

# INTERNATIONAL STANDARD

**IEC**  
**61156-6**

First edition  
2002-03

---

---

## Multicore and symmetrical pair/quad cables for digital communications –

### Part 6: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Work area wiring – Sectional specification

*Câbles multiconducteurs à paires symétriques et quartes  
pour transmissions numériques –*

*Partie 6:  
Câbles à paires symétriques et quartes avec caractéristiques  
de transmission allant jusqu'à 600 MHz –  
Raccordement de terminal – Spécification intermédiaire*



Reference number  
IEC 61156-6:2002(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** ([www.iec.ch](http://www.iec.ch))

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site ([www.iec.ch/catlg-e.htm](http://www.iec.ch/catlg-e.htm)) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications ([www.iec.ch/JP.htm](http://www.iec.ch/JP.htm)) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: [custserv@iec.ch](mailto:custserv@iec.ch)  
Tel: +41 22 919 02 11  
Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

# IEC 61156-6

First edition  
2002-03

---

---

## Multicore and symmetrical pair/quad cables for digital communications –

### Part 6: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Work area wiring – Sectional specification

*Câbles multiconducteurs à paires symétriques et quartes  
pour transmissions numériques –*

*Partie 6:  
Câbles à paires symétriques et quartes avec caractéristiques  
de transmission allant jusqu'à 600 MHz –  
Raccordement de terminal – Spécification intermédiaire*

© IEC 2002 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

PRICE CODE

**R**

*For price, see current catalogue*

## CONTENTS

FOREWORD.....	4
<b>1 General .....</b>	<b>5</b>
1.1 Scope.....	5
1.2 Normative references .....	6
1.3 Installation considerations.....	6
1.4 Climatic conditions.....	6
<b>2 Definitions, materials and cable construction.....</b>	<b>6</b>
2.1 Definitions .....	6
2.2 Materials and cable construction.....	6
2.2.1 General remarks .....	6
2.2.2 Cable construction .....	6
2.2.3 Conductor.....	6
2.2.4 Insulation.....	7
2.2.5 Colour code of insulation.....	7
2.2.6 Cable element .....	7
2.2.7 Screening of cable element.....	7
2.2.8 Cable make-up .....	7
2.2.9 Screening of cable core .....	7
2.2.10 Sheath.....	7
2.2.11 Colour of sheath .....	8
2.2.12 Identification .....	8
2.2.13 Finished cable .....	8
<b>3 Characteristics and requirements.....</b>	<b>8</b>
3.1 General remarks.....	8
3.2 Electrical characteristics .....	8
3.2.1 Conductor resistance.....	8
3.2.2 Resistance unbalance.....	8
3.2.3 Dielectric strength.....	8
3.2.4 Insulation resistance .....	8
3.2.5 Mutual capacitance.....	9
3.2.6 Capacitance unbalance pair to ground.....	9
3.2.7 Transfer impedance.....	9
3.2.8 Resistance of the screen.....	9
3.3 Transmission characteristics.....	9
3.3.1 Velocity of propagation, delay and differential delay (delay skew) .....	9
3.3.2 Attenuation .....	10
3.3.3 Unbalance attenuation .....	11
3.3.4 Near-end crosstalk.....	12
3.3.5 Far-end crosstalk (FEXT).....	13
3.3.6 Characteristic impedance.....	14
3.3.7 Return loss (RL) .....	15
3.3.8 Screening attenuation .....	15
3.3.9 Coupling attenuation .....	15

3.4	Mechanical and dimensional characteristics and requirements .....	16
3.4.1	Dimensional requirements.....	16
3.4.2	Elongation at break of the conductor .....	16
3.4.3	Elongation at break of the insulation.....	16
3.4.4	Elongation at break of the sheath.....	16
3.4.5	Tensile strength of the sheath .....	16
3.4.6	Crush test of the cable .....	16
3.4.7	Impact test of the cable.....	16
3.4.8	Repeated bending of the cable.....	16
3.4.9	Tensile performance of the cable .....	16
3.5	Environmental characteristics .....	16
3.5.1	Shrinkage of insulation.....	16
3.5.2	Wrapping test of insulation after thermal ageing .....	16
3.5.3	Bending test of insulation at low temperature .....	16
3.5.4	Elongation at break of the sheath after ageing.....	17
3.5.5	Tensile strength of the sheath after ageing.....	17
3.5.6	Sheath pressure test at high temperature.....	17
3.5.7	Cold bend test of the cable .....	17
3.5.8	Heat shock test.....	17
3.5.9	Flame propagation characteristics of a single cable.....	17
3.5.10	Flame propagation characteristics of bunched cables.....	17
3.5.11	Acid gas evolution.....	17
3.5.12	Smoke generation.....	17
3.5.13	Toxic gas emission .....	17
3.5.14	Combined flame and smoke test .....	17
4	Introduction to the blank detail specification .....	17

IEC 61156-6:2002

<https://standards.iteh.ai/standards/iec/443e91e3-55f1-4c13-9881-c94d14a0d431/iec-61156-6-2002>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES  
FOR DIGITAL COMMUNICATIONS –**

**Part 6: Symmetrical pair/quad cables  
with transmission characteristics up to 600 MHz –  
Work area wiring – Sectional specification**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61156-6 has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors and accessories for communication and signalling.

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

FDIS	Report on voting
46C/512/FDIS	46C/518/RVD

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

This standard should be read in conjunction with IEC 61156-1.

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

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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

## MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS –

### Part 6: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Work area wiring – Sectional specification

## 1 General

### 1.1 Scope

This sectional specification relates to IEC 61156-1: *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*. The cables described herein are specifically intended to construct patch, equipment, and work area cords for class D, E and F channels, as defined in IEC 11801:2000, *Information technology – Generic cabling for customer premises* (see Table 1).

It covers individually screened (STP), common screened (FTP) and unscreened (UTP) pairs or quads having a pair count of four pairs or less. The transmission characteristics of the cables are specified at 20 °C. See Annex A of IEC 61156-5 for a discussion of cable performance at temperatures higher than 20 °C.

The designation "Category 5e" is used herein to describe an enhanced Category 5 cable and is used in the same context as "Category 5" in ISO/IEC 11801. This enhanced cable is designated Category 5e to differentiate it from the Category 5 cables described in IEC 61156-2, 61156-3, and 61156-4. Although both Category 5 and 5e cables are characterized to 100 MHz and can be used for Class D channels, Category 5e has additional requirements, as compared to Category 5, which make it preferred for use in systems utilizing four pairs transmitting simultaneously in both directions.

**Table 1 – Cable categories**

Cable designation	Maximum reference frequency MHz	Channel designation
Category 5e	100 <sup>a</sup>	D
Category 6	250	E
Category 7	600	F

<sup>a</sup> Some characteristics are measured up to 125 MHz in order to comply with IEEE's request to specify the electrical performances up to a frequency 25 % higher than the referenced frequency.

These cables are intended for various new communication systems that are under development and which use as many as four pairs simultaneously. In this sense, this sectional specification provides the cable characteristics required by system developers to evaluate new systems.

The cables covered by this sectional specification are intended to operate with voltages and currents normally encountered in communication systems. These cables are not intended to be used in conjunction with low impedance sources, for example, the electric power supplies of public utility mains.

Though the recommended temperature range during installation is 0 °C +50 °C, the actual temperature range during installation should be indicated in the detail specification.

## 1.2 Normative references

The following referenced documents are indispensable for the application 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 61156-5, *Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification*

ISO/IEC 11801:2000, *Information technology – Generic cabling for customer premises*

Publications listed in IEC 61156-1 also apply.

## 1.3 Installation considerations

Installation considerations will be addressed in a future revision of 1.3 of IEC 61156-1.

## 1.4 Climatic conditions

Under static conditions, the cables shall operate in the temperature range from  $-40\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$ . The temperature dependence of the cables is specified for screened and unscreened cables, and should be taken into account for the design of an actual cabling system. Patch cables are susceptible to moisture pick-up. This in turn impacts also on the attenuation. Therefore the maximum increase in attenuation due to long term exposure to humidity is specified.

## 2 Definitions, materials and cable construction

### 2.1 Definitions

See 2.1 of IEC 61156-1.

### 2.2 Materials and cable construction

#### 2.2.1 General remarks

The choice of materials and cable construction shall be suitable for the intended application and installation of the cable. Particular care shall be taken to meet any special requirements for fire performance (such as burning properties, smoke generation, evolution of halogen gas, etc.).

#### 2.2.2 Cable construction

The cable construction shall be in accordance with the details and dimensions given in the relevant detail specification.

#### 2.2.3 Conductor

The conductor shall be solid or stranded annealed copper conductor, in accordance with 2.2.3 of IEC 61156-1 and shall have a nominal diameter between 0,4 mm to 0,65 mm. The stranded conductor should have preferably seven strands. Conductor diameter up to 0,8 mm may be used if compatible with the connecting hardware.

The conductor shall be plain or tinned.

The conductor may consist of one or more elements of thin copper or copper alloy tape, which shall be applied helically over a fibrous thread (tinsel cord). In this case, joints in the complete element shall not be permitted.



#### 2.2.4 Insulation

The conductor shall be insulated with a suitable thermoplastic material. Examples of suitable materials are

- polyolefin;
- fluoropolymer;
- low-smoke zero-halogen thermoplastic material.

The insulation may be solid or cellular with or without a solid dielectric skin. The insulation shall be continuous and shall have a thickness such that the completed cable meets the specified requirements. The nominal thickness of the insulation shall be compatible with the method of conductor termination.

#### 2.2.5 Colour code of insulation

The colour code is not specified but shall be indicated in the relevant detail specification. The colours shall be readily identifiable and shall correspond reasonably with the standard colours shown in IEC 60304.

NOTE It is acceptable to mark or stripe the "a" wire with the colour of the "b" wire to facilitate pair identification.

#### 2.2.6 Cable element

The cable element shall be a pair or quad adequately twisted.

#### 2.2.7 Screening of cable element

When required, the screen for the cable element shall be in accordance with 2.2.7 of IEC 61156-1.

#### 2.2.8 Cable make-up

A cross web or any other spacer may be used to separate the cable elements. The cable elements, including cross webs or spacers, shall be assembled to form the cable core.

The core of the cable may be wrapped with a protective layer of non-hygroscopic material.

#### 2.2.9 Screening of cable core

When required by the relevant detail specification, a screen for the cable core shall be provided.

The screen shall be in accordance with 2.2.9 of IEC 61156-1.

#### 2.2.10 Sheath

The sheath material shall consist of a suitable thermoplastic material.

Examples of suitable materials are

- polyolefin;
- PVC;
- fluoropolymer;
- low-smoke zero-halogen thermoplastic material.

The sheath shall be continuous, having a thickness as uniform as possible. A non-metallic ripcord may be provided. When provided, the ripcord shall be non-hygroscopic.

### 2.2.11 Colour of sheath

The colour of the sheath is not specified, but it should be stated in the relevant detail specification.

### 2.2.12 Identification

Each length of cable shall be identified as to the manufacturer, and when required, the year of manufacture, using one of the following methods:

- a) appropriately coloured threads or tapes;
- b) with a printed tape;
- c) printing on the cable core wrapping;
- d) marking on the sheath.

Additional markings, such as length marking, etc., are permitted on the cable sheath. If used, such markings should be indicated in the relevant detail specification.

### 2.2.13 Finished cable

The finished cable shall be adequately protected for storage and shipment.

## 3 Characteristics and requirements

### 3.1 General remarks

This clause lists the characteristics and minimum requirements of a cable complying with this sectional specification. Test methods shall be in accordance with clause 3 of IEC 61156-1. A detail specification may be prepared to identify a specific product and its performance capabilities (see clause 4).

### 3.2 Electrical characteristics

The tests shall be carried out on a cable length of not less than 100 m, unless otherwise specified.

#### 3.2.1 Conductor resistance

When measured in accordance with 5.1 of IEC 60189-1, the maximum loop resistance shall not exceed 29,0  $\Omega$ /100 m of cable.

#### 3.2.2 Resistance unbalance

The conductor resistance unbalance shall not exceed 2 %.

#### 3.2.3 Dielectric strength

The test shall be performed on conductor/conductor and, where screen(s) are present, conductor/screen with 1,0 kV d.c. for 1 min or, alternately, with 2,5 kV d.c. for 2 s. An a.c. voltage may be used. The a.c. voltage levels in these cases shall be 0,7 kV a.c. for 1 min or, alternately, 1,7 kV a.c. for 2 s.

#### 3.2.4 Insulation resistance

The test shall be performed both on

- conductor/conductor;
- conductor/screen (when present).

The minimum insulation resistance at 20 °C shall not be less than 5 000 M $\Omega$ ·km.