ISO/IEC TS 29125

Edition 1.0 2024-10

INTERNATIONAL STANDARD

AMENDMENT 2

Information technology – Telecommunications cabling requirements for remote powering of terminal equipment

ISO/IEC TS 29125:2017-04/AMD2:2024-10(en)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

ISO/IEC TS 29125

Edition 1.0 2024-10

INTERNATIONAL STANDARD

AMENDMENT 2

Information technology – Telecommunications cabling requirements for remote powering of terminal equipment

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.200 ISBN 978-2-8322-9893-0

Warning! Make sure that you obtained this publication from an authorized distributor.

INFORMATION TECHNOLOGY – TELECOMMUNICATIONS CABLING REQUIREMENTS FOR REMOTE POWERING OF TERMINAL EQUIPMENT

AMENDMENT 2

FOREWORD

1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.
2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO National bodies.
3) IEC and ISO documents have the form of recommendations for international use and are accepted by IEC and ISO National bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC and ISO documents is accurate, IEC and ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC and ISO National bodies undertake to apply IEC and ISO documents transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC and ISO document and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC and ISO do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC and ISO marks of conformity. IEC and ISO are not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this document.
7) No liability shall attach to IEC and ISO or their directors, employees, servants or agents including individual experts and members of its technical committees and IEC and ISO National bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this ISO/IEC document or any other IEC and ISO documents.
8) Attention is drawn to the Normative references cited in this document. Use of the referenced publications is indispensable for the correct application of this document.
9) IEC and ISO draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC and ISO take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC and ISO had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch and www.iso.org/patents. IEC and ISO shall not be held responsible for identifying any or all such patent rights.

Amendment 2 to IEC ISO/IEC TS 29125:2017 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The text of this Amendment is based on the following documents:

Draft	Report on voting
JTC1-SC25/3272/DTS	JTC1-SC25/3289/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, and the ISO/IEC Directives, JTC 1 Supplement available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

INTRODUCTION to the amendment

This amendment incorporates changes necessary to extend the current for remote powering using single pair cabling up to 2 000 mA.

Introduction

Insert the following after the first bullet of the fourth paragraph:

- guidance on wire diameter and bundling on heating;

1 Scope

Replace the second bullet of list item a), added by Amendment 1, with:

- 1-pair balanced cabling using currents per conductor of up to 2 000 mA;

In the NOTE, delete "4-pair".

6.3 Temperature rise and current capacity

Replace the last sentence of the first paragraph with the following sentence:

The standards in the ISO/IEC°11801 series specify this temperature up to 60 °C in MICE C_1 environments and 70 °C in MICE C_2 and C_3 environments.

Replace the existing Table 5, added by Amendment 1, with the following new Table 5:

Table 5 – Maximum current per conductor versus temperature rise in a 37 1-pair cable bundle in air and conduit

Temperature rise	Current per conductor					
K	0,57 mm wire diameter mA		0,40 mm stranded wire diameter (cords) mA		1,02 mm stranded wire diameter (cords) mA	
	air	conduit	air	conduit	air	conduit
5	866	738	608	518	1 550	1 320
7,5	1 061	904	744	634	1 900	1 620
10	1 225	1 044	860	732	2 190	1 870
12,5	1 370	1 167	961	819	-	2 090
15	1 501	1 278	1 053	897	-	-
17,5	1 621	1 381	1 137	969	-	-
20	1 733	1 476	1 216	1 036	-	-

Temperature rise above 10 K shown in grey background is not recommended for cables installed in an environment that can reach 50 °C.

NOTE 1 These values are based on conductor temperature measurement of typical cables and cords.

NOTE 2 Currents above 2 000 mA are for information only.

In Table 6, added by Amendment 1, delete column "0,32 mm diameter", as follows:

Table 6 – Calculated worst case current per conductor versus temperature rise in a bundle of 37 1-pair cables of different conductor diameters in air and conduit

ΔT	0,40 mm diameter mA		0,51 mm diameter mA		0,57 mm diameter mA		0,65 mm diameter mA		0,81 mm diameter mA		1,02 mm diameter mA	
°C	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit
2	384	327	490	417	548	466	624	532	779	663	981	835
4	543	463	693	590	775	660	883	753	1 101	938	1 387	1 181
6	666	567	849	723	949	808	1 082	922	1 349	1 149	1 699	1 446
8	769	655	981	835	1 096	933	1 249	1 065	1 558	1 327	1 962	1 670
10	860	732	1 096	934	1 225	1 044	1 397	1 190	1 742	1 484	2 194	1 867
12	942	802	1 201	1 023	1 342	1 143	1 530	1 304	1 908	1 625	2 403	2 046
14	1 017	867	1 297	1 105	1 450	1 235	1 653	1 409	2 061	1 755	2 596	2 210
16	1 087	926	1 387	1 181	1 550	1 320	1 767	1 506	2 203	1 877	2 775	2 362
18	1 153	983	1 471	1 253	1 644	1 400	1 874	1 597	2 337	1 991	2 943	2 506
20	1 216	1 036	1 551	1 321	1 733	1 476	1 976	1 684	2 463	2 098	3 102	2 641

Temperature rise above 10 °C shown in grey background is not recommended.

The values in this table are based on the implicit DC resistance derived from the insertion loss of the various conductor diameters of cable. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.

NOTE 1 The current per conductor for each 1-pair cable is also dependent on the cable construction.

NOTE 2 Currents above 2 000 mA are for information only.

6.4.3 Cable count within a bundle

Replace the first three paragraphs, added by Amendment 1, with the following text:

This document uses 37-cable bundles as the basis for developing the temperature rise and current per conductor with all pairs energized. For other cases (e.g. where bundle count exceeds 37 cables), the guidelines provided in 6.4.4 can be used.

Refer to Table 7 to determine the maximum temperature rise using 2 000 mA per conductor for 1-pair cable bundles of different count.

NOTE The temperature rise of one cable is lower than that of a 7-cable bundle shown in all tables.

6.4.4 Reducing temperature increase

In the sixth paragraph, replace "Figure 1" with "Figure 3".

In the seventh paragraph, replace "Figure 2" with "Figure 4".

In Table 4, replace the left column heading "No. of pairs" with "No. of energized pairs" and replace "°C" with "K" in two places.

Replace Table 8, Figure 3, Table 9 and Figure 4, all added by Amendment 1, with the following new Table 8, Figure 3, Table 9 and Figure 4:

Table 8 – Temperature rise for a 0,57 mm conductor diameter 1-pair cable versus current for different bundle sizes in air

Bundle size	**Current** mA									
	200	400	600	800	1 000	1 200	1 400	1 600	1 800	2 000
	ΔT K									
7	0,1	0,4	0,9	1,7	2,6	3,7	5,1	6,6	8,4	10,3
19	0,2	0,7	1,6	2,9	4,5	6,5	8,8	11,5	14,6	18,0
37	0,3	1,1	2,4	4,3	6,7	9,6	13,0	17,0	21,6	26,6
61	0,4	1,4	3,2	5,8	9,0	13,0	17,7	23,1	29,2	36,0
91	0,5	1,9	4,2	7,4	11,6	16,7	22,7	29,6	37,5	46,3

Temperature rise above 10 K shown in grey background is not recommended for cables installed in an environment that can reach 50 °C.

The values in this table are based on the DC resistance of the cable conductors. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.

NOTE The temperature rise for a particular cable is also dependent on the cable construction.

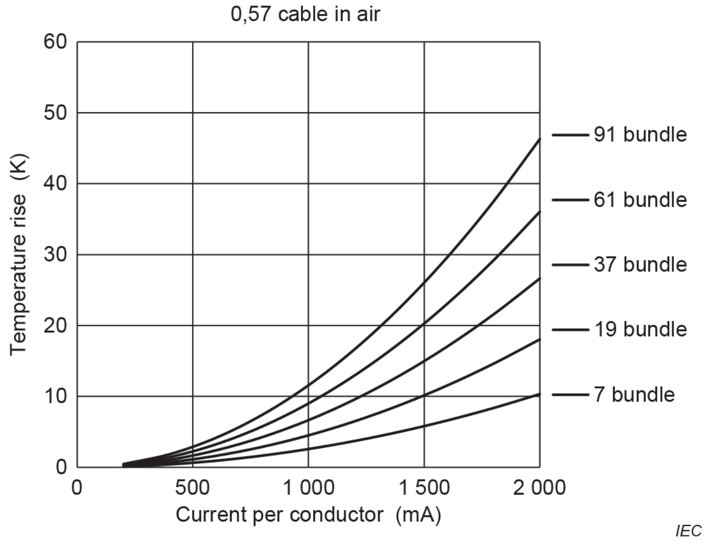

Figure 3 – Temperature rise for a 0,57 mm conductor diameter 1-pair cable versus current for different bundle sizes in air

Table 9 – Temperature rise for a 0,57 mm conductor diameter 1-pair cable versus current for different bundle sizes in conduit

Bundle size	**Current** mA									
	200	400	600	800	1 000	1 200	1 400	1 600	1 800	2 000
	ΔT K									
7	0,2	0,6	1,4	2,4	3,8	5,3	7,2	9,3	11,7	14,5
19	0,3	1,0	2,3	4,1	6,4	9,0	12,0	15,5	19,5	24,0
37	0,4	1,5	3,3	5,9	9,2	12,8	17,0	22,0	27,6	33,8
61	0,5	1,9	4,4	7,8	12,1	16,8	22,2	28,6	35,7	43,7
91	0,6	2,4	5,5	9,8	15,2	20,9	27,6	35,3	44,1	53,8

Temperature rise above 10 K shown in grey background is not recommended for cables installed in an environment that can reach 50 °C.

The values in this table are based on the DC resistance of the cable conductors. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.

NOTE The temperature rise for a particular cable is also dependent on the cable construction.

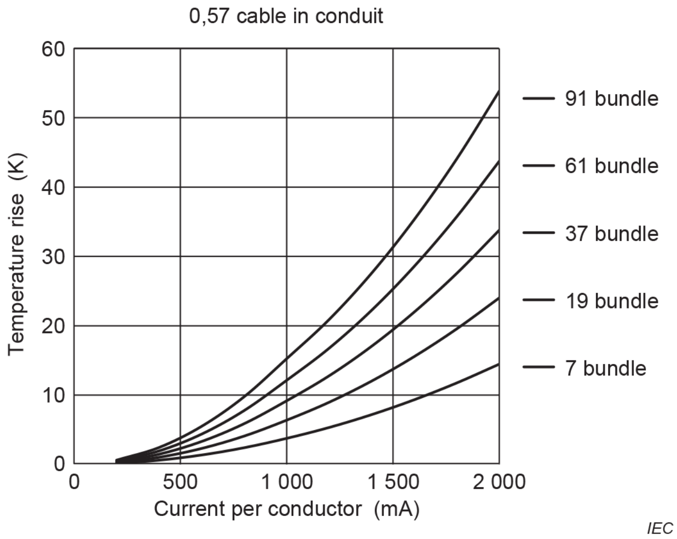

Figure 4 – Temperature rise for a 0,57 mm conductor diameter 1-pair cable versus current for different bundle sizes in conduit

Add the following new text, tables and figures at the end of 6.4.4.

Table 10 shows the temperature rise for a 1,02 mm conductor diameter 1-pair cable versus current for different bundle sizes in air. Figure 6 shows these data in graphical form.

Table 11 shows the temperature rise for a 1,02 mm conductor diameter 1-pair cable versus current for different bundle sizes in conduit. Figure 7 shows these data in graphical form.

Table 10 – Temperature rise for a 1,02 mm conductor diameter 1-pair cable versus current for different bundle sizes in air

Bundle size	**Current** mA									
	200	400	600	800	1 000	1 200	1 400	1 600	1 800	2 000
	$\Delta \boldsymbol{T}$ K									
7	0,1	0,2	0,3	0,5	0,8	1,1	1,5	1,9	2,4	3,0
19	0.3	0,4	0,6	1,0	1,4	1,9	2,6	3,3	4,1	5,0
37	0,5	0,7	1,0	1,5	2,1	2,8	3,7	4,7	5,8	7,1
61	0,7	1,0	1,4	2,0	2,8	3,8	4,9	6,2	7,6	9,3
91	1,1	1,4	1,9	2,7	3,6	4,8	6,1	7,7	9,5	11,5

Temperature rise above 10 K shown in grey background is not recommended for cables installed in an environment that can reach 50 °C.

The values in this table are based on the DC resistance of the cable conductors. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.

NOTE The temperature rise for a particular cable is also dependent on the cable construction.

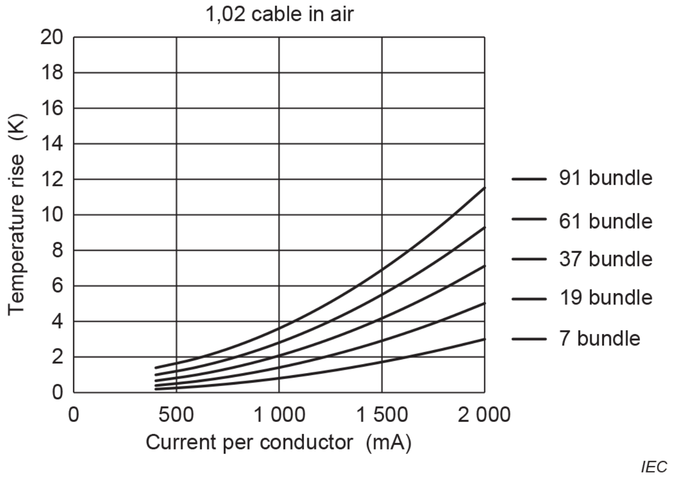

Figure 6 – Temperature rise for a 1,02 mm conductor diameter 1-pair cable versus current for different bundle sizes in air

Table 11 – Temperature rise for a 1,02 mm conductor diameter 1-pair cable versus current for different bundle sizes in conduit

Bundle size	**Current** mA									
	200	400	600	800	1 000	1 200	1 400	1 600	1 800	2 000
	ΔT K									
7	0,1	0,2	0,5	0,8	1,2	1,7	2,2	2,9	3,7	4,5
19	0,2	0,4	0,8	1,3	2,0	2,8	3,8	4,9	6,1	7,5
37	0,4	0,7	1,2	1,9	2,9	4,0	5,3	6,9	8,6	10,6
61	0,6	1,0	1,7	2,6	3,8	5,2	6,9	8,9	11,2	13,7
91	0,9	1,4	2,2	3,3	4,8	6,5	8,6	11,0	13,8	16,8

Temperature rise above 10 K shown in grey background is not recommended for cables installed in an environment that can reach 50 °C.

The values in this table are based on the DC resistance of the cable conductors. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.

NOTE The temperature rise for a particular cable is also dependent on the cable construction.

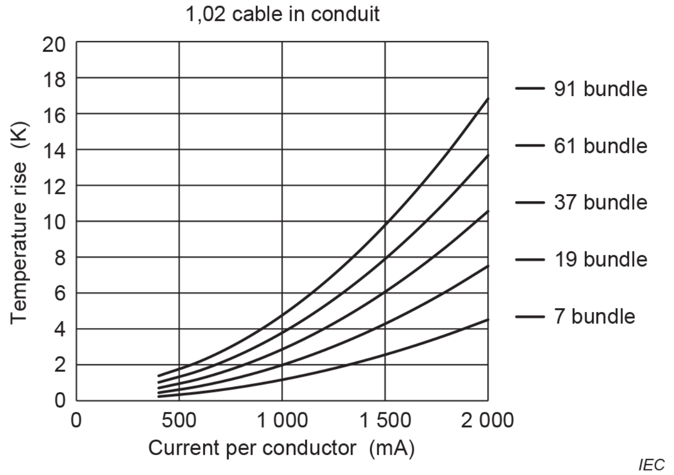

Figure 7 – Temperature rise for a 1,02 mm conductor diameter 1-pair cable versus current for different bundle sizes in conduit

8.2 4-pair balanced cabling

In the first paragraph of this subclause, added by Amendment 1, replace the second sentence with the following:

Connecting hardware contacts can deteriorate as a result of mating or un-mating under electrical load, leading to possible degradation of transmission characteristics (see IEC 60512-99-001 and IEC 60512-99-002).

Replace the NOTE with the following new NOTE:

NOTE A test schedule for connectors under electrical load is described in IEC 60512-99-001 and IEC 60512-99-002.

8.3 1-pair balanced cabling

*In the second paragraph and NOTE of this subclause, added by Amendment 1, replace "*IEC 60512-99-002*" with "*IEC 60512-99-003*" (two occurrences).*

B.2 Power dissipated (P)

Replace the entry for n_c with the following text:

n_c is the number of conductors per cable carrying remote powering current (i_c)

= 2 times the number of pairs carrying remote powering current:

n_c = 2 for 1-pair cables;

n_c = 8 for 4-pair cables;

B.3 Temperature difference from ambient temperature to bundle surface (ΔT_u)

Replace "°C*" in Formula (B.2) with "*K*".*

B.3.2 Typical values for constant ρ_u

Add the following at the end of the subclause:

In this document all calculated conduit tables assume a ρ-factor of 0,25. Environments with different ρ-factors shall be recalculated.

B.4 Temperature difference from bundle surface to bundle centre (ΔT_{th})

Replace "°C" in Formulae (B.3) and (B.4) with "K".

B.7 Adaptation model used to derive temperature rise vs. cables in a bundle

Replace the first two lines below "where" with the following:

ΔT is the temperature rise in K,

I is the current per conductor in A,

B.9 Example

In the first and second paragraphs, replace "°C" with "K" (two occurrences).

B.10 Coefficients for air and conduit

Replace Table B.1 with the following table:

Table B.1 – Bundling coefficients for different types of 4-pair cables and cords (all 4 pairs energized) in air and conduit

Cable type	Bundling coefficients			
	Open air		Conduit	
	C_1	C_2	C_1	C_2
0,4 mm cords	0,578 0	7,120 0	0,792 0	11,700 0
Category 5 cables	0,506 8	3,973 2	0,633 2	6,120 0
Category 6 cables	0,422 8	2,828 0	0,482 4	4,713 2
Category 6_A cables	0,342 8	2,505 2	0,370 4	3,986 8
Category 7 cables	0,342 8	2,505 2	0,370 4	3,986 8
Category 7_A cables	0,174 4	2,060 0	0,222 0	3,364 0
NOTE The bundling coefficients for Category 7_A cables were determined from the relative resistance values in IEC TR 61156-1-6.				

In Table B.2, added by Amendment 1, delete the line for 0,32 mm conductor diameter.

C.1.2 1-pair cabling

Replace the entire text of this subclause, added by Amendment 1, with the following new text:

The DC loop resistance requirements of each pair of a channel are specified in ISO/IEC 11801-1:2017/AMD1:–, when measured in accordance with IEC 61935-4. For convenience, Table C.4 shows those requirements.

Table C.4 – Maximum DC loop resistance of 1-pair channels

T1-A-1000	T1-A-400	T1-A-100	T1-B	T1-C
47,0 Ω	58,5 Ω	14,9 Ω	14,9 Ω	14,9 Ω
NOTE DC loop resistance applies only to pairs that provide DC continuity end-to-end. For testing connectivity, refer to IEC 61935-4.				

The DC loop resistance requirements of a 1-pair channel can be calculated using Table B.2 for DC resistance of the horizontal portion of the single pair channel, the respective resistance of single pair cords, and the maximum number of connections with 0,10 Ω per connection. For example, for a T1-B channel the maximum DC resistance is typically 14,9 Ω.

While the values in Table C.4 represent the maximum DC loop resistance values specified, the actual DC loop resistance is dependent on the conductor size and length of the cabling. Selecting a larger conductor size, often associated with a higher performance category of cabling, is one way to reduce DC loop resistance and improve both energy loss in the cabling and cable heating. Careful attention to cable routing to minimize cable lengths will substantially decrease DC loop resistance.

C.2.3 1-pair cabling

Replace the text of this subclause, added by Amendment 1, with the following new text:

The DC resistance unbalance between the two conductors of a single pair link shall not exceed 3 % or 200 mΩ , whichever is greater.

Bibliography

Add the following new references:

IEC 60512-99-003, *Connectors for electrical and electronic equipment – Tests and measurements – Part 99-003: Endurance test schedules – Test 99c: Test schedule for balanced single-pair connectors separating (unmating) under electrical load*

IEC 61935-4, *Specification for the testing of balanced and coaxial information technology cabling – Part 4: Installed balanced single pair cabling as specified in ISO/IEC 11801-1 and related standards*[1]

ISO/IEC 11801-1:2017/AMD1:–[2], *Information technology – Generic cabling for customer premises – Part 1: General requirements*

Replace the references to IEC 61076-3-104, IEC 61076-3-110, IEC 61156-1:2007 and ISO/IEC/IEEE 8802-3:2014 with the following references:

IEC 61076-3-104, *Connectors for electrical and electronic equipment – Product requirements – Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 2 000 MHz*

IEC 61076-3-110, *Connectors for electronic equipment – Product requirements – Part 3-110: Detail specification for free and fixed connectors for data transmission with frequencies up to 3 000 MHz*

IEC 61156-1, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

ISO/IEC/IEEE 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

---

1 First edition under preparation. Stage at the time of publication: IEC CD 61935-4:2024.

2 Under preparation. Stage at the time of publication: ISO/IEC CD 11801-1:2017/AMD1:2023.

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
info@iec.ch
www.iec.ch