deal with these cases by writing a “Special investigation test schedule” (SITS), which has the effect of stating requirements where there is no designated standard or of supplementing or varying the requirements in the application of the designated standard. Information on any relevant SITS may be obtained from the Director, BABT, Claremont House, 34 Molesey Road, Hersham, Walton-on-Thames, Surrey, KT12 4RQ.

Since this standard was originally published, several directives concerning the provision of telecommunication services have been promulgated by the Commission of the European Communities. As a result, the European Telecommunications Standards Institute (ETSI) has been authorized to produce European Telecommunication Standards (ETSS) and Technical Bases for Regulation (TBRs) from which Common Technical Requirements will be derived. Consequently, it is anticipated that national standards will eventually be replaced.

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 1984.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24, 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 Section of BS 6328 specifies requirements for apparatus to be connected to particular private digital circuits, according to CCITT G-series Recommendations, operated by certain public telecommunication operators (PTOs).

NOTE 1 Connected to particular private digital circuits means both direct connection to an NTP and connection to an NTP via one or more items of intervening apparatus.

The requirements applicable to an apparatus are dependent on the service category to which the apparatus is to be connected and on the use to which the circuit is to be put. The requirements are specified for the following two reflected jitter performance categories:

- a) for applications with no specific reflected jitter performance requirements;
- b) for applications where specific reflected jitter performance is a requirement.

NOTE 2 As an example, reflected jitter performance category b) may be required if live speech signals are being conveyed particularly if such signal are also conveyed by a public switched network.

If the apparatus is also to be connected to other services run by certain PTOs, for the purpose of approval for connection it will have to meet any additional requirements specified in the standard covering attachments to those services.

The requirements are intended to minimize the risk of interference with other users and to ensure the integrity of the public telecommunications networks.

NOTE 3 The requirements for the safety of the public telecommunication systems from electrical conditions originating in the connected apparatus are specified elsewhere.

This Section of BS 6328 applies, for the purposes of connection, to digital private circuits offering the service categories, with various data rates according to CCITT G-series Recommendations, listed in Table 1 and run by the PTOs referred to in that table. The requirements and tests for conformance for each service category are specified as indicated in Table 1.

BS 6328-8.2 covers the CCITT

Recommendation G.703 service at 64 kbit/s.

NOTE 4 Compliance with this Section of BS 6328 is intended to provide for the prevention of interference with the PTO's networks and other users, but compliance will not necessarily ensure that the apparatus is satisfactory for the user's purpose, nor that apparatus intended to work on one PTO's service will work on another PTO's service.

NOTE 5 PTOs may offer digital circuits under different names that may change from time to time. PTOs should specify which of their circuits are appropriate for the connection of apparatus complying with this Section of BS 6328 or any of the other Parts.

NOTE 6 The characteristics of British Telecommunications plc digital circuits are obtainable by writing to:

British Telecommunications plc
Corporate Relations Department
British Telecom Centre
Newgate Street
London EC1A 7AJ

The characteristics of Kingston Communications (Hull) plc digital circuits are obtainable by writing to:

Kingston Communications (Hull) plc
Telephone House
Carr Lane
Kingston-upon-Hull
HU1 3RE
For the attention of:
The Technical Support Unit
Transmission and Private Circuits Section

The characteristics of Mercury Communications Ltd. digital circuits are obtainable by writing to:

Mercury Communications Ltd.
90 Long Acre
London
WC2E 9NP
For the attention of:
Sales Support Engineering

NOTE 7 The titles of the publications referred to in this standard are listed on the inside back cover.

Table 1 — Services covered

Service category	Interface type ^a	Data rate	Clause giving requirements		Appendix describing tests	PTO		
	CCITT Recommendation		No specific reflected jitter performance requirements	With specific reflected jitter performance requirements		BT ^b	Hull ^c	MCL ^d
1	G.703	Kbit s 2048	5.1	5.3	A	Yes	Yes	Yes
2	G.703	8448	5.2	5.4	B	Yes		Yes

^a It should not be assumed that all PTOs will choose the same set of options available within the Recommendations.

^b British Telecommunications plc.

^c Kingston Communications (Hull) plc.

^d Mercury Communications Ltd.

2 Definitions and abbreviations

2.1 Definitions

For the purposes of this Section of BS 6328 the following definitions apply.

2.1.1 apparatus terminations

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

2.1.2 BNC connector

a type of coaxial connector with bayonet latching

2.1.3 input port

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

2.1.4 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

2.1.5 jitter

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

2.1.6 jitter gain

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

2.1.7 mask

boundaries of the waveform

2.1.8 non-reactive

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

2.1.9 output port

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

2.1.10 particular digital circuit

a point-to-point digital telecommunication circuit run by a PTO for the transfer of digital signals at the data rate of transmission specified for the applicable service category of Table 1

2.1.11 reflected jitter performance category

the jitter performance category applicable when apparatus is configured in a network

NOTE The requisite category will be determined by the configuration in association with recommended procedures for the control of jitter (see Appendix F).

2.1.12 type test

test or series of tests directed towards approval of a design, conducted to determine whether an item is capable of meeting the requirements of the product specification

2.1.13 return loss

the 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.

2.1.14 slip

the 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

2.1.15 unit interval

time required for one element of data

2.1.16 wander

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

2.2 Abbreviations

The following abbreviations are used in this Section of BS 6328

2.2.1 HDB3

High density bipolar (3) coding.

2.2.2 Text deleted**2.2.3 NTP**

Network termination point.

NOTE NTP is defined in the PTO's licence.

2.2.4 PTO

Public telecommunication operator.

2.2.5 UI

Unit interval.

3 General requirements**3.1 Text deleted****3.2 General test requirements**

Tests for compliance with the requirements of this standard shall be type tests (see 2.1.12).

If the apparatus can be connected to more than one particular digital circuit, the requirements of this Section of BS 6328 shall apply to each individual connection.

3.3 Environment for tests

All tests shall be performed at:

- a) an ambient temperature in the range 15 °C to 25 °C;
- b) a relative humidity in the range 45 % to 75 %
- c) an air pressure in the range 86 kPa to 106 kPa.

3.4 Power supply limitations

For apparatus that is directly powered from the mains supply all tests shall be carried out within $\pm 5\%$ of the normal operating voltage. If apparatus is powered by other means and those means are not supplied as part of the apparatus, e.g. batteries, stabilized a.c. supplies and d.c., all tests shall be carried out within the power supply limit declared by the supplier. If the power supply is a.c., the tests shall be conducted within $\pm 4\%$ of the stated frequency as declared by the supplier.

3.5 Test equipment requirements

Unless otherwise specified in this Section of BS 6328 test equipment used to measure voltage shall have a minimum resistance of 5 M Ω . Current measurements shall be made using a current measuring device of resistance no greater than 1 Ω .

3.6 Tolerances on test measurements

Unless otherwise specified in this Section of BS 6328 all voltage, current and resistance measurements specified in the tests shall be made with an accuracy of $\pm 1\%$.

3.7 Tolerances on test components

Unless otherwise specified in this Section of BS 6328 test components, assigned values shall be within $\pm 1\%$ of nominal value. All resistors specified shall be non-reactive (see 2.1.8).

3.8 Test connections

Apparatus shall be submitted for approval with apparatus terminations as supplied to the user.

NOTE 1 It is recommended that apparatus submitted for approval is designed to comply with the appropriate specification of the PTO to ensure a usable connection.

NOTE 2 It is recommended that the Test House should terminate the test equipment leads in a manner compatible with the apparatus terminations.

3.9 Compliance testing

Compliance testing shall be applied at the apparatus terminations, i.e. for apparatus complying with:

- a) 4.2, at the connectors that mate with 75 Ω BNC sockets;
- b) 4.3 a), at the means of connection to the apparatus;
- c) 4.3 b), at the means of connection to the apparatus.

3.10 Apparatus normal operating modes

Unless otherwise specified in this Section of BS 6328 all functional tests shall be performed with the apparatus in its normal operating modes as defined by the requirements of 7.1.6.

4 Connection requirements**4.1 Text deleted****4.2 Integral connection arrangement**

If apparatus is provided with connecting cables for connection to the particular digital circuit that cannot be detached without the use of tools, the cables provided shall terminate on connectors capable of being properly mated with 75 Ω BNC sockets. Physical dimensions required for compatibility are specified in Figure 2 of BS 9210 N0001-2:1982.

NOTE The two connectors on the NTP to which the apparatus has to connect will be 75 Ω BNC sockets labelled TFC IN and TFC OUT.

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

- a) the apparatus transmit cable or termination shall be identified as for the forward direction of transmission associated with the PTO's socket labelled TFC IN;
- b) the apparatus receive cable or termination shall be identified as for the reverse direction of transmission associated with the PTO's socket labelled TFC OUT.

Compliance shall be checked by inspection.

4.3 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;

no requirements are specified for the means of connection to the apparatus (i.e. the point of connection between the apparatus and the detachable cables), except that the input and output connections at the apparatus shall have means of identification in accordance with 4.2 a) and 4.2 b).

Compliance shall be checked by inspection.

4.4 Earthing of coaxial cable

4.4.1 Connection to apparatus transmit cable

A facility shall be provided at the apparatus to enable the signal earth of the apparatus to be either isolated from, or connected to, the conductor at the output port that is to be connected to the outer conductor of the coaxial cable that is to be connected to the NTP. Compliance shall be checked by inspection.

4.4.2 Connection to apparatus receive cable

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

Compliance shall be checked by inspection.

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

5 Service requirements

5.1 Requirements of the 2 048 kbit/s service (no specific reflected jitter performance requirements)

5.1.1 Apparatus service digital rate

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

Compliance shall be tested in accordance with A.1, noting that the waveform of Figure 1 implies a bit rate of 2 048 kbit/s.

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

Compliance shall be checked by the test described in A.2.

5.1.3 Apparatus output port operational requirements

5.1.3.1 Coding

Coding of the digital signal appearing at the output port of the apparatus shall be consistent with the HDB3 coding rules as defined in CCITT Recommendation G.703.

Compliance shall be tested in accordance with A.3.

5.1.3.2 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:

- a) nominal peak voltage of mark (pulse): 2.37 V;
- b) peak voltage of space (no pulse): 0 ± 0.237 V;
- c) nominal pulse width: 244 ns;
- d) ratio of positive to negative pulse amplitudes at the mid-points of pulse width: 0.95 to 1.05;
- e) ratio of positive to negative pulse widths at the nominal half amplitudes: 0.95 to 1.05.

Compliance shall be tested in accordance with A.4.2.

5.1.3.3 Maximum jitter at the apparatus output port

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

5.1.3.3.1 Apparatus with wholly internal timing

Apparatus shall comply with one of the following.

- a) The maximum levels of jitter present on the digital signal at the apparatus output port shall not exceed the limits given in Table 3.
- b) The maximum levels of jitter present on the digital signal at the apparatus output port shall not exceed the limits given in Table 4.

Compliance shall be tested by measurement as described in Table 3 or Table 4 as appropriate, using instrumentation in accordance with CCITT Recommendation O.171 and the test configuration indicated in A.1.