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DATA COMMUNICATION OVER THE TELEPHONE NETWORK

ELECTRICAL CHARACTERISTICS FOR UNBALANCED DOUBLE-CURRENT INTERCHANGE CIRCUITS OPERATING AT DATA SIGNALLING RATES NOMINALLY UP TO 100 kbit/s

ITU-T Recommendation V.10

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation V.10 was revised by the ITU-T Study Group XVII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation V.10

ELECTRICAL CHARACTERISTICS FOR UNBALANCED DOUBLE-CURRENT INTERCHANGE CIRCUITS OPERATING AT DATA SIGNALLING RATES NOMINALLY UP TO 100 kbit/s^{1) 2)}

(Geneva, 1976; amended at Geneva, 1980, at Melbourne, 1988 and Helsinki, 1993)

1 Introduction

This Recommendation deals with the electrical characteristics of the generator, receiver and interconnecting leads of an unbalanced interchange circuit employing a differential receiver.

In the context of this Recommendation an unbalanced interchange circuit is defined as consisting of an unbalanced generator connected to a receiver by an interconnecting lead and a common return lead.

Annexes and appendices are provided to give guidance on a number of application aspects as follows:

Annex A Compatibility with other interfaces

Annex B Considerations for coaxial cable applications - V.10 COAXIAL

Appendix I Waveshaping

Appendix II Cable guidelines

NOTE – Generator and load devices meeting the electrical characteristics of this Recommendation need not operate over the entire data signalling rate range specified. They may be designed to operate over narrower ranges to satisfy specific requirements more economically, particularly at lower data signalling rates.

The interconnecting cable is normally not terminated, but the matter of terminating coaxial interconnecting cable is dealt with in Annex B. Where the interchange circuit incorporates the special provisions for coaxial applications with cable termination this shall be referred to as “complying with Recommendation V.10 (COAXIAL)”.

Reference measurements are described which may be used to verify certain of the recommended parameters but it is a matter for individual manufacturers to decide what tests are necessary to ensure compliance with this Recommendation.

2 Field of application

The electrical characteristics specified in this Recommendation apply to interchange circuits operating with data signalling rates up to 100 kbit/s.

This Recommendation is not intended to apply to equipment implemented in discrete component technology, for which the electrical characteristics covered by Recommendation V.28 are more appropriate.

Typical points of application are illustrated in Figure 1.

Whilst the unbalanced interchange circuit is primarily intended for use at the lower data signalling rates, its use should be avoided in the following cases:

- 1) where the interconnecting cable is too long for proper unbalanced circuit operation;
- 2) where extraneous noise sources make unbalanced circuit operation impossible;
- 3) where it is necessary to minimize interference with other signals.

Whilst a restriction on maximum cable length is not specified, guidelines are given with respect to conservative operating distance as a function of data signalling rates (see Appendix II).

1) This Recommendation is also designated as X.26 in the X-Series Recommendations.

2) Signalling rates above the suggested 100 kbit/s may also be employed, but the maximum suggested operating distances should be shortened accordingly (see Figure II-1).

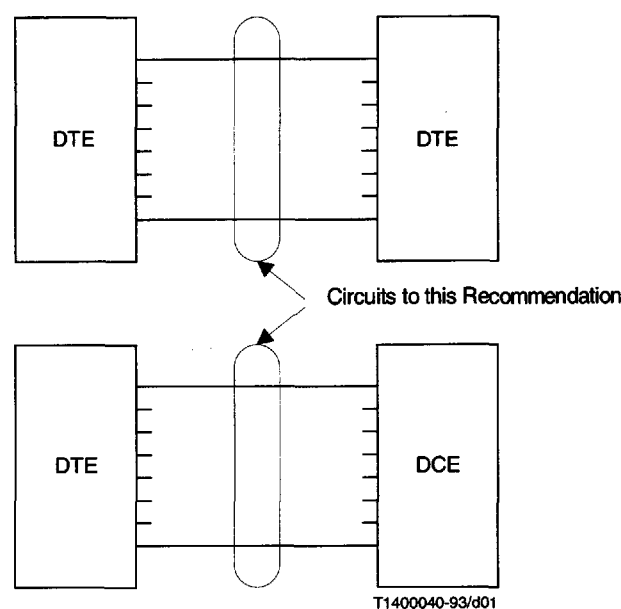


FIGURE 1/V.10

Typical applications of unbalanced interchange circuits

3 Symbolic representation of an interchange circuit

See Figure 2.

For data transmission applications, it is commonly accepted that the interface cabling is provided by the DTE. This introduces the line of demarcation between the DTE plus cable and the DCE. This line is also called the interchange point and physically implemented in the form of a connector. The applications also require interchange circuits in both directions. This leads to an illustration as shown in Figure 3.

4 Generator polarities and receiver significant levels

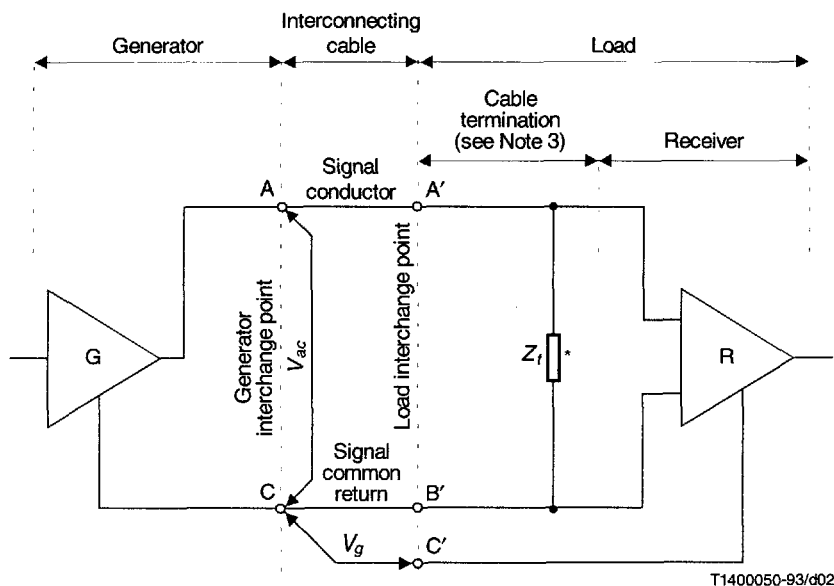
4.1 Generator

The signal conditions for the generator are specified in terms of the voltage between output points A and C shown in Figure 2.

When the signal condition 0 (space) for data circuits, or ON for control and timing circuits, is transmitted the output point A is positive with respect to point C. When the signal condition 1 (mark) for data circuits, or OFF for control and timing circuits, is transmitted the output point A is negative with respect to point C.

4.2 Receiver

The receiver significant levels are shown in Table 1, where $V_{A'}$ and $V_{B'}$ are respectively the voltage at points A' and B' relative to point C'.



* This terminating resistor is only used with "V.10-COAXIAL", see Annex B.

- V_{ac} Generator output voltage
- V_g Ground potential difference
- Z_t Cable termination impedance
- A Generator active interchange point
- C Generator common return point
- A' Load active interchange point
- B' Load common return point
- C' Receiver zero reference point

NOTES

- 1 Two interchange points are shown. The output characteristics of the generator, excluding any interconnecting cable, are defined at the "generator interchange point". The electrical characteristics to which the receiver must respond are defined at the "load interchange point".
- 2 The connection of the signal common return is dealt with in 10 below. Points C and C' may be connected to protective ground if required by national regulations.
- 3 The interconnecting cable is normally not terminated. The termination of coaxial interconnecting cable is dealt with in Annex B.

FIGURE 2/V.10

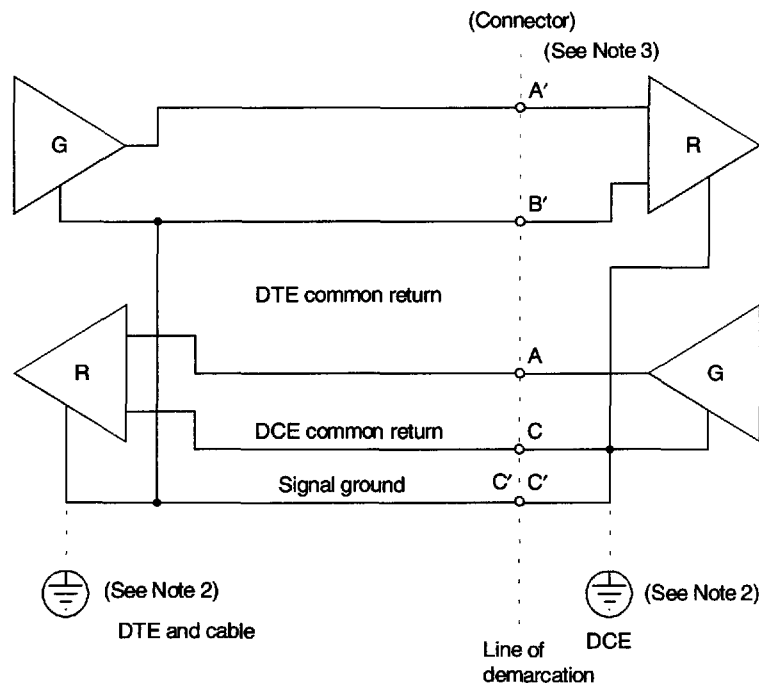
Symbolic representation of an unbalanced interchange circuit

5 Generator³⁾

5.1 Output impedance

The total dynamic output impedance of the generator shall be equal to or less than 50 ohms.

³⁾ For test purposes other than specified in this Recommendation (e.g. signal quality measurement), a transmitter test load of 450 ohms may be used.



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NOTES

- 1 The zero volt reference interchange points C' may be interconnected via the signal ground conductor.
- 2 Signal ground may be further connected to external protective ground if national regulations require.
- 3 The type of connector with this electrical characteristic specification depends on the application. ISO specifies, for data transmission over telephone type facilities, a 37-pin connector in ISO 4902.

FIGURE 3/V.10
Practical representation of the interface

TABLE 1/V.10
Receiver significant levels

	$V_{A'} - V_{B'} \leq -0.3 \text{ V}$	$V_{A'} - V_{B'} \geq +0.3 \text{ V}$
Data circuits	1	0
Control and timing circuits	OFF	ON

5.2 Static reference measurements

The generator characteristics are specified in accordance with measurements illustrated in Figure 4 and described in 5.2.1 to 5.2.4.