INTERNATIONAL STANDARD

ISO 4903

Second edition
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Information technology — Data communication — 15-pole DTE/DCE interface connector and contact number assignments

Technologies de l'information — Communication de données — Connecteur d'interface ETTD/ETCD à 15 pôles et affectation des numéros de contact

Reference number
ISO 4903 : 1989 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4903 was prepared by Technical Committee ISO/TC 97, *Information processing systems.*

This second edition cancels and replaces the first edition (ISO 4903 : 1980), of which it constitutes a minor revision; certain terms have been aligned with the terms and definitions used by IEC.

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Information technology — Data communication — 15-pole DTE/DCE interface connector and contact number assignments

1 Scope

This International Standard specifies the 15-pole connector and the assignment of contact numbers at the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) where CCITT[1] Recommendations X.24, X26, and X.27 are applicable.

International Standard ISO/IEC 4903 additionally provides the dimensions of the connector housing, as well as the recommended means of providing a locking device (latching block) and connector shielding.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 261 : 1973, *ISO general purpose metric screw threads — General plan.*

ISO 2110 : 1989, *Information technology — Data communication — 25-pole DTE/DCE interface connector and contact number assignments.*

CCITT Recommendation V.28 : 1989, *Electrical characteristics for unbalanced double-current interchange circuits.*

CCITT Recommendation X.20 : 1989, *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for start-stop transmission services on public data networks.*

CCITT Recommendation X.21 : 1989, *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for synchronous operation on public data networks.*

CCITT Recommendation X.22 : 1989, *Multiplex DTE/DCE interface for user classes 3-6.*

CCITT Recommendation X.24 : 1989, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data network.*

CCITT Recommendation X.26 (or V.10) : 1989, *Electrical characteristics for unbalanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications.*

CCITT Recommendation X.27 (or V.11) : 1989, *Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications.*

IEC Publication 50(581) : 1978, *International Electrotechnical Vocabulary — Chapter 581 : Electromechanical components for electronic equipment.*

IEC Publication 807-2 : 1985, *Rectangular connectors for frequencies below 3 MHz — Part 2: Detail specification for a range of connectors with round contacts — Fixed solder contact types.*

3 Definitions

The following definitions have been taken from IEC Publication 50(581) : 1978.

3.1 cable adaptor: A part of a connector or an accessory consisting of a rigid housing for attachment to the connector body. It may incorporate provision for a cable clamp or seal for terminating screens and provide shielding from electrical interference. It may be straight or angled.

3.2 connector housing: A part of a connector into which the insert and contacts are assembled.

3.3 contact arrangement: The number, spacing and configuration of contacts in a component.

1) International Telegraph and Telephone Consultative Committee.

3.4 female contact: A contact intended to make electrical engagement on its inner surface and which will accept entry of a male contact.

3.5 intermateable connectors: Two connectors are intermateable when they are capable of being connected electrically and mechanically but without regard to their performance and intermountability.

3.6 locking device: A feature incorporated in certain components to provide mechanical retention of their mating part.

3.7 male contact: A contact intended to make electrical engagement on its outer surface and which will enter a female contact.

3.8 (n-pole-)connector: A component which terminates conductors for the purpose of providing connection and disconnection to a suitable mating component.

4 Connector

Figures 1 to 5 illustrate the 15-pole interface connector. Only those dimensions that are essential to mating are shown. Figure 1 illustrates the DTE connector which has 15 male contacts in a connector housing. Figure 2 illustrates the DCE connector which has 15 female contacts in a connector housing. The connector housing on the DCE connector is dimensioned to fit inside the connector housing on the DTE connector (see figures 1 and 2). Contact numbering is specified in figures 1 and 2. Figure 3 illustrates the dimensions for the contact spacing. Figures 4 and 5 illustrate the dimensions for the male and female contacts respectively.

The DCE connector shall be equipped with a locking device consisting of two latching blocks as specified in figure 2. Due to the fact that the latching blocks have threaded holes which can act as nuts, the DTE connector may be equipped either with lever devices for latching to the latching blocks on the DCE connector or with screws that fit into the threaded holes in the latching blocks.

The thread of the latching blocks shall be M3 as specified in figure 2.

Sufficient connector dimensions are provided in this International Standard to ensure intermateable connectors. They are consistent with the detailed connector specification in IEC Publication 807-2.

In annex A, diagrams for finger clearance areas are given to provide guidance for equipment designers. Figure A.1 shows the maximum DTE connector outline including all means for latching to the latching blocks. Figure A.2 shows the minimum DCE connector spacing when multiple interface arrangements are used.

5 Assignment of contact numbers

The assignment of contact numbers for the interchange circuits specified in CCITT Recommendations X.20, X.21 and X.22 is given in table 1 for implementations using X.26 and X.27 electrical characteristics. Additionally, contact 1 is reserved for connection of the shield of shielded interconnecting cable. Table 2 gives a list of interchange circuits and their description. Their provision and use shall be in conformity with the corresponding CCITT DCE Recommendations.

6 Connector shielding

Connector shielding is optional. If it is used, for example due to national regulations, etc., it shall be accomplished by the use of metallic connector housings on both the DTE connector and the DCE connector.

7 Interconnecting configurations for mixed use of X.26, X.26 and V.28 electrical characteristics

Considerations for the interworking of equipment implementing X.26 on one side of the interface with equipment implementing X.27 on the other side of the interface are given in annex A.2 of CCITT Recommendations X.26 and X.27. In addition, the definition of the category 1 and 2 receiver configurations is provided in V.10.

Guidance concerning possible interconnecting configurations applicable to the X.20 and X.21 interfaces is provided in annex B.

Guidance concerning the necessary adaptation when there is a need for X.20 DCE implementing X.26 characteristics to interwork with X.20 DTE implementing V.28 characteristics is given in annex C. Any adapters required to accomplish the interworking with equipment meeting the V.28 requirements shall be provided with equipment meeting the requirements of this International Standard, i.e., the X.20/X.26 DCE. No revisions or modifications shall be required in the equipment using V.28 electrical characteristics.

Table 1 — Assignment of contact numbers for interface CCITT Recommendations X.20, X.21, and X.22

Contact number[6]	Interchange circuit assignment				
	X.20[2]		X.21[3]		X.22
	X.26	X.27[5]	X.26[4], [5]	X.27[5]	X.27[5]
1	[1]	[1]	[1]	[1]	[1]
2	T	T(A)	T	T(A)	T(A)
3	—	—	C	C(A)	C(A)
4	R	R(A)	R(A)	R(A)	R(A)
5	—	—	I(A)	I(A)	I(A)
6	—	—	S(A)	S(A)	S(A)
7	—	—	X/B(A)[7]	X/B(A)[7]	F(A)
8	G	G	G	G	G
9	Ga	T(B)	Ga	T(B)	T(B)
10	—	—	Ga	C(B)	C(B)
11	Gb	R(B)	R(B)	R(B)	R(B)
12	—	—	I(B)	I(B)	I(B)
13	—	—	S(B)	S(B)	S(B)
14	—	—	X/B(B)[7]	X/B(B)[7]	F(B)
15	Reserved for future international use				

NOTES

1 Contact 1 is assigned for connecting the shields between tandem sections of shielded interface cable. The shield may be connected either to protective ground or to signal ground at either the DTE or DCE or both in accordance with national regulations.

Signal ground may be further connected to protective ground in accordance with national safety regulations. Caution should be exercised to avoid establishment of ground loops carrying high currents.

2 DTEs may employ either X.26 or X.27 electrical characteristics to operate with DCEs using X.26 electrical characteristics in accordance with X.20.

3 DTEs may employ either X.26 or X.27 electrical characteristics to operate with DCEs using X.27 electrical characteristics in accordance with X.21 for data signalling rates of 9,6 kbit/s and below. Only X.27 applies above 9,6 kbit/s.

4 The assignment of contact numbers has been chosen considering interworking between X.26 DTE and X.27 DCE using the considerations given in annex 2 of Recommendations X.26 and X.27.

5 Where balanced circuits are concerned, the associated pairs are designated "A" and "B" in X.27.

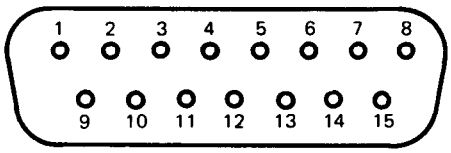
6 The assignment of contact numbers has been aligned to specify pairing and connection to multipaired interconnecting cable. Respective paired contacts are 2 and 9, 3 and 10, ..., 8 and 15.

7 Circuit X is used if the DTE has to provide signal element timing.

Table 2 — List of interchange circuits

Circuit designation	Description
G	Signal ground or common return
Ga	DTE common return
Gb	DCE common return
T	Transmit
R	Receive
C	Control
I	Indication
S	Signal element timing
B	Byte timing
F	Frame start identification
X	DTE transmit signal element timing

Dimensions in millimetres



DTE contact arrangement viewed
from connector front (DCE side)

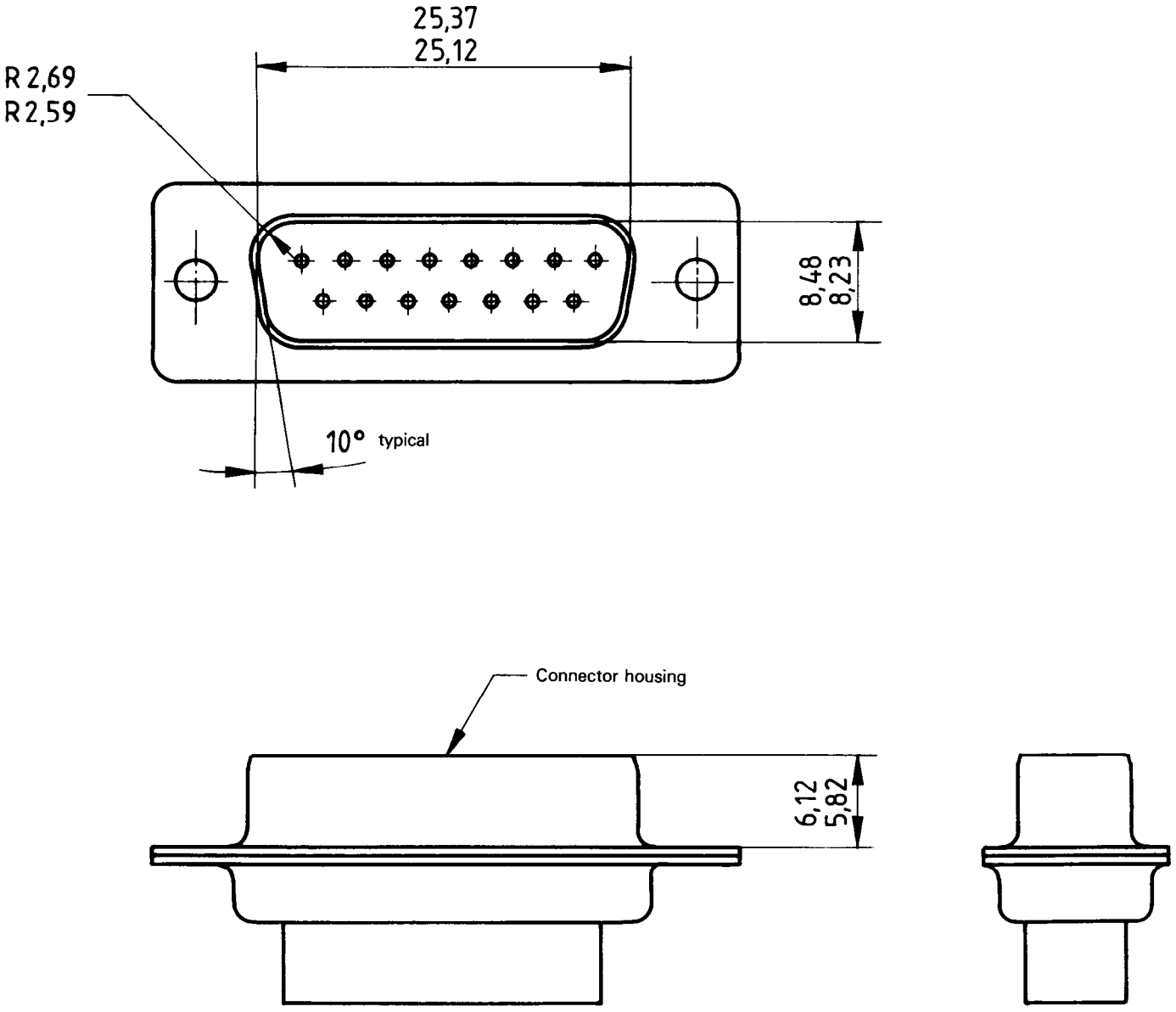
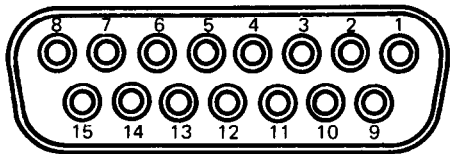
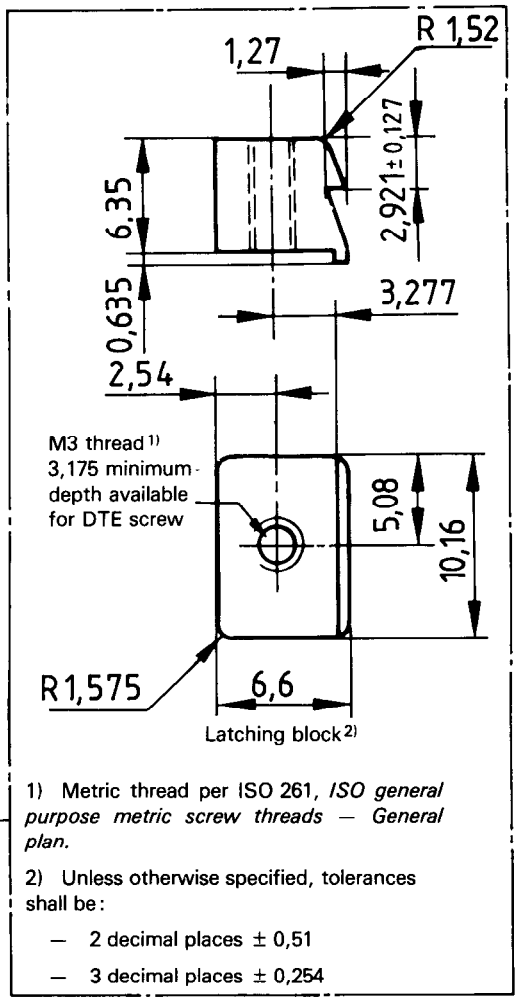


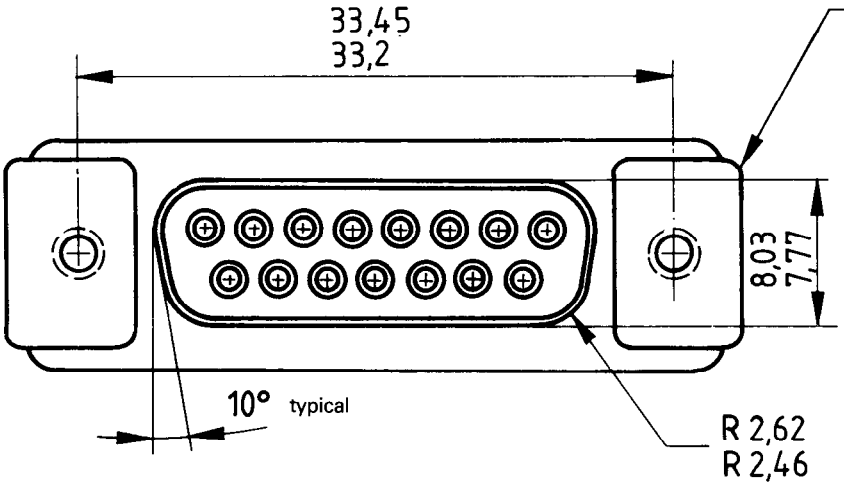
Figure 1 — DTE connector

Dimensions in millimetres



DCE contact arrangement viewed from connector front (DTE side)





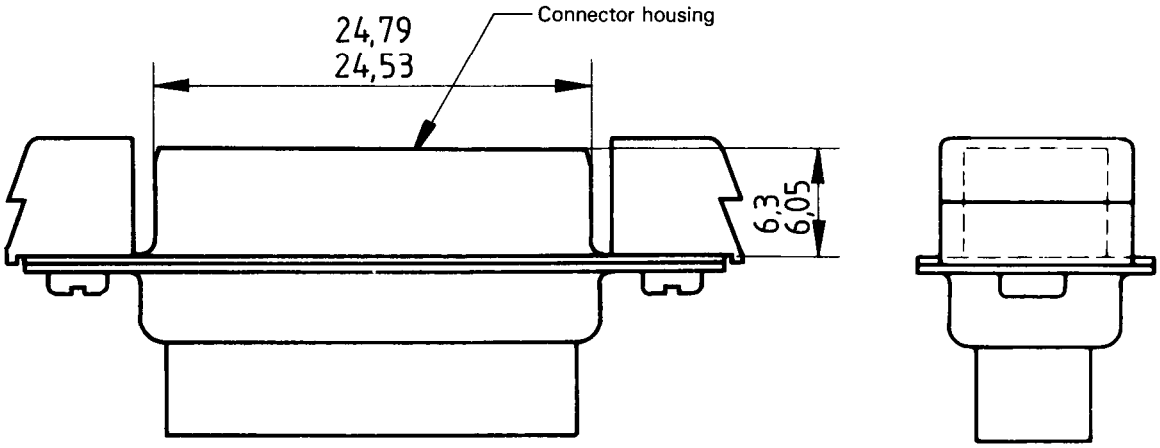


Figure 2 — DCE connector

Dimensions in millimetres

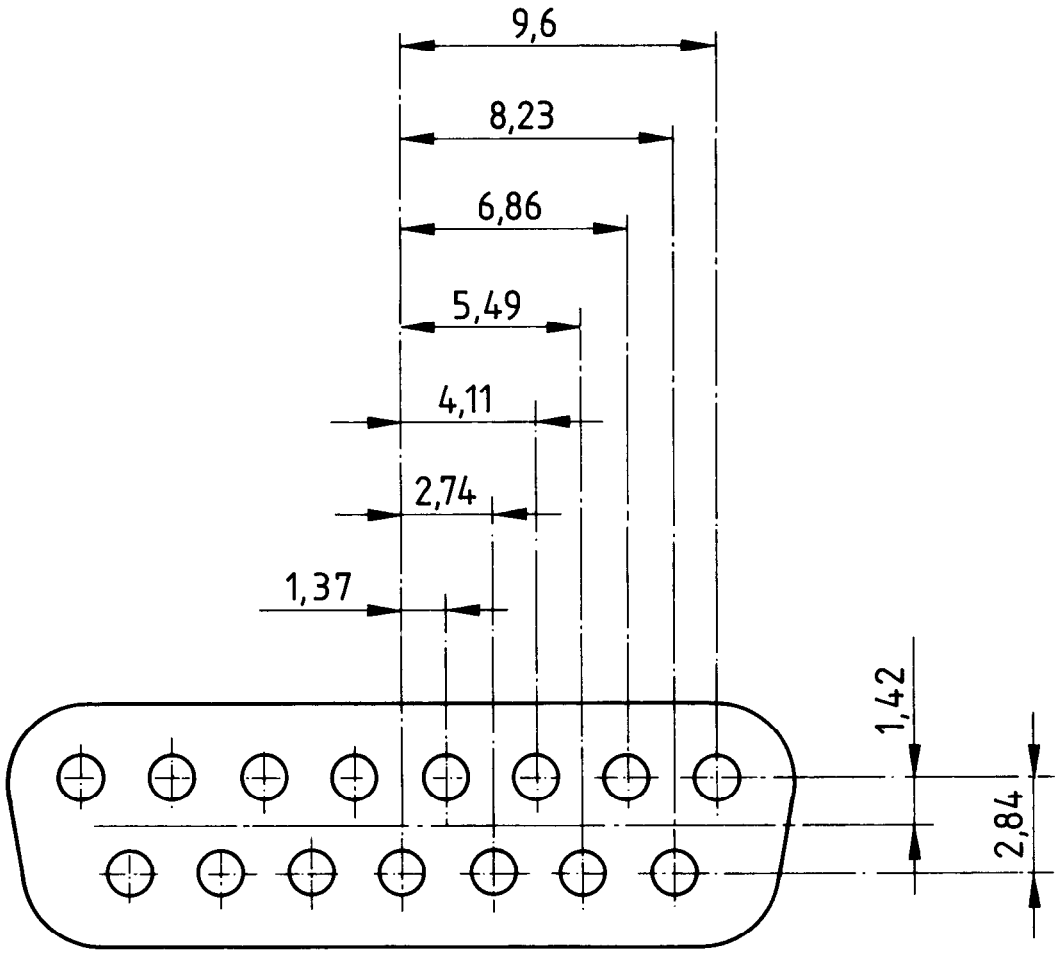


Figure 3 — Contact spacing dimensions

Dimensions in millimetres

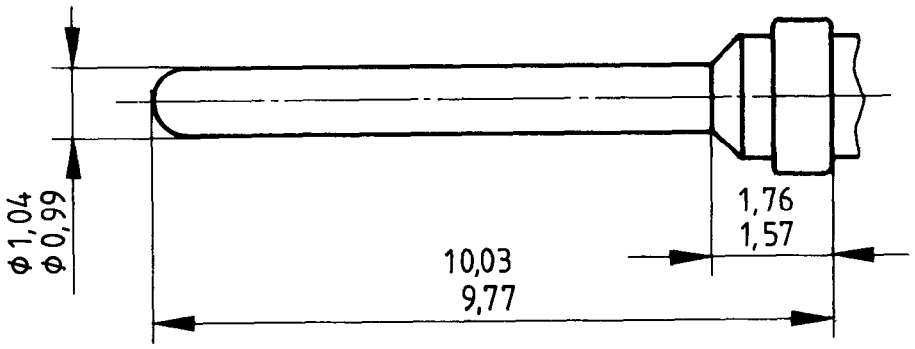
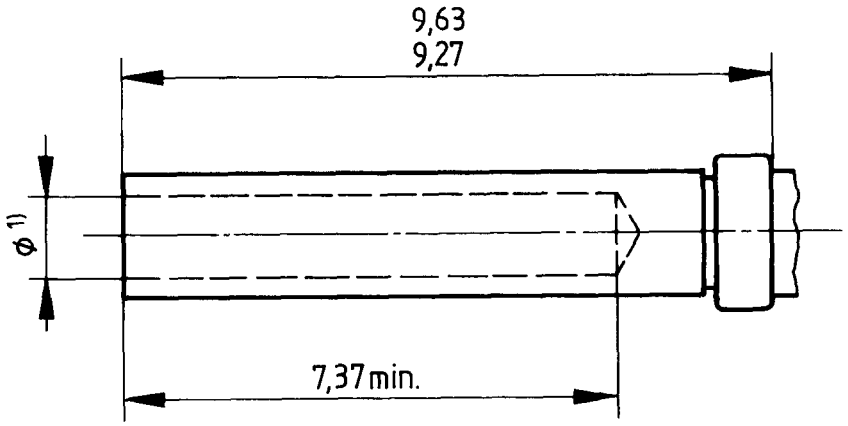


Figure 4 — Male contact



1) When the male contact is mated with the female contact, sufficient force should be applied by the female contact to ensure proper electrical contact.

Figure 5 — Female contact

Annex A
(informative)

Diagrams for finger clearance

This annex provides guidance on finger clearance for equipment designers.

Figure A.1 shows the maximum DTE connector outline.

Figure A.2 shows the minimum recommended spacing between multiple DCE connectors, taking into account the various locking devices (levers, screws) of DTE connectors.

Dimensions in millimetres

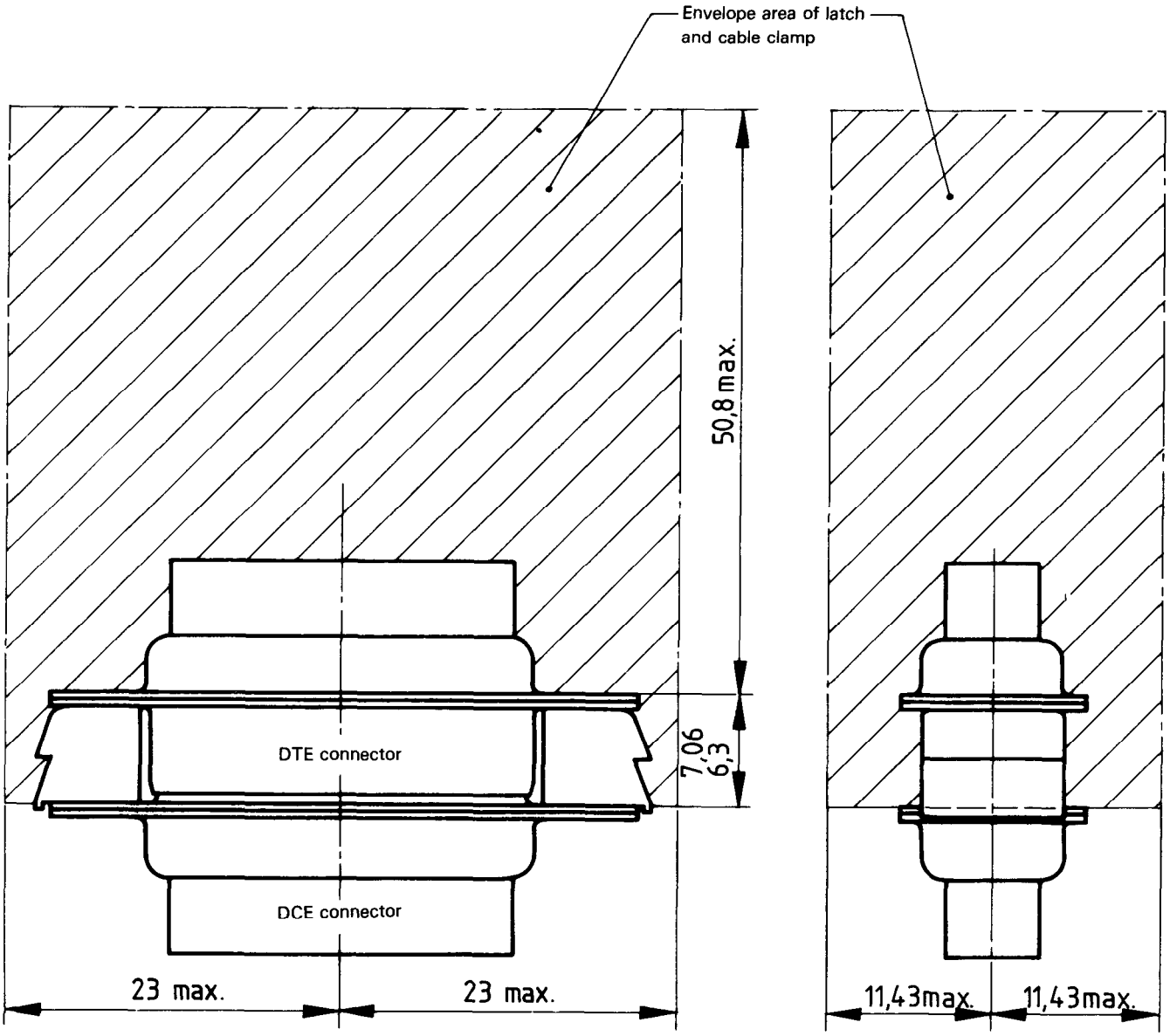


Figure A.1 — Maximum DTE connector outline

Dimensions in millimetres

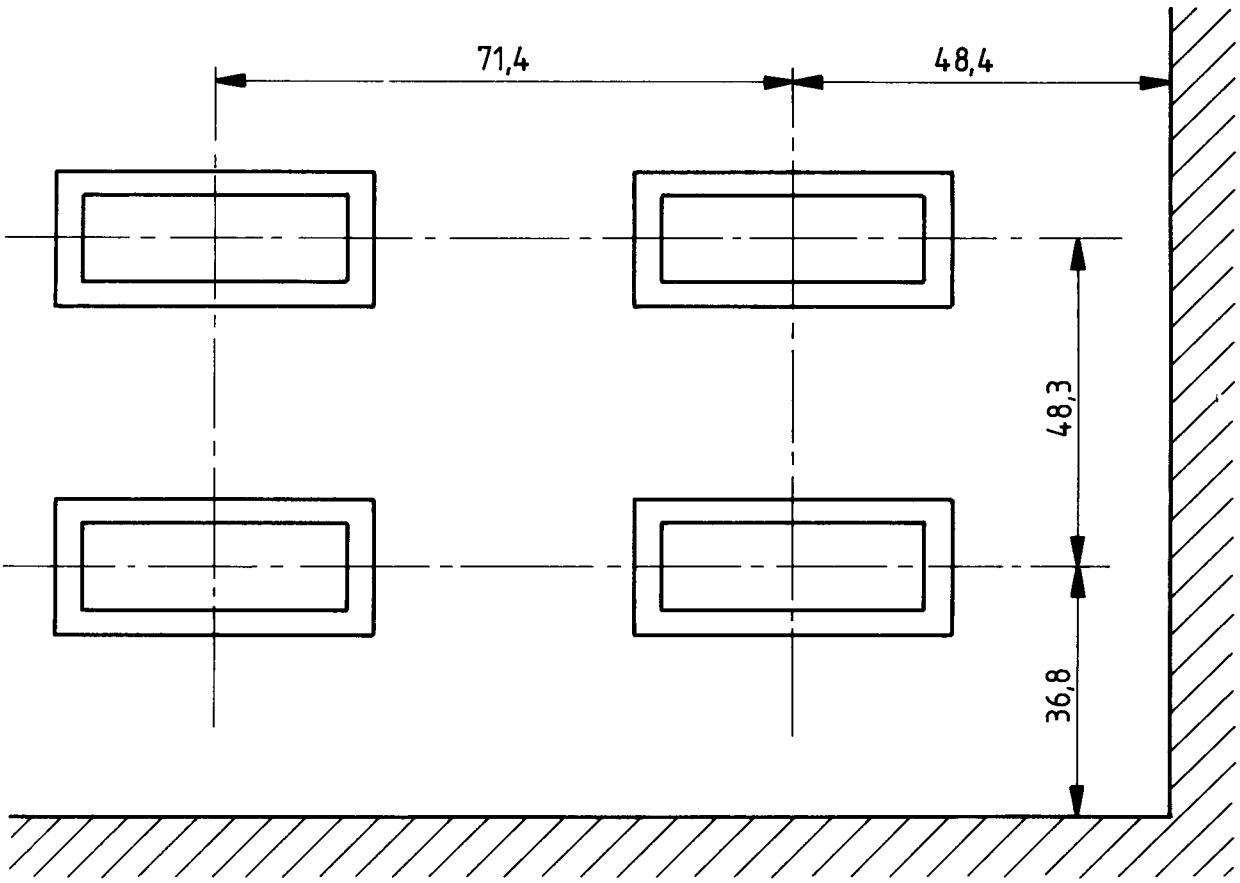


Figure A.2 — Minimum DCE connector spacing

Annex B
(informative)

Generator/receiver interconnecting configurations

B.1 CCITT Recommendation X.20

CCITT Recommendation X.20 states that the electrical characteristics of CCITT Recommendation X.26 apply to the DCE side of the interface while electrical characteristics of either CCITT Recommendations X.26, X.27 (without optional cable termination in the load), or V.28 may apply to the DTE side of the interface. Figures B.1 and B.2 provide diagrams of the associated interconnecting configurations for X.26 and X.27 DTE. For interconnection of X.20/X.26 DCE with DTE using V.28 electrical characteristics and the 25-pole connector according to ISO 2110, refer to annex C of this International Standard.

B.2 CCITT Recommendation X.21

CCITT Recommendation X.21 states that the electrical characteristics of CCITT Recommendation X.27 (without optional cable termination in the load) apply to the DCE while electrical characteristics of either X.26 or X.27 (without optional cable termination in the load) may apply to the DTE for synchronous classes of operation at 9,6 kbit/s and below. For synchronous classes of operation above 9,6 kbit/s, the electrical characteristics of X.27 with optional cable termination in the load apply to both the DTE and DCE. Figures B.3 and B.4 provide diagrams of the associated interconnecting configurations for X.26 and X.27 DTE.

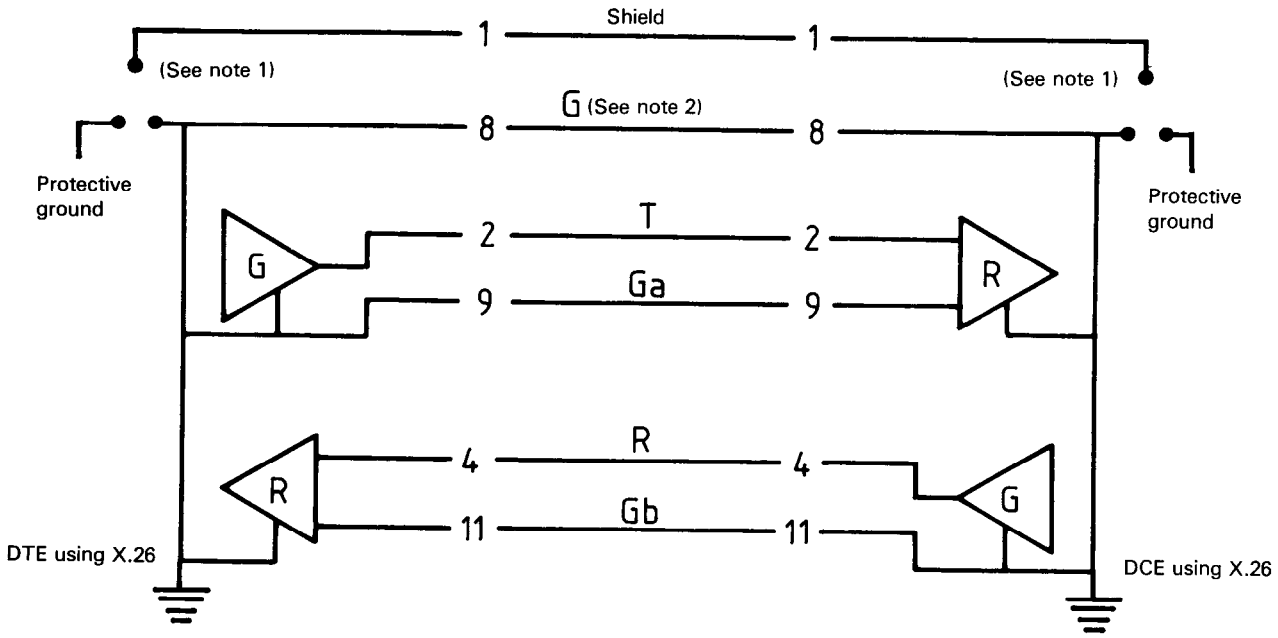


Figure B.1 — X.20 interconnection configuration for X.26 DTE/X.26 DCE

NOTES

1 Contact 1 is assigned for connecting the shields between tandem sections of shielded interface cable. The shield may be connected either to protective ground or to signal ground at either the DTE or DCE or both in accordance with national regulations.

Signal ground may be further connected to protective ground in accordance with national safety regulations. Caution should be exercised to avoid establishment of ground loops carrying high currents.

2 Provision of circuit G is optional.

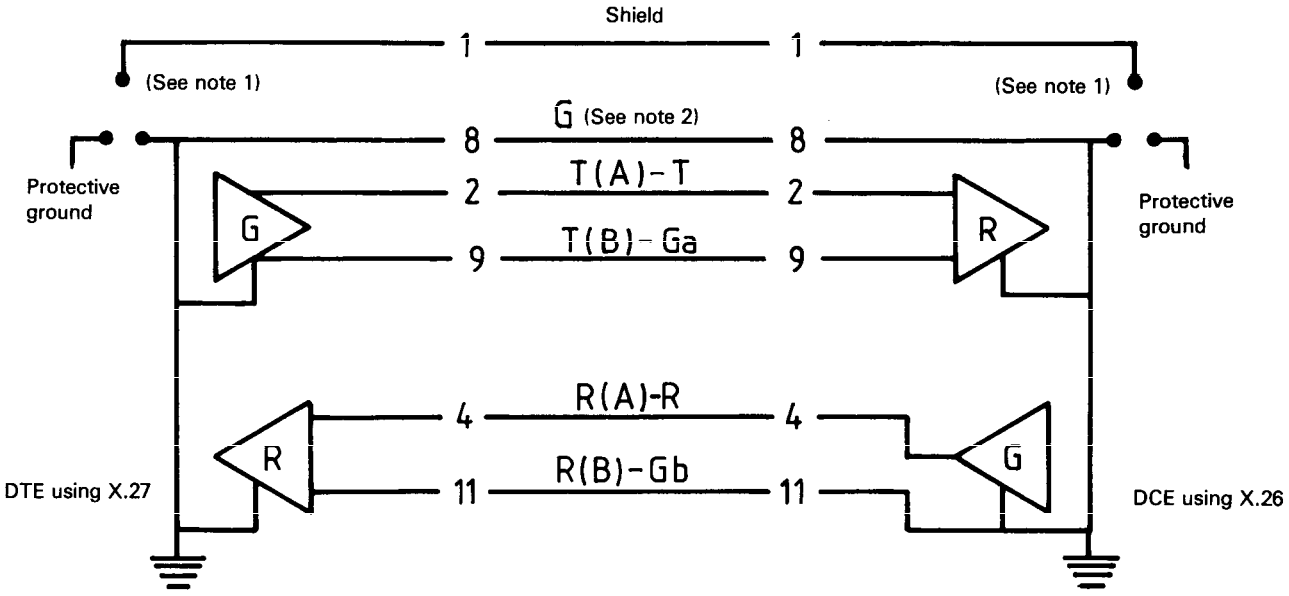


Figure B.2 — X.20 interconnection configuration for X.27 DTE/X.26 DCE

NOTES

1 Contact 1 is assigned for connecting the shields between tandem sections of shielded interface cable. The shield may be connected either to protective ground or to signal ground at either the DTE or DCE or both in accordance with national regulations.

Signal ground may be further connected to protective ground in accordance with national safety regulations. Caution should be exercised to avoid establishment of ground loops carrying high currents.

2 Provision of circuit G is optional.

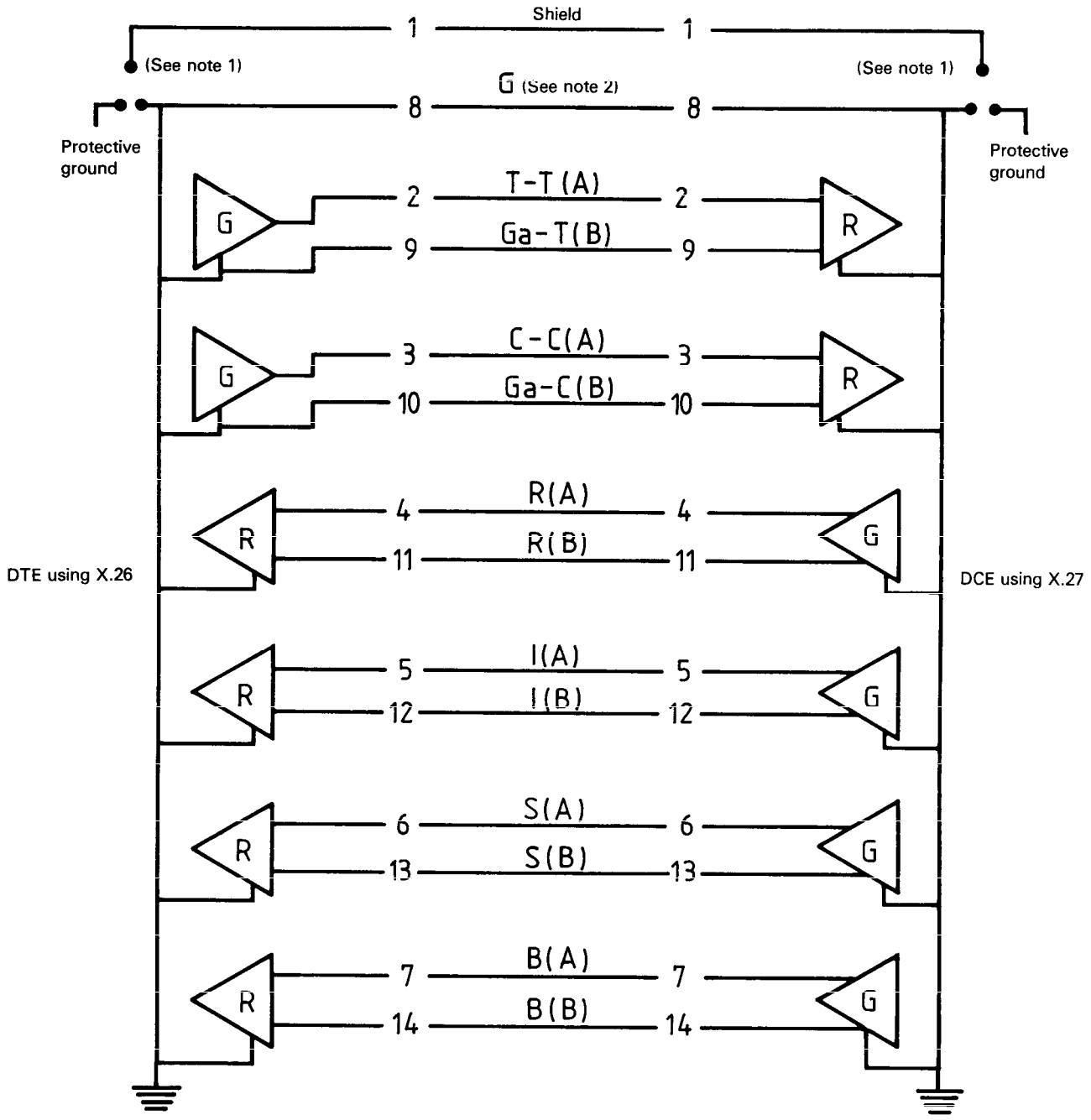


Figure B.3 — X.21 interconnection configuration for X.26 DTE/X.27 DCE

NOTES

1 Contact 1 is assigned for connecting the shields between tandem sections of shielded interface cable. The shield may be connected either to protective ground or to signal ground at either the DTE or DCE or both in accordance with national regulations.

Signal ground may be further connected to protective ground in accordance with national safety regulations. Caution should be exercised to avoid establishment of ground loops carrying high currents.

2 Provision of circuit G is optional.

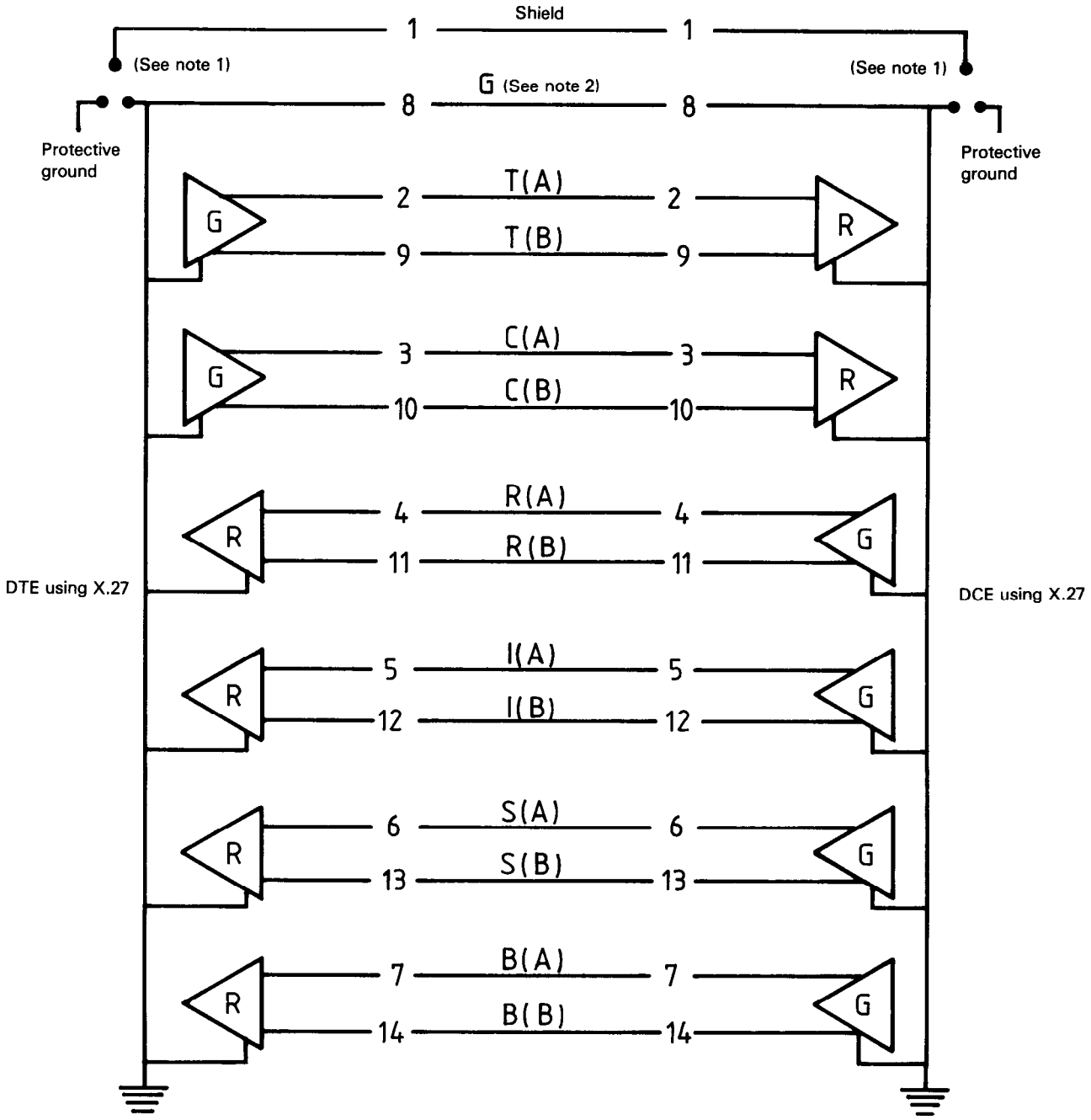


Figure B.4 — X.21 interconnection configuration for X.27 DTE/X.27 DCE

NOTES

1 Contact 1 is assigned for connecting the shields between tandem sections of shielded interface cable. The shield may be connected either to protective ground or to signal ground at either the DTE or DCE or both in accordance with national regulations.

Signal ground may be further connected to protective ground in accordance with national safety regulations. Caution should be exercised to avoid establishment of ground loops carrying high currents.

2 Provision of circuit G is optional.

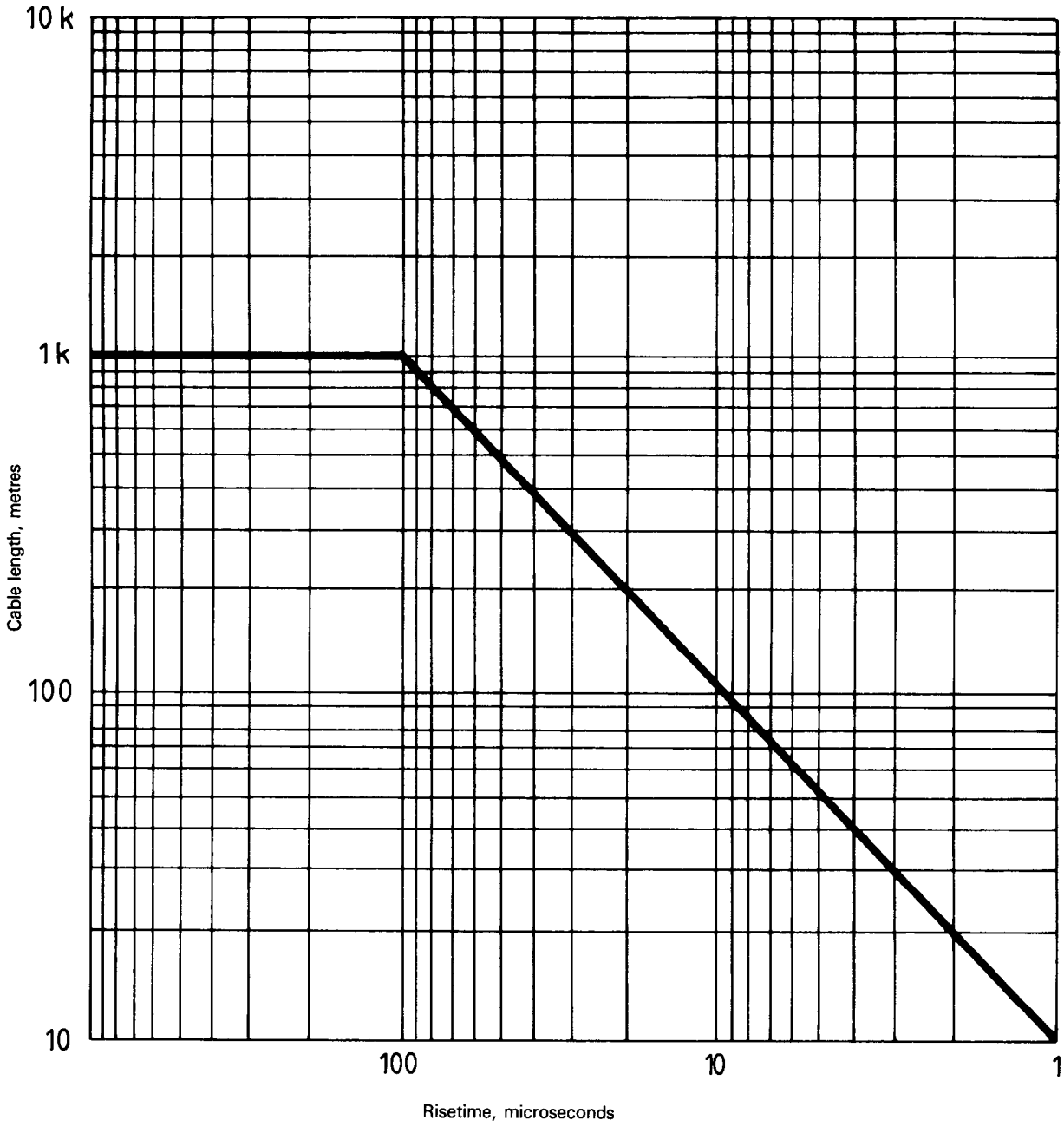


Figure B.5 — Cable length against risetime

Annex C
(informative)

Interworking requirements with V.28 circuits

C.1 Scope

This annex describes an interconnection configuration with an adapter that may be used to provide interworking between X.20/V.28 DTE and X.20/X.26 DCE.

C.2 Electrical characteristics

This clause describes the necessary adaptation of equipment designed for X.26 characteristics to make it closely resemble the V.28 characteristics. An overlap in values of parameters of X.26 and V.28 has been established such that additional provisions incorporated in the interface circuits using X.26 will make the necessary adjustments to ensure proper operation with V.28 circuits. It should be noted that the performance associated with interworking X.26 circuits with V.28 circuits is limited to that normally associated with V.28 operation.

C.2.1 Protection

X.26 states that the receivers shall not be damaged by voltages up to 12 V while V.28 generators may produce output voltages up to 25 V. Although many commercially available X.26 receivers have been designed to withstand and operate properly with the higher V.28 voltages, protection will be necessary for those receivers which do not have sufficient tolerance. X.26 generators may also be damaged by the higher V.28 generator voltages if they are inadvertently interconnected or shorted together. Since the short circuit condition between V.28 and X.26 generators is purely a fault situation, any further consideration is left to the equipment designer.

C.2.2 Signal levels

The generator output signal levels stated in X.26 and V.28 have an overlap in the 5 V to 6 V range. Furthermore, X.26 levels can be as low as 4 V while V.28 levels can be as high as 25 V. The considerations associated with the upper limit levels of V.28 generators operating with X.26 receivers have been covered in C.2.1. On the lower limit, although an X.26 generator output level between 4 V and 5 V is not within the V.28 recommendation, satisfactory operation with V.28 receivers having a 3 V transition margin can be expected because of the low source impedance of X.26 generators.

C.2.3 Risetime, data rate, distance

V.28 states that the risetime for the signal to pass through the ± 3 V transition region shall not exceed 3 % of the signal element duration. X.26, on the other hand, generally requires much slower risetimes specified from 10 % to 90 % of the total signal amplitude to reduce cross talk for operation over longer distances. It is possible, however, through proper selection of the waveshaping for generators in X.20/X.26 DCE to meet the requirements of both X.26 and V.28 simultaneously for data signalling rates applicable to X.20.

In CCITT Recommendation X.26, a graph is provided of data signalling rate versus cable length. This graph has been translated in figure B.5 to show the relationships of risetime and cable length. As an example, figure B.5 shows that the fastest risetime allowed by X.26 for a 1 000 m cable length is 100 µs. When operating X.26 generators with V.28 receivers, the 100 µs risetime will meet the V.28 requirements of less than 3 % of the unit interval for data signalling rates up to 300 bit/s.

C.2.4 Circuit failure conditions

A V.28 receiver designed to detect either a power-off condition or disconnection of the interconnecting cable will have no problem detecting these conditions when interworking with an X.26 generator. In the reverse situation, the V.28 recommendation allows the generator impedance in the power-off condition to be as low as 300 Ω which is too low for fault detection by an X.26 receiver using the conventional voltage biasing method. As a result, it will be necessary to incorporate a minimum of 2 kΩ in series with the input to the X.26 receiver in order to ensure proper detection of these conditions when the conventional voltage biasing method is used.

C.2.5 Signal return

X.26 requires two signal return circuits, one for each direction of transmission, while V.28 requires only one. For the X.20 interface, it is therefore necessary to connect circuits Ga and Gb of X.26 DCE with circuit G of V.28 DTE. X.26 DCE may also implement circuit G. In this case, circuits Ga, Gb, and G of the X.26 DCE should all be connected to circuit G of the V.28 DTE as shown in figure C.3.

C.3 Mechanical characteristics

ISO 2110 specifies the 25-pole DTE/DCE interface connector and assignment of contact numbers for V.28 equipment. X.20/X.26 DCE conforming to this International Standard uses a 15-pole connector which belongs to the same family of connectors as the 25-pole connector. Therefore, mechanical adaptation is necessary for interworking between X.20/X.26 DCE and X.20/V.28 DTE. A 25/15-pole arrangement applies for all such interconnections.

C.4 Suggested implementation

The actual method of implementation for satisfying the provisions outlined in clauses C.2 and C.3 is not standardized because a number of innovative approaches are possible. Accordingly, it is left to the designer of DCE meeting the X.20/X.26 interface characteristics to incorporate the necessary provisions when interworking with X.20/V.28 DTE is desired as a special feature. It should not be assumed that any

DCE meeting X.20/X.26 will interwork with X.20/V.28 DTE unless a specific reference is made that the requirements for interworking are fulfilled.

One method of satisfying the provisions outlined in clauses C.2 and C.3 has been developed. It is presented in this clause as guidance for implementing X.20/X.26 DCE where interworking with V.28 DTE is essential.

C.4.1 Protection of X.26 receivers

Although X.26 states that receivers need only withstand 12 V without being damaged, a number of receiver integrated circuits are available that can withstand and operate properly with the higher voltages which are possible from V.28 generators. When the X.26 receivers do not have adequate tolerance, however, additional protection will be required. This can be accomplished by the addition of an attenuating L-pad in front of the X.26 receiver input as shown in figure C.1. The L-pad with a 2 kΩ series resistance and a 3,3 kΩ shunt resistance has an additional effect of appearing as a high impedance source. Therefore, the pad should be no further from the X.26 receiver input than 3 m of cable to ensure that near-end cross talk from adjacent circuits does not reach an unacceptable level (1 V peak).

C.4.2 Generator output signals

An X.26 generator signal risetime of 100 µs or faster will allow operation within V.28 and X.26 specifications at data signalling rates up to 300 bit/s.

C.4.3 Fault detection provisions

As specified earlier, a resistance of 2 kΩ (see C.2.4) in series with the input to the X.26 receiver is required for detection of the power-off condition if the receiver uses the biasing method. This additional resistance is not required, however, if the L-pad is included for receiver protection or if other methods are used for fault detection.

C.4.4 External adapter

A simple external adapter can be used to interconnect X.20/X.26 DCE with X.20/V.28 DTE. Figure C.2 shows the placement of such an adapter which provides the necessary electrical and mechanical conversions.

The wiring diagram of the 25/15-pole adapter is shown in figure C.3. The L-pad which may be necessary for circuit T is also shown. The pad can be easily implemented using 1/8 W resistors. The strapping of the signal return leads can also be accomplished in the adapter. As pointed out earlier, the L-pad should be located within 3 m of cable from the X.26 receiver to avoid excessive near-end cross talk.

C.4.5 Summary of suggested provisions

a) 25/15-pole mechanical adapter;

b) X.26 generator signal risetime should be no slower than 100 µs;

c) L-pad attenuator, if needed, on circuit T in adapter;

d) connect signal return circuits Ga and Gb together with circuit G (if implemented) from the X.20/X.26 DCE to circuit G from the X.20/V.28 DTE in the adapter;

e) when the L-pad attenuator is used on circuit T, install adapter such that the cable length between the adapter and the X.26 DCE does not exceed 3 m;

f) total cable length between the X.26 DCE and the V.28 DTE is limited to the length normally associated with V.28 operation.

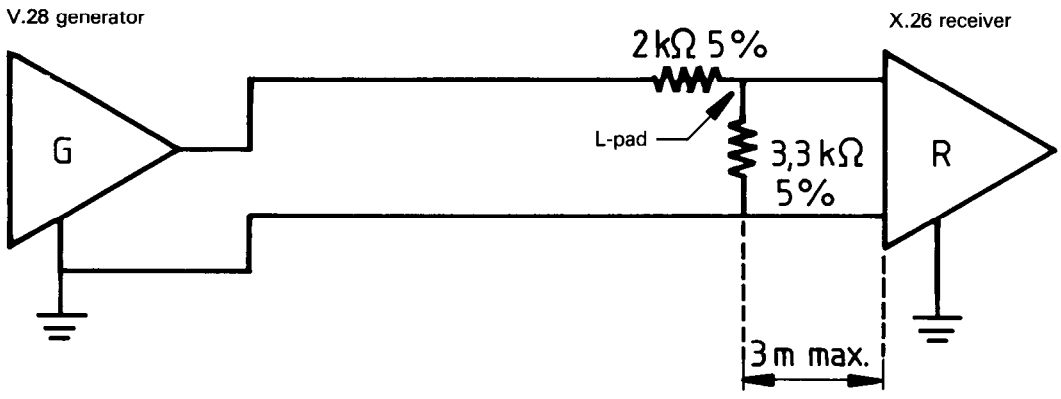


Figure C.1 — L-pad attenuator for protection of X.26 receiver

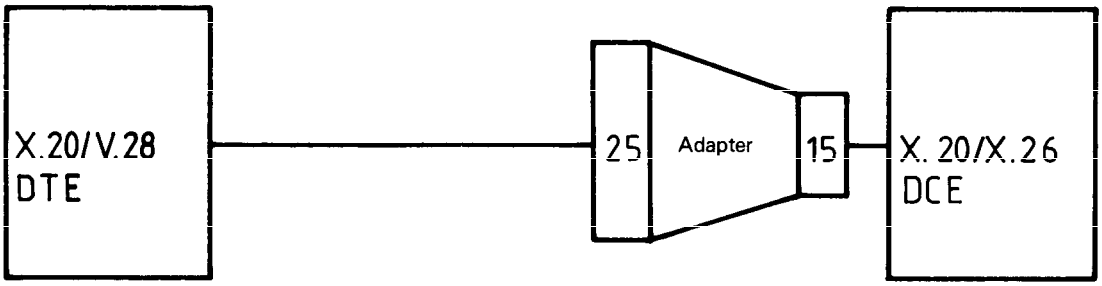


Figure C.2 — Interconnection configuration with 25/15-pole adapter

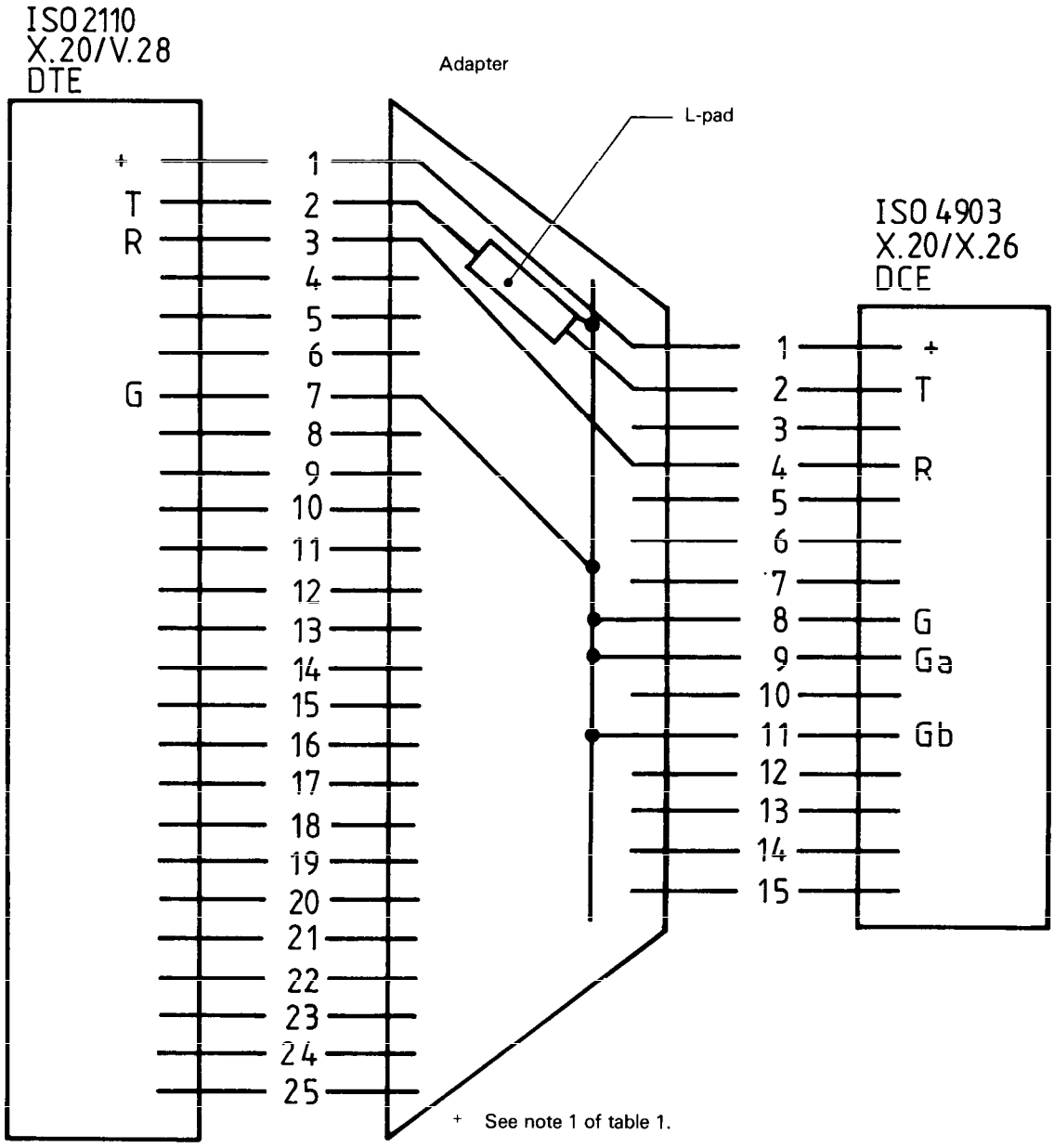


Figure C.3 — Adapter wiring diagram

UDC 681.327.8 : 621.316.541

Descriptors : data processing, data transmission, network interconnection, data communication equipment, connecting equipment, electric connectors, connector pins, multi-contact connectors, specifications, dimensions, layout, numbering.

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