IEC 61156-12

Edition 2.0 2025-04

INTERNATIONAL STANDARD

Multicore and symmetrical pair/quad cables for digital communications – Part 12: Symmetrical single pair cables with transmission characteristics up to 1,25 GHz – Work area wiring – Sectional specification

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.120.20

ISBN 978-2-8327-0376-2

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

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 Installation considerations 7
4.1 General remarks 7
4.2 Bending radius of installed cable 7
4.3 Climatic conditions 7
5 Materials and cable construction 7
5.1 General remarks 7
5.2 Cable construction 7
5.3 Conductor 8
5.4 Insulation 8
5.5 Cable element 8
5.6 Screening of the cable element 8
5.7 Cable make-up 8
5.8 Screening of the cable core 8
5.9 Sheath 8
5.10 Identification 9
5.11 Finished cable 9
6 Characteristics and requirements 9
6.1 General remarks 9
6.2 Electrical characteristics and tests 9
6.2.1 Conductor resistance 9
6.2.2 Resistance unbalance 9
6.2.3 Dielectric strength 10
6.2.4 Insulation resistance 10
6.2.5 Mutual capacitance 10
6.2.6 Capacitance unbalance 10
6.2.7 Transfer impedance 10
6.2.8 Coupling attenuation and low frequency coupling attenuation 10
6.2.9 Current-carrying capacity 11
6.3 Transmission characteristics 11
6.3.1 Velocity of propagation (phase velocity) 11
6.3.2 Phase delay and differential delay (delay skew) 11
6.3.3 Attenuation (α) 12
6.3.4 Unbalance attenuation (TCL and EL TCTL) 13
6.3.5 Alien (exogenous) near-end crosstalk (PS ANEXT) 13
6.3.6 Alien (exogenous) far-end crosstalk (PS AACR-F) 14
6.3.7 Alien (exogenous) crosstalk of bundled cables 14
6.3.8 Impedance 14
6.3.9 Return loss (RL) 15
6.4 Mechanical and dimensional characteristics and requirements 15
6.4.1 Dimensional requirements 15
6.4.2 Elongation at break of the conductor 15
6.4.3 Tensile strength of the insulation 15

6.4.4 Elongation at break of the insulation 15
6.4.5 Adhesion of the insulation to the conductor 15
6.4.6 Elongation at break of the sheath 15
6.4.7 Tensile strength of the sheath 16
6.4.8 Crush test of the cable 16
6.4.9 Impact test of the cable 16
6.4.10 Bending under tension 16
6.4.11 Repeated bending of the cable 16
6.4.12 Tensile performance of the cable 16
6.4.13 Shock-test requirements of the cable 16
6.4.14 Bump-test requirements of the cable 16
6.4.15 Vibration-test requirements of a cable 16
6.5 Environmental characteristics 16
6.5.1 Shrinkage of the insulation 16
6.5.2 Wrapping test of the insulation after thermal ageing 16
6.5.3 Bending test of insulation at low temperature 16
6.5.4 Elongation at break of the sheath after ageing 17
6.5.5 Tensile strength of the sheath after ageing 17
6.5.6 Sheath pressure test at high temperature 17
6.5.7 Cold bend test of the cable 17
6.5.8 Heat shock test 17
6.5.9 Damp heat steady state 17
6.5.10 Solar radiation 17
6.5.11 Solvents and contaminating fluids 17
6.5.12 Salt mist and sulphur dioxide 17
6.5.13 Water immersion 17
6.5.14 Hygroscopicity 17
6.5.15 Wicking 17
6.5.16 Flame propagation characteristics of a single cable 17
6.5.17 Flame propagation characteristics of bunched cables 18
6.5.18 Halogen gas evolution 18
6.5.19 Smoke generation 18
6.5.20 Toxic gas emission 18
6.5.21 Integrated fire test method for cables in environmental air handling spaces 18
7 Bundled cable requirements 18
7.1 General 18
7.2 Single pairs sharing one sheath 18
7.2.1 General 18
7.2.2 Near-end crosstalk (NEXT) 18
7.2.3 Attenuation to crosstalk ratio far-end (PS ACR-F) 19
Annex A (informative) Blank detail specification 20
Annex B (informative) Background information for coupling attenuation and low frequency coupling attenuation requirements 25
Bibliography 26

Table 1 – Transfer impedance 10
Table 2 – Coupling attenuation 11

Table 3 – Low frequency coupling attenuation 11
Table 4 – Attenuation equation constants 12
Table 5 – TCL requirements 13
Table 6 – EL TCTL requirements 13
Table 7 – PS ANEXT requirements 14
Table 8 – PS AACR-F requirements 14
Table 9 – RL requirements 15
Table 10 – NEXT and PS NEXT requirements 19
Table 11 – ACR-F and PS ACR-F requirements 19
Table A.1 – Blank detail specification 21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS –

Part 12: Symmetrical single pair cables with transmission characteristics up to 1,25 GHz – Work area wiring – Sectional specification

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC 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 National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC 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 National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees 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 IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes 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 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. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61156-12 has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

This second edition cancels and replaces the first edition published in 2021. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) additional cable type in support of T1-C generic single pair cabling up to 1,25 GHz;
b) introduction of low frequency coupling attenuation as an integral parameter describing screening efficiency at frequencies below 30 MHz.

The text of this International Standard is based on the following documents:

Draft	Report on voting
46C/1302/CDV	46C/1315/RVC

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 International Standard 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 ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61156 series, published under the general title *Multicore and symmetrical pair/quad cables for digital communications*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

1 Scope

This part of IEC 61156 specifies cables intended to be used for single balanced pair cabling for office, home and industrial application described in ISO/IEC 11801-1:2017 and ISO/IEC 11801-1:2017/AMD1[1]. An example of existing application is 1000BASE-T1, see ISO/IEC TR 11801-9906. The transmission characteristics of these cables are specified up to a frequency of 1,25 GHz and at a temperature of 20 °C. The T1-B type cable is specified from 0,1 MHz to 600 MHz, the T1-C type cable from 0,1 MHz to 1,25 GHz. Depending on the MICE environment and the installation conditions, either unscreened or screened cables can be used. A blank detail specification can be found in Annex A.

These cables can comprise more than one pair in the event that several systems are operated in parallel. In this case, refer to Clause 7.

The cables covered by this document are intended to operate with voltages and currents normally encountered in communication systems. While these cables are not intended to be used in conjunction with low impedance sources, for example the electric power supplies of public utility mains, they are intended to be used to support the delivery of low-voltage remote powering applications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60708, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath*

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

IEC 61156-6, *Multicore and symmetrical pair/quad cables for digital communications – Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Work area wiring – Sectional specification*

IEC 62153-4-3, *Metallic communication cable test methods – Part 4-3: Electromagnetic compatibility (EMC) – Surface transfer impedance – Triaxial method*

IEC 62153-4-5, *Metallic communication cables test methods – Part 4-5: Electromagnetic compatibility (EMC) – Screening or coupling attenuation – Absorbing clamp method*

IEC 62153-4-9:2018, *Metallic communication cable test methods – Part 4-9: Electromagnetic compatibility (EMC) – Coupling attenuation of screened balanced cables, triaxial method*
IEC 62153-4-9:2018/AMD1:2020

ISO/IEC TS 29125, *Information technology – Telecommunications cabling requirements for remote powering of terminal equipment*

---

[1] Under preparation. Stage at the time of publication: ISO/IEC/CCDV 11801-1:2024.