

INTERNATIONAL STANDARD



**Connectors for electrical and electronic equipment –
Part 7: Detail specification for up to 7 ways including PE or FE (data/power) and
shield pin, free and fixed circular connectors for balanced single-pair data
transmission with current-carrying capacity – Mechanical mating information,
pin assignment and additional requirements for type 7**

<https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5f5-4ff5-a679-7b95727a9df1/iec-63171-7-2023>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 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.

IEC Secretariat
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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 Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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 63171-7:2023](https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5b-41b5-a679-7b95727a9d11/iec-63171-7-2023)

<https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5b-41b5-a679-7b95727a9d11/iec-63171-7-2023>

INTERNATIONAL STANDARD



**Connectors for electrical and electronic equipment –
Part 7: Detail specification for up to 7 ways including PE or FE (data/power) and
shield pin, free and fixed circular connectors for balanced single-pair data
transmission with current-carrying capacity – Mechanical mating information,
pin assignment and additional requirements for type 7**

<https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5f5-4ff5-a679-7b95727a9df1/iec-63171-7-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.220.10

ISBN 978-2-8322-7003-5

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

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	10
4 Technical information	10
4.1 Systems of levels – Compatibility levels, according to IEC 61076-1	10
4.1.1 Performance level.....	10
4.1.2 Compatibility levels according to IEC 61076	10
4.2 Classification into climatic categories.....	10
4.3 Clearance and creepage distances	10
4.4 Current-carrying capacity	11
4.5 Marking.....	11
4.6 Safety aspects	11
5 Dimensional information	11
5.1 General.....	11
5.2 Codings	11
5.3 Styles	13
5.3.1 Overview	13
5.3.2 Styles 6J-P12C, 6J-M12C and 6J-C12C	14
5.3.3 Styles 6J-P12CI, 6J-M12CI and 6J-C12CI	15
5.3.4 Styles 6P-P12C, 6P-M12C.....	15
5.3.5 Styles 6P-P12CI and 6P-M12CI	16
5.4 Interface dimensions.....	16
5.5 Gauges.....	21
6 Characteristics	22
6.1 General.....	22
6.2 Pin assignment	22
6.3 Classification into climatic category	23
6.4 Electrical characteristics	24
6.4.1 Creepage and clearance distances	24
6.4.2 Voltage proof.....	25
6.4.3 Voltage rating	25
6.4.4 Current-temperature derating.....	26
6.4.5 Current rating	26
6.4.6 Interface contact resistance.....	26
6.4.7 Input to output DC resistance	26
6.4.8 Input to output DC resistance unbalance	26
6.4.9 Insulation resistance.....	27
6.4.10 Impedance.....	27
6.5 Transmission performance.....	27
6.5.1 General	27
6.5.2 Insertion loss	27
6.5.3 Return loss	27
6.5.4 Propagation delay.....	27
6.5.5 Transverse conversion loss	27

6.5.6	Transverse conversion transfer loss	27
6.5.7	Transfer impedance	27
6.5.8	Coupling attenuation	27
6.5.9	Power sum alien (exogenous) NEXT	28
6.5.10	Power sum alien (exogenous) FEXT	28
6.6	Mechanical characteristics	28
6.6.1	IP degree of protection	28
6.6.2	Mechanical operation	28
6.6.3	Effectiveness of connector coupling devices	28
6.6.4	Insertion and withdrawal forces	28
6.6.5	Polarizing and keying method	28
6.6.6	Dynamic stress	28
7	Tests and test schedule	28
7.1	General	28
7.2	Mounting of specimens	29
7.2.1	General	29
7.2.2	Arrangement for contact resistance measurement	29
7.2.3	Arrangement for dynamic stress tests	30
7.2.4	Wiring of specimens	30
7.3	Test procedures and measuring methods	30
7.4	Preconditioning	30
7.5	Test schedules	30
7.6	Basic (minimum) test schedule	30
7.7	Full test schedule	30
Annex A (informative) Safety considerations for cord sets made of connectors in accordance with this document		32
Bibliography		33
Figure 1 – Type 7 connector overview		7
Figure 2 – Styles 6J-P12C, 6J-M12C, 6J-C12C overall dimensions		15
Figure 3 – Styles 6J-P12CI, 6J-M12CI and 6J-C12CI overall dimensions		15
Figure 4 – Styles 6P-P12C and 6P-M12C overall dimensions		16
Figure 5 – Styles 6P-P12CI and 6P-M12CI overall dimensions		16
Figure 6 – Mating dimensions for the codings Type I to V and styles with male contacts (at the example of coding Type I)		17
Figure 7 – Dimensions of PE pin for the codings Type I to V and styles with male contacts (at the example of coding Type IV)		18
Figure 8 – Mating dimensions for the codings Type VI and Type VII and styles with male contacts (at the example of coding Type VII)		20
Figure 9 – Mating dimensions for the styles with female contacts (at the example of codings Type I and Type IV)		21
Figure 10 – Gauge dimensions		22
Figure 11 – Pin assignments, front views, Types I and II		22
Figure 12 – Pin assignments, front views, M12, Types III, IV and V		23
Figure 13 – Pin assignments, front views, M12, Types VI and VII		23
Figure 14 – Contact resistance arrangement		29
Figure 15 – Arrangement for vibration and mechanical shock tests		30

Table 1 – Codings.....	12
Table 2 – Styles.....	14
Table 3 – Dimensions for Figure 6 and Figure 7.....	18
Table 4 – Dimensions for Figure 8.....	20
Table 5 – Dimensions for Figure 9.....	21
Table 6 – Gauges.....	22
Table 7 – Pin assignments.....	23
Table 8 – Climatic category.....	24
Table 9 – Creepage and clearance distances.....	24
Table 10 – Voltage proof.....	25
Table 11 – Voltage ratings.....	25
Table 12 – Current ratings of connectors.....	26
Table 13 – Interface contact resistance.....	26
Table 14 – Insulation resistance.....	27
Table 15 – Insertion and withdrawal forces.....	28
Table 16 – Replacement for AP8 in test group AP of IEC 63171.....	31
Table 17 – Additional tests in test group AP of IEC 63171.....	31

IEC STANDARD PREVIEW
(standards.iteh.ai)

[IEC 63171-7:2023](https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5f5-4ff5-a679-7b95727a9df1/iec-63171-7-2023)

<https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5f5-4ff5-a679-7b95727a9df1/iec-63171-7-2023>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT –**Part 7: Detail specification for up to 7 ways including PE or FE (data/power) and shield pin, free and fixed circular connectors for balanced single-pair data transmission with current-carrying capacity – Mechanical mating information, pin assignment and additional requirements for type 7**

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.

IEC 63171-7 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment. It is an International Standard.

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

Draft	Report on voting
48B/3033/FDIS	48B/3044/RVD

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.

A list of all parts in the IEC 63171 series, published under the general title *Connectors for electrical and electronic equipment*, can be found on the IEC website.

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.

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

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

(standards.iteh.ai)

IEC 63171-7:2023

<https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5f5-4ff5-a679-7b95727a9dfl/iec-63171-7-2023>

INTRODUCTION

IEC 63171 is the base specification of the whole series. Subsequent specifications do not duplicate information given in the base document, but list only additional requirements. For the complete specification regarding connectors described in this Part of the IEC 63171 series, read this document in conjunction with IEC 63171.

A general overview about the connectors in this document is shown in Figure 1.

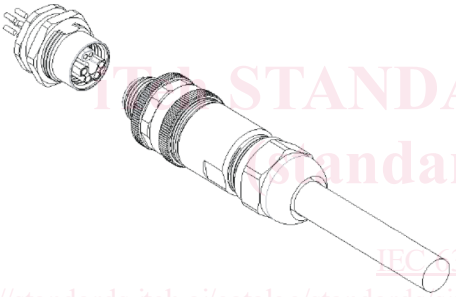

<p>IEC SC 48B – Electrical connectors</p> <p>Specification available from:</p> <p>IEC General secretariat or from the addresses shown on the inside cover.</p>	<p>IEC 63171-7 Ed. 1</p>
<p>DETAIL SPECIFICATION in accordance with IEC 61076-1</p>	<p>M12 screw locking or push-pull locking (or both)</p>
 <p>IEC</p>	<p>Circular connectors, size 12, with 4 up to 7 ways including PE or FE (according to coding) for power and data transmission, either</p> <ul style="list-style-type: none"> – with M12 screw-locking mechanism (styles with M12 in the name), or – with a quick-locking push-pull mechanism with a size derived from that (styles with P12 in the name), or – with both mechanisms combined (styles with C12 in the name). <p>Multiple mating interfaces, each associated with a coding referred to as "type I" through "type VII", differing by power transmission capabilities and intents.</p> <p>2 ways + additional shield pin (to be connected to the cable sheath) support balanced differential data transmission with frequencies up to 600 MHz, Category B as per IEC 63171.</p> <p>Free cable connectors:</p> <ul style="list-style-type: none"> – male or female, – straight connectors, – rewirable or non-rewirable.
 <p>IEC</p>	<p>Fixed connectors:</p> <ul style="list-style-type: none"> – male or female, – single-hole mounting. <p>With circular mounting orientation</p>

Figure 1 – Type 7 connector overview

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT –

Part 7: Detail specification for up to 7 ways including PE or FE (data/power) and shield pin, free and fixed circular connectors for balanced single-pair data transmission with current-carrying capacity – Mechanical mating information, pin assignment and additional requirements for type 7

1 Scope

This part of IEC 63171 covers shielded free and fixed circular connectors with 4 ways up to 7 ways for power and data transmission and specifies the common dimensions, mechanical, electrical and transmission characteristics and environmental requirements as well as test specifications respectively.

The connectors described in this document are either equipped with an M12 screw-locking mechanism (styles with M12 in the name) or a quick-locking push-pull mechanism with a size derived from that (styles with P12 in the name) or both mechanisms combined (styles with C12 in the name). For the sake of simplicity, the connectors' size is denoted as "size 12" in this document.

This document provides multiple mating interfaces each of which is associated with a coding preventing the mating of incompatible male and female connectors. These codings are referred to as "Type x", where "x" is represented by a Roman numeral.

For all codings, two ways and the additional shield pin, which is intended to be connected to the cable screen, support differential data transmission with frequencies up to 600 MHz by meeting the requirements of Category B, as defined in IEC 63171.

NOTE 1 Connecting the shield pin to the cable sheath is also required for data transmission with 20 MHz (IEC 63171, Category A).

NOTE 2 The connectors are intended to be used for single-pair Ethernet (SPE) according to the following IEEE Standards: 10BASE-T1 (IEEE 802.3cg), 100BASE-T1 (IEEE 802.3bw), 1000BASE-T1 (IEEE 802.3bp).

NOTE 3 Power over Data line (PoDL) power supply according to IEEE 802.3bu can be optionally used for the two ways intended for data transmission, even in addition to the power supply provided through the dedicated power ways.

The individual codings differ by their power transmission capabilities and intents. The additional ways provide for DC power transmission with up to 63 V/16 A and 600 V/16 A or AC power transmission with rated voltage and rated current up to 600 V/16 A (single-phase) or 480 V/8 A (three-phase). See Table 11 and Table 12 for the voltage and current ratings, and Table 5 for the pin assignments for the individual codings.

Some codings feature a PE pin for safety purposes.

The PE pin needs to be connected to all accessible metal parts.

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 60050-581, *International Electrotechnical Vocabulary – Chapter 581: Electromechanical components for electronic equipment*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60352 (all parts), *Solderless connections*

IEC 60512-1, *Connectors for electronic equipment – Tests and measurements – Part 1: General*

IEC 60512-1-1, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

IEC 60512-1-2, *Connectors for electronic equipment – Tests and measurements – Part 1-2: General examination – Test 1b: Examination of dimension and mass*

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-3-1, *Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance*

IEC 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof*

IEC 60512-5-2, *Connectors for electronic equipment – Tests and measurements – Part 5-2: Current-carrying capacity tests – Test 5b: Current-temperature derating*

IEC 60512-11-1, *Connectors for electrical and electronic equipment – Tests and measurements – Part 11-1: Climatic tests – Test 11a: Climatic sequence*

IEC 60512-11-9, *Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat*

IEC 60512-11-10, *Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold*

IEC 60512-11-12, *Connectors for electronic equipment – Tests and measurements – Part 11-12: Climatic tests – Test 11m: Damp heat, cyclic*

IEC 60512-13-2, *Connectors for electronic equipment – Tests and measurements – Part 13-2: Mechanical operation tests – Test 13b: Insertion and withdrawal forces*

IEC 60512-13-5, *Connectors for electronic equipment – Tests and measurements – Part 13-5: Mechanical operation tests – Test 13e: Polarizing and keying method*

IEC 60512-28-100, *Connectors for electronic equipment – Tests and measurements – Part 28-100: Signal integrity tests up to 1000 MHz on 60603-7 and 61076-3 series connectors – Tests 28a to 28g*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 61076-1:2006, *Connectors for electronic equipment – Product requirements – Part 1: Generic specification*

IEC 61076-3, *Connectors for electronic equipment – Product requirements – Part 3: Sectional specification for rectangular connectors*

IEC 61984:2008, *Connectors – Safety requirements and tests*

IEC TR 63040, *Guidance on clearances and creepage distances in particular for distances equal to or less than 2 mm – Test results of research on influencing parameters*

IEC 63171:2021, *Connectors for Electrical and Electronic Equipment – Shielded or unshielded free and fixed connectors for balanced single-pair data transmission with current carrying capacity; General requirements and tests*

ISO 21920-1:2021, *Geometrical product specifications (GPS) – Surface texture: Profile – Part 1: Indication of surface texture*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-581, IEC 60512-1, IEC 61076-1, and IEC 61076-3 apply.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>
<https://standards.iteh.ai/catalog/standards/sist/462d65d1-e5f5-4ff5-a679-7b95727a9df1/iec-63171-7-2023>

4 Technical information

4.1 Systems of levels – Compatibility levels, according to IEC 61076-1

4.1.1 Performance level

Connectors according to this document are classified by mating performance level (MPL). See 6.6.2 for details.

4.1.2 Compatibility levels according to IEC 61076

a) Intermateability

Intermateability (level 2 of IEC 61076-1) standardizes only dimensions of electrical and mechanical interfaces. Intermateability shall be ensured by application of the "Go" and "No-Go" gauge requirements in the standards that may be referenced, and adherence to the dimensional requirements within.

b) Interoperability

Interoperability of different connectors shall be assured by compliance with the specified interface dimensions and by compliance with the requirements in 6.4 and 6.5 proven by the respective testing sequences in Clause 7.

4.2 Classification into climatic categories

See 6.3.

4.3 Clearance and creepage distances

See 6.4.1.