

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

---

**Twinax cables for digital communications –  
Part 2: Family specification – Cable for Ethernet-over-twinax physical interfaces**

**Câbles twinax pour transmissions numériques –  
Partie 2: Spécification de famille – Câble pour interfaces physiques Ethernet sur  
twinax**





## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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 corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://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](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://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](mailto:sales@iec.ch).

---

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Catalogue IEC - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

---

**Twinax cables for digital communications –  
Part 2: Family specification – Cable for Ethernet-over-twinax physical interfaces**

**Câbles twinax pour transmissions numériques –  
Partie 2: Spécification de famille – Câble pour interfaces physiques Ethernet sur  
twinax**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 33.120.20

ISBN 978-2-8322-6160-6

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Requirements for cables construction .....	8
4.1 General remarks .....	8
4.2 Cable construction .....	8
4.2.1 General .....	8
4.2.2 Conductor.....	8
4.2.3 Insulation.....	8
4.2.4 Colour code.....	8
4.2.5 Drain wire .....	8
4.2.6 Screening of cable assembly element.....	8
4.2.7 Cable make-up .....	8
4.2.8 Screening of the cable core .....	8
4.2.9 Sheath.....	9
4.2.10 Colour of sheath .....	9
4.2.11 Identification.....	9
4.2.12 Finished cable .....	9
5 Requirements and test methods .....	9
5.1 General remarks .....	9
5.2 Electrical tests .....	10
5.2.1 Conductor resistance.....	10
5.2.2 Resistance unbalance.....	10
5.2.3 Dielectric strength.....	10
5.2.4 Insulation resistance.....	10
5.2.5 Mutual capacitance.....	10
5.2.6 Surface transfer impedance.....	10
5.3 Transmission requirements and tests.....	10
5.3.1 General .....	10
5.3.2 Characteristic impedance .....	10
5.3.3 Return loss .....	10
5.3.4 Attenuation .....	10
5.3.5 Propagation delay, inter-element delay skew, and intra-element delay skew.....	10
5.3.6 Near-end crosstalk (NEXT).....	10
5.3.7 Attenuation to crosstalk ratio far-end (ACR-F) .....	11
5.3.8 Transverse conversion loss (TCL) .....	11
5.3.9 Equal level transverse conversion transfer loss (ELTCTL) .....	11
5.3.10 Screening attenuation.....	11
5.3.11 Coupling attenuation.....	11
5.4 Mechanical and dimensional requirements and test methods .....	11
5.4.1 General .....	11
5.4.2 Measurement of dimensions .....	11
5.4.3 Elongation at break of the conductor.....	11
5.4.4 Tensile strength of the insulation .....	11

- 5.4.5 Elongation at break of the sheath ..... 11
- 5.4.6 Tensile strength of the sheath..... 11
- 5.4.7 Crush test of the cable..... 11
- 5.4.8 Impact test of the cable ..... 11
- 5.4.9 Repeated bending of the cable ..... 12
- 5.4.10 Tensile performance of the cable ..... 12
- 5.5 Environmental tests ..... 12
  - 5.5.1 Shrinkage of the insulation ..... 12
  - 5.5.2 Wrapping test of the insulation after thermal ageing ..... 12
  - 5.5.3 Bending test of the insulation at low temperature..... 12
  - 5.5.4 Tensile strength and elongation of the sheath after ageing ..... 12
  - 5.5.5 Sheath pressure test at high temperature ..... 12
  - 5.5.6 Cold bend test of the cable ..... 12
  - 5.5.7 Heat shock test..... 12
  - 5.5.8 Flame propagation characteristics of a single cable ..... 12
  - 5.5.9 Flame propagation characteristics of bunched cables ..... 12
  - 5.5.10 Smoke generation..... 12
- Bibliography..... 13
  
- Table 1 – Supported IEEE 802.3 Ethernet-over-twinax implementations, configurations.....8
- Table 2 – Supported IEEE 802.3 Ethernet-over-twinax implementations, transmission requirements.....9

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## TWINAX CABLES FOR DIGITAL COMMUNICATIONS –

**Part 2: Family specification – Cable for Ethernet-over-twinax physical interfaces**

## 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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62783-2 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.

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

FDIS	Report on voting
46C/1103/FDIS	46C/1108/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This International Standard is to be used in conjunction with the first edition of IEC 62783-1:—<sup>1</sup>.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

---

<sup>1</sup> Under preparation. Stage at the time of publication: IEC FDIS 62783-1:2018.

## INTRODUCTION

This International Standard is a family specification. It constitutes Part 2 of the IEC 62783 series, which covers specific characteristics of twinax cables.

This document describes cables that are in compliance with the generic twinax cable requirements given in IEC 62783-1.

The family of twinax cables covered in this document are specifically intended for interconnection of Ethernet links over twinax cables, which are implemented using twinax link segments in accordance with IEEE Std 802.3™ Ethernet physical interfaces, for example, 10GBASE-CX4.

## TWINAX CABLES FOR DIGITAL COMMUNICATIONS –

### Part 2: Family specification – Cable for Ethernet-over-twinax physical interfaces

#### 1 Scope

This part of IEC 62783 covers indoor cables and specifies the definitions and requirements of twin-axial cables used in digital communication systems.

This document, which is a family specification, gives additional requirements for twinax cables for use in IEEE Std 802.3 Ethernet physical interfaces.

This document gives requirements and transmission characteristics for single twinax elements as well as for multiple twinax elements within the same sheath, i.e. "twinax cable".

#### 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 TR 61156-1-22:2009, *Multicore and symmetrical pair/quad cables for digital communications – Part 1-2: Electrical transmission characteristics and test methods of symmetrical pair/quad cables*

IEC TR 61156-1-2:2009/AMD1:2014

IEC 62783-1:—<sup>3</sup>, *Twinax cables for digital communications – Part 1: Generic specification*

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62783-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

---

<sup>2</sup> A consolidated version of this publication exists, comprising IEC TR 61156-1-2:2009 and IEC TR 61156-1-2:2009/AMD 1:2014.

<sup>3</sup> Under preparation. Stage at the time of publication: IEC FDIS 62783-1:2018.