IEC 61918

Edition 4.2 2024-03
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Industrial communication networks – Installation of communication networks in industrial premises



IEC 61918:2018-09+AMD1:2022-03+AMD2:2024-03 CSV(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 33.020; 35.240.50

ISBN 978-2-8322-8571-8

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INDUSTRIAL COMMUNICATION NETWORKS –

Installation of communication networks in industrial premises

FOREWORD

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IEC 61918 edition 4.2 contains the fourth edition (2018-09) [documents 65C/928/FDIS and 65C/933/RVD], its amendment 1 (2022-03) [documents 65C/1141/FDIS and 65C/1162/RVD] and its amendment 2 (2024-03) [documents 65C/1282/FDIS and 65C/1290/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61918 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This fourth edition constitutes a technical revision.

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

a) the reference to ISO/IEC 24702 has been replaced with reference to the new ISO/IEC 11801-3; this affects Table 2;
b) some terms and abbreviated terms have been modified in Clause 3;
c) Subclauses 4.1.2, 4.4.2.5, 4.4.3.4.1 and 5.7 have been updated;
d) Figure 2 and Figure 3 have been updated; Figure 13, Figure 16, Figure 30 and Figure 49 have been added;
e) Table 7 has been updated;
f) Annex D and Annex M have been extended to cover additional communication profile families; Annex H has been extended to cover the M12-8 X-coding connector use;
g) Annex O has been modified by including references to the new edition of the ISO/IEC 11801 series, ISO/IEC TR 11801-9902 and ISO/IEC 14763-4;
h) Annex P has been added.

This standard is to be used in conjunction with the IEC 61784-5 series with regard to the installation of communication profiles (CPs).

Those standards of the IEC 61784-5 series which are still specified for use in conjunction with IEC 61918:2013 can also be used in conjunction with this edition, provided that the user takes into account the fact that the reference to ISO/IEC 24702 has been replaced with a reference to ISO/IEC 11801-3:2017.

NOTE This solution applies for the installation profiles that are affected only by this modified reference.

This standard is referenced by ISO/IEC 14763-2, which covers installation of generic cabling outside the automation islands in industrial premises.

This standard was developed in cooperation with ISO/IEC JTC1/SC25 which is responsible for the ISO/IEC 11801 series.

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

The committee has decided that the contents of this document and its amendments 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

INTRODUCTION

Process and factory automation rely increasingly on communication networks and fieldbuses that are inherently designed to cope with the specific environmental conditions of the industrial premises. The networks and fieldbuses provide for an effective integration of applications among the several functional units of the plant/factory. One of the benefits of integrating field-generated data with higher-level management systems is to reduce production costs. At the same time, integrated data helps to maintain or even increase the quantity and quality of production. A correct network installation is an important prerequisite for communications availability, reliability, and performance. This requires proper consideration of safety and security conditions and environmental aspects such as mechanical, liquid, particulate, climatic, chemicals and electromagnetic interference.

The specifications of these communication networks are provided in the following documents.

ISO/IEC 11801-3 specifies design of generic telecommunications infrastructures within industrial premises and provides the foundations for some of the transmission performance specifications of this document. ISO/IEC 11801-3 specifies only the raw bandwidth capability of a channel; it does not specify useful data transfer rate for a specific network using that channel or expected errors after taking account of interference during the communication process, as is needed for industrial automation.

The IEC 61158 fieldbus standard and IEC 62026-3 and their companion standard IEC 61784-1 and IEC 61784-2 jointly specify several Communication Profiles (CPs) suitable for industrial automation. These CPs specify a raw bandwidth capability and in addition, they specify bit modulation and encoding rules for their fieldbus. Some profiles also specify target levels for useful data transfer rate, and maximum values for errors caused by interference during the communication process.

This document provides a common point of reference for the installation of the media of most used industrial communication networks for most industrial sites.

This document provides a consistent set of installation rules for industrial automation islands where control applications reside. In addition, it offers support for the definition and installation of the interfaces between automation island networks and generic cabling.

One of the problems it seeks to solve is the situation created when different parts of a large automation site are provided by suppliers that use non-homogeneous installation guidelines having different structures and contents. This lack of consistency greatly increases the potential for errors and mismatch situations liable to compromise the communication system.

This document was developed by harmonising the approaches of several user groups and industrial consortia.

The document covers the life cycle of an installation in the following clauses (see the map of the document in Figure 1):

- Clause 4: Installation planning;
- Clause 5: Installation implementation;
- Clause 6: Installation verification and acceptance test;
- Clause 7: Installation administration;
- Clause 8: Installation maintenance and installation troubleshooting.

The methods described in these clauses are written in such a way as to provide installation guidance for a wide range of technician skills.

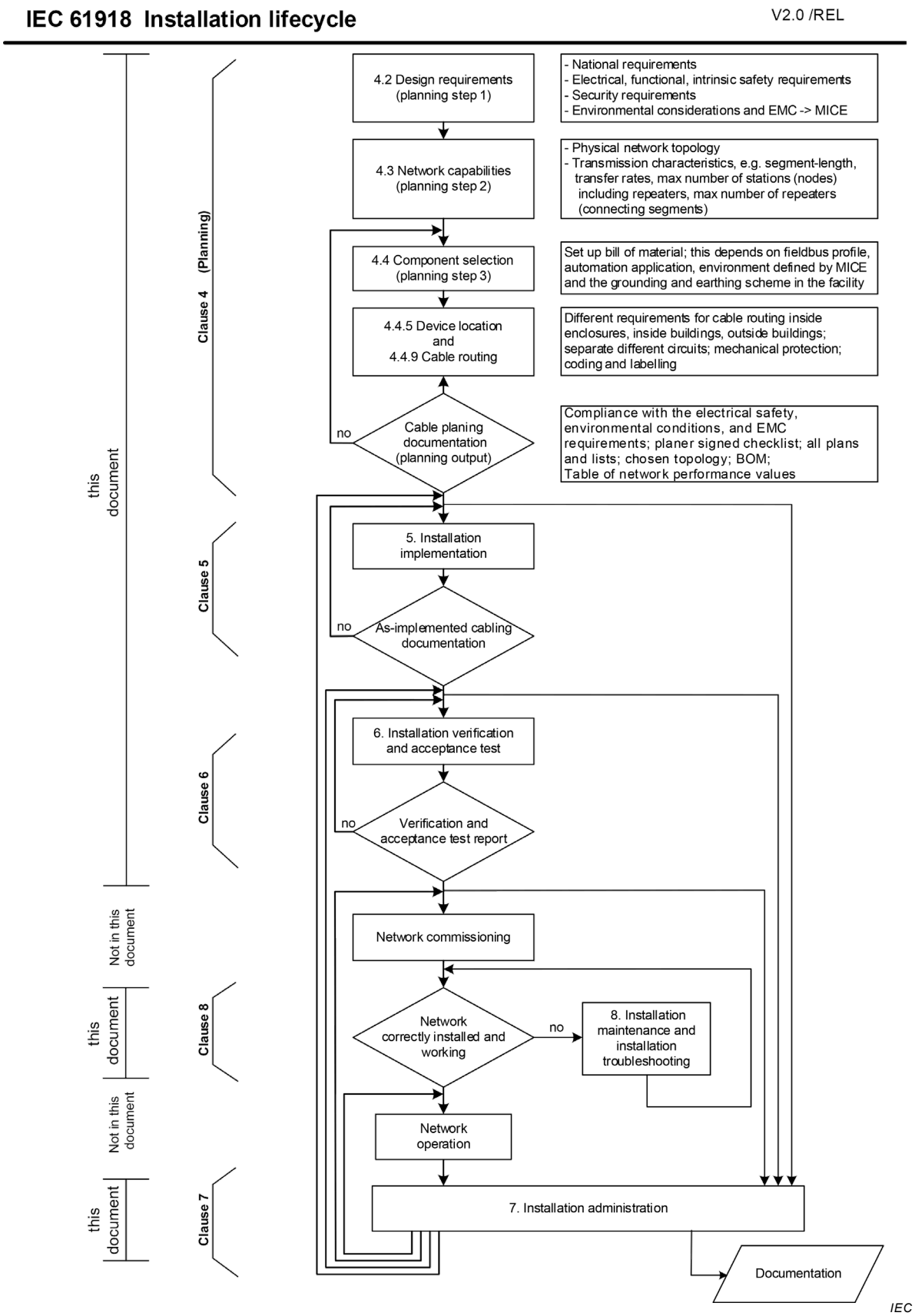


Figure 1 – Industrial network installation life cycle

The installation of a communication system is supported by this document used in conjunction with the relevant installation profile. The installation profile establishes the technology-specific

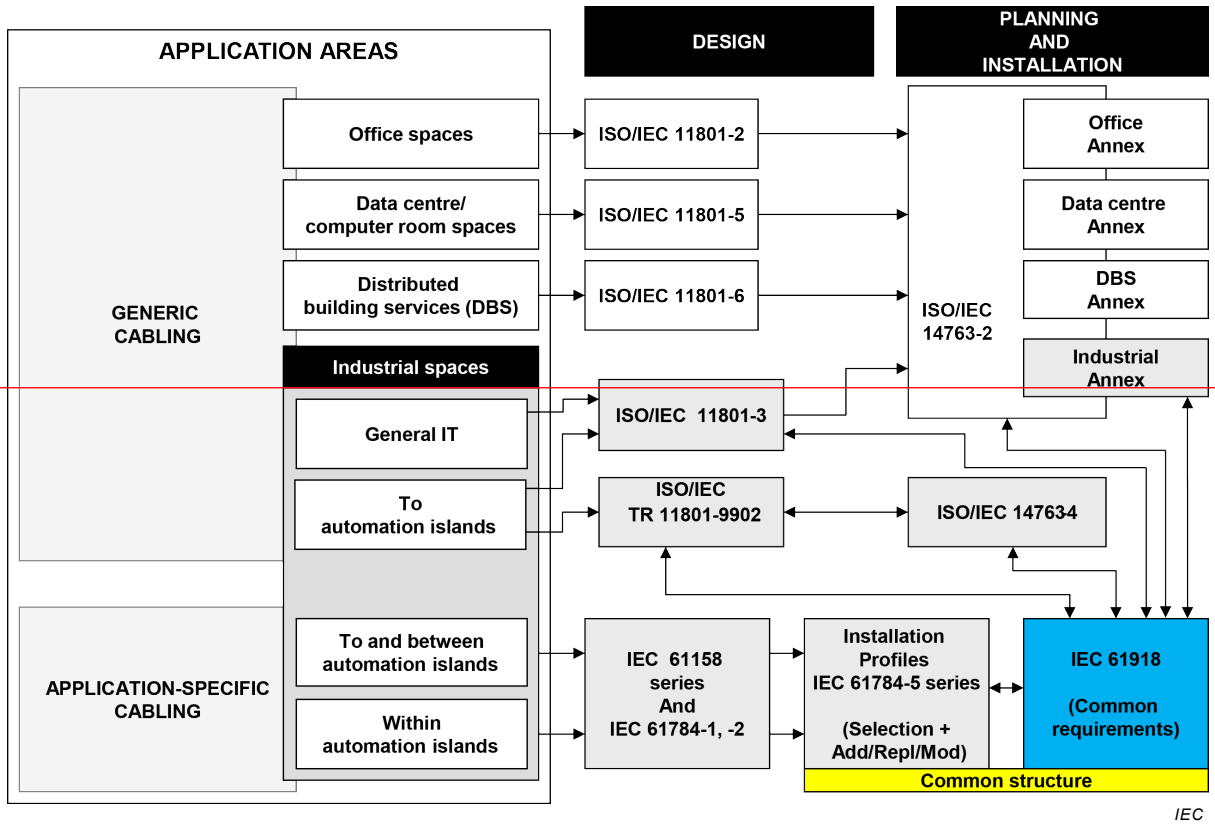
requirements in terms of which requirements apply as they are in this document, or which have been extended, modified, or replaced.

For the fieldbuses that are defined in the IEC 61784 (all parts) as communication profiles (CPs) of the communication profile families (CPF), the installation is specified in the installation profiles that are available in the IEC 61784-5-n documents, where n is the CPF number.
IEC 61158-1 describes the relationship between the fieldbus and the CPs and the relevant installation profiles (see Figure 2).

Those documents of IEC 61784-5 (all parts) that are still specified for use in conjunction with IEC 61918:2013 can also be used in conjunction with this edition 2018, provided that the user takes into account the fact that the reference to ISO/IEC 24702 has been replaced with a reference to ISO/IEC 11801-3:2017.

NOTE This solution applies for the Installation profiles that are affected only by this modified reference

For the installation of generic cabling in industrial premises, IEC 61918 is referenced to by ISO/IEC 14763-2 (see Figure 2).



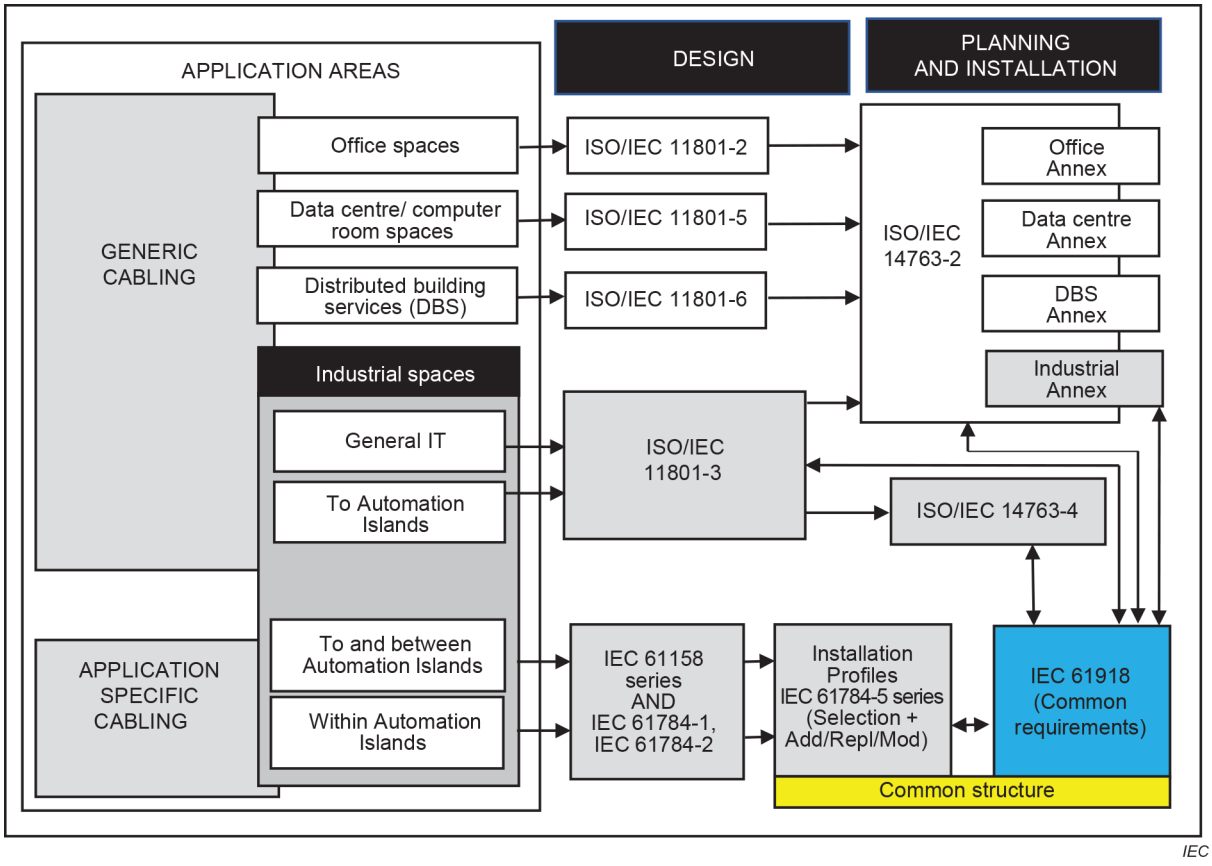


Figure 2 – Standards relationships

One of the advantages of this structure is that the users of a network know which installation requirements are common to most networks and which are specific to a particular network.

Every single plant/factory has its own installation needs in accordance with the specific critical conditions that apply to the specific application. This document and its companion standards described above provide a set of mandatory installation requirements ("shalls") and a number of recommendations ("shoulds"). It is up to the owner of the specific industrial enterprise to explicitly request that the cabling installation be implemented in accordance with these standards and to list all recommendations that shall be considered as mandatory requirements for the specific case.

INTRODUCTION to Amendment 1

This Amendment 1 describes the installation in the critical environment of industrial premises of balanced 1-pair networks that use cabling in connection with Ethernet specified in 1000BASE-T1 type A, which allows bidirectional signal transmission at 1 000 Mbit/s up to 15 m, 1000BASE-T1 type B for 1 000 Mbit/s up to 40 m, 100BASE-T1 for 100 Mbit/s up to 15 m, 10BASE-T1S for 10 Mbit/s up to 15 m, 10BASE-T1L for 10 Mbit/s up to 1 000 m.

These balanced 1-pair networks use the industrial versions of 1 000 Mbit/s and 100 Mbit/s ISO/IEC/IEEE 8802-3:2021, and 10 Mbit/s IEEE Std 802.3cg networks.

INTRODUCTION to Amendment 2

This Amendment 2 describes the result of the maintenance activity of IEC 61918:2018 that takes into account the evolution of the technology, which is being considered during the Installation Profiles revision cycle.

The following technical changes were made in IEC 61918:2018/AMD1:2022 and IEC 61918:2018/AMD2:2024:

a) Subclauses 4.1.2, 4.1.3, 4.2.1.2, 4.2.2, 4.2.3.2, 4.3.2.1, 4.3.2.3, 4.4.1.2.1, 4.4.2.2, 4.4.2.5. 4.4.3.1, 4.4.3.2.1, 4.4.3.4.1, 4.4.7.1.4, 4.4.7.3.1, 5.1.1, 5.7, 6.1, 6.2.8.3, 6.3.2.1.2 and 8.3.3 have been updated;

b) Annex O has been modified by replacing the references to ISO/IEC TR 11801-9902 with references to ISO/IEC 11801-3:2017/AMD1:2021;

c) Table B.3 has been updated;

d) Clause B.6 has been added;

e) Annexes D, I, J, K and M have been updated;

f) Annex Q has been added.

INDUSTRIAL COMMUNICATION NETWORKS –

Installation of communication networks in industrial premises

1 Scope

This document specifies basic requirements for the installation of media for communication networks within and between the automation islands, of industrial sites. This document covers balanced and optical fibre cabling. It also covers the cabling infrastructure for wireless media, but not the wireless media itself. Additional media are covered in IEC 61784-5 (all parts).

This document is a companion standard to the communication networks of the industrial automation islands and especially to the communication networks specified in IEC 61158 (all parts) and IEC 61784 (all parts).

In addition, this document covers the connection between the generic telecommunications cabling specified in ISO/IEC 11801-3 and the specific communication cabling of an automation island, where an automation outlet (AO) replaces the telecommunication outlet (TO) of ISO/IEC 11801-3.

NOTE If the interface used at the AO does not conform to that specified for the TO of ISO/IEC 11801-3, the cabling no longer conforms to ISO/IEC 11801-3 although certain features, including performance, of generic cabling may be retained.

This document provides guidelines that cope with the critical aspects of the industrial automation area (safety, security and environmental aspects such as mechanical, liquid, particulate, climatic, chemicals and electromagnetic interference).

~~This document does not recognise implementations of power distribution with or through Ethernet balanced cabling systems.~~

This document deals with the roles of planner, installer, verifier, and acceptance test personnel, administration and maintenance personnel and specifies the relevant responsibilities and/or gives guidance.

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 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-44, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-5-54, *Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors*

IEC 60512-29-100, *Connectors for electronic equipment – Tests and measurements – Part 29-100: Signal integrity tests up to 500 MHz on M12 style connectors – Tests 29a to 29g*

~~IEC 60603 (all parts), *Connectors for electronic equipment*~~

IEC 60603-7 (all parts), *Connectors for electronic equipment – Part 7: Detail specification for 8-way, unshielded, free and fixed connectors*

IEC 60757, *Code for designation of colours*

IEC 60793 (all parts), *Optical fibres*

IEC 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 60794 (all parts), *Optical fibre cables*

IEC 60807-2, *Rectangular connectors for frequencies below 3 MHz – Part 2: Detail specification for a range of connectors, with assessed quality, with trapezoidal shaped metal shells and round contacts – Fixed solder contact types*

IEC 60807-3, *Rectangular connectors for frequencies below 3 MHz – Part 3: Detail specification for a range of connectors with trapezoidal shaped metal shells and round contacts – Removable crimp contact types with closed crimp barrels, rear insertion/rear extraction*

IEC 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61010-2-201, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-201: Particular requirements for control equipment*

IEC 61010-2-203:—[1], *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-203: Particular requirements for industrial communication circuits and communication port interconnection*

IEC 61076-2-101, *Connectors for electronic equipment – Product requirements – Part 2-101: Circular connectors – Detail specification for M12 connectors with screw-locking*

IEC 61076-2-104, *Connectors for electronic equipment – Product requirements – Part 2-104: Circular connectors – Detail specification for circular connectors with M8 screw-locking or snap-locking*

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1 Under preparation. Stage at the time of publication: IEC/ACDV 61010-2-203:2021.

IEC 61076-2-109, *Connectors for electronic equipment – Product requirements – Part 2-109: Circular connectors – Detail specification for connectors with M 12 x 1 screw-locking, for data transmission frequencies up to 500 MHz*

IEC 61076-2-114, *Connectors for electrical and electronic equipment – Product requirements – Part 2-114: Circular connectors – Detail specification for connectors with M8 screw- locking with power contacts and signal contacts for data transmission up to 100 MHz*

IEC 61076-3-122, *Connectors for electrical and electronic equipment – Product requirements – Part 3-122: Detail specification for 8-way, shielded, free and fixed connectors for I/O and data transmission with frequencies up to 500 MHz and current-carrying capacity in industrial environments*

IEC 61076-3-124, *Connectors for electrical and electronic equipment – Product requirements – Part 3-124: Rectangular connectors – Detail specification for 10-way, shielded, free and fixed connectors for I/O and data transmission with frequencies up to 500 MHz*

IEC 61076-3-106, *Connectors for electronic equipment – Product requirements – Part 3-106: Rectangular connectors – Detail specification for protective housings for use with 8-way shielded and unshielded connectors for industrial environments incorporating the IEC 60603-7 series interface*

IEC 61076-3-117, *Connectors for electronic equipment – Product requirements – Part 3-117: Rectangular connectors – Detail specification for protective housings for use with 8-way shielded and unshielded connectors for industrial environments incorporating the IEC 60603-7 series interface – Variant 14 related to IEC 61076-3-106 – Push-pull coupling*

IEC 61156 (all parts), *Multicore and symmetrical pair/quad cables for digital communications*

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

IEC 61156-11, *Multicore and symmetrical pair/quad cables for digital communications – Part 11: Symmetrical single pair cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification*

IEC 61156-12, *Multicore and symmetrical pair/quad cables for digital communications – Part 12: Symmetrical single pair cables with transmission characteristics up to 600 MHz – Work area wiring – Sectional specification*

IEC 61156-13:2023, *Multicore and symmetrical pair/quad cables for digital communications – Part 13: Symmetrical single pair cables with transmission characteristics up to 20 MHz – Horizontal floor wiring – Sectional specification*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61158-2:~~2014~~2023, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61169-8, *Radio-frequency connectors – Part 8: Sectional specification – RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock – Characteristic impedance 50 ohms (type BNC)*

IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components performance standard*

IEC 61753-1, *Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance standards*

IEC 61753-1-3, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1-3: General and guidance for single-mode fibre optic connector and cable assembly for industrial environment, Category I*

IEC 61754-2, *Fibre optic connector interfaces – Part 2: Type BFOC/2,5 connector family*

IEC 61754-4, *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces – Part 4: Type SC connector family*

IEC 61754-20, *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces – Part 20: Type LC connector family*

IEC 61754-22, *Fibre optic connector interfaces – Part 22: Type F-SMA connector family*

IEC 61754-24, *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces – Part 24: Type SC-RJ connector family*

IEC 61784 (all parts), *Industrial communication networks – Profiles*

~~IEC 61784-1: –, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*[2]~~

IEC 61784-1-x, *Industrial networks – Profiles – Part 1-x: Fieldbus profiles*

~~IEC 61784-2: –, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*[3]~~

IEC 61784-2-x, *Industrial networks – Profiles – Part 2-x: Additional real-time fieldbus profiles based on ISO/IEC/IEEE 8802-3*

IEC 61784-3 (all parts), *Industrial communication networks – Profiles – Part 3: Functional safety fieldbuses – General rules and profile definitions*

IEC 61784-5 (all parts), *Industrial communication networks – Profiles – Part 5: Installation of fieldbuses*

IEC 61935-1:~~2015~~2019, *Specification for the testing of balanced and coaxial information technology cabling – Part 1: Installed balanced cabling as specified in ISO/IEC 11801-1 and related standards*

IEC 61935-1-1:2019, *Specification for the testing of balanced and coaxial information technology cabling – Part 1-1: Additional requirements for the measurement of transverse conversion loss and equal level transverse conversion transfer loss*

IEC 61935-2, *Specification for the testing of balanced and coaxial information technology cabling – Part 2: Cords as specified in ISO/IEC 11801 and related standards*

IEC 62439 (all parts), *Industrial communication networks – High availability automation networks*

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~~[2] Under preparation. Stage at the time of publication: IEC/FDIS 61784-1:2018~~

~~[3] Under preparation. Stage at the time of publication: IEC/FDIS 61784-2:2018.~~

IEC 62443 (all parts), *Security for industrial automation and control systems*[4]

IEC 62708, *Documents kinds for electrical and instrumentation projects in the process industry*

IEC 63171-2:2021, *Connectors for electrical and electronic equipment – Part 2: Detail specification for 2-way, shielded or unshielded, free and fixed connectors: mechanical mating information, pin assignment and additional requirements for type 2*

IEC 63171-5:2022, *Connectors for electrical and electronic equipment – Part 5: Detail specification for 2-way M8 and M12 circular connectors, shielded or unshielded, free and fixed – Mechanical mating information, pin assignment and additional requirements for Type 5*

IEC 63171-6, *Connectors for electrical and electronic equipment – Part 6: Detail specification for 2-way and 4-way (data/power), shielded, free and fixed connectors for power and data transmission with frequencies up to 600 MHz*

ISO/IEC/IEEE 8802-3:2021, ~~*Information technology –*~~ *Telecommunications and* ~~*information*~~ *exchange between technology systems – Requirements for local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

ISO/IEC 11801 (all parts), *Information technology – Generic cabling for customer premises*

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

ISO/IEC 11801-3:2017, *Information technology – Generic cabling for customer premises – Part 3: Industrial premises*
ISO/IEC 11801-3:2017/AMD1:2021

~~ISO/IEC TR 11801-9902:2017, *Information technology – Generic cabling for customer premises – Part 9902: Specifications for End-to-end link configurations*~~

ISO/IEC 14763-2:~~2012~~2019, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*
~~ISO/IEC 14763-2:2012/AMD1:2015~~[5]

ISO/IEC 14763-3:2014, *Information technology – Implementation and operation of customer premises cabling – Part 3: Testing of optical fibre cabling*
ISO/IEC 14763-3:2014/AMD1:2018

ISO/IEC 14763-4:~~2018~~2021, *Information technology – Implementation and operation of customer premises cabling – Part 4: Measurement of end-to-end (E2E) links, modular plug terminated links (MPTL) and direct attach cabling*

ISO/IEC TS 29125:2017, *Information Technology – Telecommunications cabling requirements for remote powering of terminal equipment*
ISO/IEC TS 29125:2017/AMD1:2020

EN 50174-2, *Information technology – Cabling installation – Part 2: Installation planning and practices inside buildings*

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4 Check http://webstore.iec.ch for the published parts. Other parts are under consideration.

~~5 A consolidated version of this publication exists, comprising ISO/IEC 14763-2:2012 and ISO/IEC 614763-2:2012/AMD 1:2015.~~

EN 50310, *Application of Equipotential Bonding and Earthing in Buildings with Information Technology Equipment*

IEEE Std 802.3-~~2015~~2022*, ~~IEEE~~ Standard for Ethernet,* available at http://www.ieee.org

NOTE 1 The contents of IEEE Std 802.3cg have been integrated in IEEE Std 802.3-2022, Clause 146.

NOTE 2 Physical Layer specifications for 100BASE-T1 and 1000BASE-T1 are provided in IEEE Std 802.3-2022, Clause 96 and Clause 97 respectively.

ANSI/(NFPA) T3.5.29 R1-2007, *Fluid power systems and components – Electrically-controlled industrial valves – Interface dimensions for electrical connectors*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61158 (all parts), IEC 61784 (all parts), ISO/IEC/IEEE 8802-3:2021, ISO/IEC 11801-1, and ISO/IEC 11801-3, some of which have been repeated here for convenience of the user, and the following 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

3.1.1
acceptance test
contractual test to prove to the customer that the installed cabling meets certain conditions of its specification

Note 1 to entry The network owner or a third party usually performs this action.

[SOURCE: IEC 60050-151:2001, 151-16-23, modified – "Item" has been changed to "installed cabling" and Note 1 to entry has been added]

3.1.2
active network element
network element containing electrically and/or optically active components that allows extension of the network

Note 1 to entry: Examples of active network elements are repeaters and switches.

3.1.3
active network
network in which data transmission between non-immediately-connected devices is dependent on active elements within those intervening devices that form the connection path

Note 1 to entry: A failure of an active network element can disrupt the network communications.

3.1.4
administration
methodology defining the documentation requirements of a cabling system and its containment, the labelling of functional elements and the process by which moves, additions and changes are recorded

3.1.5
apparatus
one or more pieces of equipment having specific and defined overall functions within industrial premises served by one or more network interfaces

Note 1 to entry: This definition applies only to IT equipment. It does not apply to devices that implement automation functions.

[SOURCE: ISO/IEC 11801-3:2017, 3.1.1, modified – Note 1 to entry has been added]

3.1.6
automation island
AI
premises where combination of all systems that control, monitor, and protect the process of a plant is installed

Note 1 to entry: A plant may contain one or more AIs. Examples of a plant that has more than one AI are: a plant that is divided in various distinct physical (geographical) areas, or a plant that is composed of several distinct processes, or a plant where a large process is divided in various distinct sub-processes.

3.1.7
automation island attachment cabling
AI attachment cabling
cabling used to connect the automation outlet (AO) to the network interface (NI) for the automation island

3.1.8
automation island network
network used for the communication within and among systems of an AI

3.1.9
automation outlet
AO
fixed connecting hardware which provides an interface to the network(s) of an automation island

Note 1 to entry: For generic cabling in accordance with ISO/IEC 11801-3, the AO replaces the TO and is the demarcation point between the generic communications cabling and the automation communication cabling.

Note 2 to entry: Where the interface used at the AO does not conform to that specified for the TO of ISO/IEC 11801-3, the generic cabling no longer conforms to ISO/IEC 11801-3.

3.1.10
balanced cable
cable consisting of one or more metallic symmetrical cable elements (twisted pairs or quads)

Note 1 to entry: There is a great variety of shielded cable and unshielded cable construction and a number of systems to identify these constructions in a shortened form. See ISO/IEC 11801-1:2017, Annex D for acronyms to use.

[SOURCE: ISO/IEC 11801-1:2017, 3.1.12, modified – Note 1 to entry has been added]

3.1.11
bonding
act of connecting together exposed conductive parts and extraneous conductive parts of apparatus, systems, or installations that are at essentially the same potential

Note 1 to entry: For safety purposes, bonding generally involves (but not necessarily) a connection to the immediately adjacent earthing system.

[SOURCE: IEC TR 61000-5-2:1997, 3.1]

3.1.12
bridge
device, operating at the data link layer of the OSI model, used to connect two networks

3.1.13
bulkhead
wall or barrier which maintains the ingress and climatic environmental classifications applicable on either side

[SOURCE: ISO/IEC 11801-3:2017, 3.1.5]

3.1.14
bulkhead connector
connector assembly mounted to a bulkhead which provides electrical or optical signal pass-through while maintaining environmental integrity

3.1.15
bulkhead connection
one (or two) optical or electrical connection(s) within a bulkhead connector assembly

3.1.16
bulkhead cable gland
hardware at an enclosure bulkhead that provides cable passage for power or signals while maintaining environmental integrity

Note 1 to entry: This hardware has no electrical connections.

3.1.17
bus
passive network having a long trunk and a number of spurs where each spur is used to connect a device to the trunk

Note 1 to entry: In a bus, all the communicating devices share a common medium to transfer data.

3.1.18
bus bar
low-impedance conductor to which several electric circuits can be connected at separate points

Note 1 to entry: In many cases, the bus bar consists of a bar.

[SOURCE: IEC 60050-151:2001, 151-12-30]

3.1.19
cable
assembly of one or more conductors and/or optical fibres, with a protective covering and possibly filling, insulating and protective material

[SOURCE: IEC 60050-151:2001, 151-12-38]

3.1.20
cable gland
installation hardware designed to permit the entry of a cable into an enclosure and which provides sealing and retention

[SOURCE: IEC 60670-1:2015, 3.10, modified – Definition has been adapted for all kinds of cables]

3.1.21
cabling
system of communication cables, cords and connecting hardware that can support the connection of automation equipment

[SOURCE: ISO/IEC 11801-1:2017, 3.1.21, modified – A reference to automation equipment has been added]

3.1.22
channel
end-to-end transmission path connecting any two pieces of application specific equipment

Note 1 to entry: Equipment cords are included in the channel, but not the connecting hardware into the application specific equipment.

Note 2 to entry: Channels specified in this document may only comprise passive components.

[SOURCE: ISO/IEC 11801-1:2017, 3.1.26, modified – Note 1 to entry and Note 2 to entry have been added]

3.1.23
condition-based (conditional) maintenance
preventive activity performed on the basis of the documentation of the performance degradation of an item (as results of, for example, auto diagnostic or wear measurement)

Note 1 to entry: It is based on a proper visibility of performance degradation or intermittent failures.

3.1.24
connection (of conductors)
intentional electric contact between conductors

[SOURCE: IEC 60050-151:2001, 151-12-07, modified – Text referring to conductors has been selected]

3.1.25
connection (of optical fibres)
intentional alignment between optical fibres to allow light to pass through

[SOURCE: IEC 60050-151:2001, 151-12-07, modified – Text has been adapted to cover optical fibres.]

3.1.26
connector
<conductors> component providing conductor connection and disconnection

Note 1 to entry: The connector is the mated pair.

Note 2 to entry: A connector has one or more contact members.

[SOURCE: IEC 60050-151:2001, 151-12-19, modified – The definition has been adapted and Note 1 to entry has been added]

3.1.27
connector
<optical fibres> component normally attached to an optical cable or piece of apparatus, for the purpose of providing optical interconnection/disconnection of optical fibres or cables

Note 1 to entry: The connector is the mated pair.

Note 2 to entry: The connector usually consists of two plugs mated together in an adaptor.

3.1.28
cord
cable, cable unit, or cable element, with a minimum of one termination

[SOURCE: ISO/IEC 11801-1:2017, 3.1.36]

3.1.29
corrective maintenance
maintenance carried out after a fault recognition and intended to put an item into a state in which it can perform a required function

[SOURCE: IEC 60050-191:1990[6], 191-07-08]

3.1.30
daisy chain
bus where each passive network interface connects two trunk sections and provides a DC coupling between those sections

Note 1 to entry: One of the sections may be a bus terminator.

Note 2 to entry: With regard to the use of “daisy chain” term for active networks, see the definition given for linear topology.

3.1.31
device
physical entity connected to the fieldbus composed of communication element and possibly other functional elements

[SOURCE: IEC 61158-2:2014, 3.1.13, modified – Some details have been deleted.]

3.1.32
distributor
functional element enabling the termination and connection of cabling subsystems to other cabling subsystems or transmission equipment

[SOURCE: ISO/IEC 11801-1: 2017, 3.1.41]

3.1.33
earth (noun), en GB
ground (noun), en US
conductive mass of the Earth, whose electric potential at any point is conventionally taken as zero

[SOURCE: IEC 61131-2: 2017, 3.1.10]

3.1.34
earth (verb), en GB
ground (verb), en US
make an electric connection between a given point in a system or in an installation or in equipment and a local earth

Note 1 to entry: The connection to local earth may be intentional, or unintentional or accidental.

Note 2 to entry: The connection may be permanent or temporary.

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6 Withdrawn.

[SOURCE: IEC 60050-195:1998, 195-01-08]

3.1.35
enclosure
housing affording the type and degree of protection suitable for the intended application

[SOURCE: IEC 61131-2: 2017, 3.1.13]

3.1.36
end-to-end link
E2E link
end to end transmission path formed by structured cabling based on passive components including the portion of the end connection that is attached to the link and the portion of the end connection that is attached to the end equipment

[SOURCE: ISO/IEC TR 11801-9902:2017, 3.1.1]

3.1.37
equipotential bonding
provision of electric connections between conductive parts, intended to achieve equipotentiality

[SOURCE: IEC 60050-195:1998, 195-01-10]

3.1.38
equipotential bonding system
interconnection of conductive parts providing equal potential between those parts

Note 1 to entry: If an equipotential bonding system is earthed, it forms part of an earthing arrangement.

[SOURCE: IEC 60050-195:1998, 195-02-22]

3.1.39
failure
termination of the ability of an item to perform a required function

Note 1 to entry: After failure, the item has a fault.

Note 2 to entry: Failure is an event, as distinguished from fault, which is a state.

[SOURCE: IEC 60050-191:1990, 191-04-01]

3.1.40
fault
state characterized by the inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

Note 1 to entry: IEC 61508-4 defines fault as an abnormal condition that may cause a reduction in, or loss of, the capability of a functional unit to perform a required function.

[SOURCE: IEC 60050-191:1990, 191-05-01, modified – Note 1 to entry has been changed and Note 2 to entry has been deleted]

3.1.41
functional earth, en GB
functional ground, en US
earthing point or points in a system or in an installation or in equipment, used for purposes other than electrical safety

[SOURCE: IEC 60050-195:1998, 195-01-13]

3.1.42
high flex cable
cable that can withstand high number of repeated flexes (usually millions of cycles) while maintaining the specified performance

3.1.43
inactive metal part
any non-current carrying metal that may be contacted by a person

3.1.44
inspection
taking measures for the observation and evaluation of the actual condition

3.1.45
intermediate cable
cable connecting the intermediate distributor to the telecommunication outlet

[SOURCE: ISO/IEC 11801-3:2017, 3.1.9]

3.1.46
intermediate distributor
distributor used to make connections between the intermediate cable, other cabling subsystems and active equipment

[SOURCE: ISO/IEC 11801-3:2017, 3.1.10]

3.1.47
intermediate industrial distributor
intermediate distributor used to make connections to and between automation islands and transmit critical process control, monitoring and automation data (PCMA) between them

[SOURCE:ISO/IEC 11801-3:2017, 3.1.11]

3.1.48
jack
part of the connector which mates with a plug

Note 1 to entry: This document uses the term jack to refer to a fixed connector.

[SOURCE: IEC 60050-581:2008, 581-26-24, modified – Text has been adapted for automation applications and Note 1 to entry has been added]

3.1.49
jack-to-jack adaptor
J-J adaptor
back-to-back jacks that have one type of jack on one side and another type of jack on the other side and do not are on an enclosure/environmental barrier

3.1.50
jack-to-jack coupler
J-J coupler
back-to-back jacks that have the same type of jack on both sides and do not are on an enclosure/environmental barrier

3.1.51
linear topology
topology where the nodes are connected in series, with two nodes connected to only one other node and all others each connected to two other nodes (that is, connected in the shape of a line)

Note 1 to entry: This topology corresponds to that of an open ring.

3.1.52
maintenance
combination of all technical and corresponding administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function

Note 1 to entry: See "preventive maintenance", and "corrective maintenance", for a more detailed definition of maintenance.

Note 2 to entry: The required function may be defined as a stated condition.

[SOURCE: IEC 60050-191:1990, 191-07-01, modified – "Administrative actions" has been replaced by"corresponding administrative actions" and the two notes to entry have been added]

3.1.53
maintenance intervention
taking measures for retaining the specified condition

3.1.54
mean time between failures
MTBF
expectation of the time between failures

[SOURCE: IEC 60050-191:1990, 191-12-08]

3.1.55
mean time to recovery
MTTR
expectation of the time to restoration

Note 1 to entry: In IEC 60050-191:1990, 191-13-08, the use of "mean time to repair" (MTTR) is deprecated.

[SOURCE: IEC 60050-191:1990, 191-13-08]

3.1.56
network
all of the media, connectors, repeaters, routers, gateways and associated node communication elements by which a given set of communicating devices are interconnected

[SOURCE: IEC 61158-2:2014, 3.1.30]

3.1.57
node
end-point of a branch in a network

3.1.58
passive network
network in which data transmission is independent of active elements within the device attached to the network

Note 1 to entry: Failure of a device does not affect the propagation of information.

3.1.59
pathway
cable route used to accommodate cables between termination points

Note 1 to entry: The cable route (e.g., conduit, ductwork, tray, or tube) is defined by a physical structure.

[SOURCE: ISO/IEC 14763-2:2012, 3.1.43, modified – The definition has been adapted and Note 1 to entry has been added.]

3.1.60
permanent link
transmission path between distributors or between the telecommunications/automation outlet and the intermediate distributor

Note 1 to entry: It excludes apparatus attachment cords, equipment cords, patch cords and jumpers but includes the connection at each end.

Note 2 to entry: This is a modification to the definition of ISO/IEC 11801 in order to allow it be used for the CPs in accordance with IEC 61784-5 (all parts).

[SOURCE: ISO/IEC 11801-1:2017, 3.1.69, modified – The definition and Note 1 to entry have been adapted and Note 2 to entry has been added]

3.1.61
plug
connector used to make connections to a jack

Note 1 to entry: This document uses the term plug to refer to a free connector.

3.1.62
preventive maintenance
maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item

[SOURCE: IEC 60050-191:1990, 191-07-07]

3.1.63
protective earthing conductor
protective conductor provided for protective earthing

[SOURCE: IEC 60050-195:1998, 195-02-11]

3.1.64
quad
cable element that comprises four insulated conductors twisted together

Note 1 to entry: Two diametrically facing conductors form a transmission pair also referred to as a side circuit.

[SOURCE: ISO/IEC 11801-1:2017, 3.1.75]

3.1.65
RC earthing
earthing via a parallel RC circuit

3.1.66
recovery (of a high resilience item)
event when an item regains its specified degree of communication performance and fault resilience after correction of a fault

Note 1 to entry: High availability networks provide resilience to enable acceptable communication to continue after one fault and possibly after multiple faults.

3.1.67
repair
take measures for the re-establishment of the specified condition

3.1.68
repeater
two-port active physical layer device that receives and retransmits all signals to increase the distance and number of devices for which signals can be correctly transferred for a given medium

[SOURCE: IEC 61158-2:2014, 3.1.38]

3.1.69
resistance to earth
real part of an impedance to earth

[SOURCE: IEC 60050-195:1998, 195-01-18]

3.1.70
restoration
state when a communication network regains its designed level of resilience redundancy

3.1.71
ring
active network where each node is connected in series to two other nodes

3.1.72
scheduled maintenance
preventive activity (time or number-of-actions directed) performed either on predefined schedule or on units of use (e.g. number of start-ups)

[SOURCE: IEC 60050-191:1990, 191-07-10, modified – The definition has been adapted and a reference to units of use has been added]

3.1.73
segment
trunk-cable section of a network that is terminated at both ends by its characteristic impedance

Note 1 to entry: Segments are linked by repeaters within a logical link and by bridges to form a network.

[SOURCE: IEC 61158-2:2014, 3.1.39 modified – The definition and the note to entry have been adapted]

3.1.74
shield (of a cable), en US
screen (of a cable), en GB
surrounding metallic layer to confine the electromagnetic field within the cable and to protect the cable from external electrical influence

Note 1 to entry: Metallic sheaths, armours and earthed concentric conductors may also serve as a shield.

Note 2 to entry: For generic cabling in industrial premises, ISO/IEC 11801-3 uses the term screen instead of shield.

Note 3 to entry: See also Note 1 to entry of the balanced cable definition.

[SOURCE: IEC 61158-2:2014, 3.1.41 modified – The definition has been adapted and the term screen has been added; Notes 2 and 3 to entry have been added]

3.1.75
(optical fibre or electrical conductor) splice
a permanent, or semi-permanent, joint whose purpose is to couple optical power between two optical fibres or to joint two electrical conductors

Note 1 to entry: Joining without connectors.

3.1.76
spur
branch-line (i.e. a link connected to a larger one at a point in its route) that is a final circuit

Note 1 to entry: The alternative term “drop cable” is used in IEC 61158.

[SOURCE: IEC 61158-2:2014, 3.1.42]

3.1.77
star
network of three or more devices where all devices are connected to a central point (which may be active or passive)

3.1.78
tap
point of attachment from a node or spur to the trunk cable

Note 1 to entry: A tap provides easy removal of a node without disrupting the link.

[SOURCE: IEC 61158-2:2014, 3.3.34]

3.1.79
telecommunication outlet
TO
fixed connecting device which provides an interface to the terminal equipment

[SOURCE: ISO/IEC 11801-1:2017, 3.1.80]

3.1.80
terminator
entity used to terminate a transmission line in its characteristic impedance to prevent reflections

Note 1 to entry: In some instances, the terminator may be embedded in an end device or in a connector.

[SOURCE: IEC 61158-2:2014, 3.1.43, modified – The definition and Note 1 to entry have been modified]

3.1.81
(network) topology
pattern of the relative positions and interconnections of the individual elements (of the network)

Note 1 to entry: The term topology is sometimes overloaded to include considerations of the delay, attenuation and physical media classes of the paths interconnecting network nodes.

[SOURCE: IEC 60050-131:2002, 131-13-02, modified – Text has been adapted for communication networks and a Note 1 to entry has been added]

3.1.82
troubleshooting
locating the fault(s)

3.1.83
trunk
main communication highway acting as a source of main supply to a number of other lines (spurs)

[SOURCE: IEC 61158-2:2014, 3.1.46]

3.1.84
validation
part of the acceptance test that is solved with measurements

3.1.85
verification
action to assess that an installation is in accordance with its specification

Note 1 to entry: The installer usually performs this action.

Note 2 to entry: This action usually covers verification of component correct selection, physical layout, communication earthing, isolation and continuity of network components.

3.1.86
wire map
mapping of connector pin-to-pin terminations of a cable

3.1.87
balanced 1-pair cable
cable consisting of a single pair of conductors, optional screen, and overall jacket, primarily intended for use in differential-mode signal transmission and power delivery applications

[SOURCE: ISO/IEC TR 11801-9906:2020, 3.1.2]

3.1.88
balanced 1-pair cabling
cabling composed of balanced 1-pair cables and balanced 1-pair connectors

3.1.89
balanced 1-pair cabling channel
transmission path between equipment constructed from balanced 1-pair cables, balanced 1-pair connectors and balanced 1-pair cable assemblies to facilitate signal and power delivery

[SOURCE: ISO/IEC 11801-3:2017/AMD1:2021, 3.1.14]

3.1.90
balanced 1-pair connector
connector intended for use with balanced 1-pair cable in differential-mode signal transmission and power delivery applications

[SOURCE: ISO/IEC TR 11801-9906:2020, 3.1.3]

3.1.91
balanced 1-pair cord
cable assembly constructed from a 1-pair cable and 1-pair connectors

[SOURCE: ISO/IEC TR 11801-9906:2020, 3.1.4]

3.1.92
edge distributor
optional additional distributor to accommodate active equipment to allow transition from balanced 4-pair cabling to balanced 1-pair cabling

[SOURCE: ISO/IEC 11801-3:2017/AMD1:2021, 3.1.15]

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

AC	Alternating current
A.I.	Action item
AI	Automation island
AO	Automation outlet
AWG	American Wire Gauge
BD	Building distributor (ISO/IEC 11801-1)
BER	Bit error rate
BFOC	Bayonet fibre optic connector
BNC	Bayonet Neill Concelman (connector for coaxial cable having a bayonet-type shell)
CBN	Common bonding network
CP	Communication profile (IEC 61784-1)
CPF	Communication profile family (IEC 61784-1)
DC	Direct current
DCR	Direct current resistance
ED	edge distributor
EFT	Electrical fast transient
EFT/B	Electrical fast transient / burst (IEC 61000-4-4)
ELFEXT	Equal level far-end crosstalk
ELTCTL	Equal level transverse conversion transfer loss
EMC	Electromagnetic compatibility (IEC 60050-161, 161-01-07)
EMI	Electromagnetic interference (IEC 60050-161, 161-01-06)
ESD	Electrical static discharge
E2E	End-to-end
FD	Floor distributor (ISO/IEC 11801-1)
FE	Functional earth
ffs	For further study
FI	Fieldbus interface
FOC	Fibre optical connector
F-SMA	Fibre sub miniature version A (IEC 61754-22)
HP	Horse power
ID	Intermediate distributor
IDC	Insulation displacement contact
IID	Industrial intermediate distributor
IP	International protection (IEC 60529)