IEC 61784-5-12

Edition 3.0 2024-03
REDLINE VERSION

INTERNATIONAL STANDARD

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Industrial ~~communication~~ networks – Profiles –
Part 5-12: Installation of fieldbuses – Installation profiles for CPF 12

IEC 61784-5-12:2024-03 RLV(en)

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Part 5-12: Installation of fieldbuses – Installation profiles for CPF 12

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.40

ISBN 978-2-8322-8595-4

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Part 5-12: Installation of fieldbuses – Installation profiles for CPF 12

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61784-5-12:2018. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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IEC 61784-5-12 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This document is to be used in conjunction with IEC 61918:2018, IEC 61918:2018/AMD1:2022 and IEC 61918/AMD2:2024.

This third edition cancels and replaces the second edition published in 2018. This edition constitutes a technical revision.

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

a) addition of four pair twisted cables;

b) the references to CP 12/1 and CP 12/2 are replaced by a CPF 12 reference.

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

Draft	Report on voting
65C1283/FDIS	65C/1297/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.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 61784-5 series, published under the general title *Industrial networks – Profiles – Installation of fieldbuses*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

This document is one of a series produced to facilitate the use of communication networks in industrial control systems.

IEC 61918:2018, IEC 61918:2018/AMD1:2022 and IEC 61918/AMD2:2024 provide the common requirements for the installation of communication networks in industrial control systems. This installation profile document provides the installation profiles of the communication profiles (CP) of a specific communication profile family (CPF) by stating which requirements of IEC 61918 fully apply and, where necessary, by supplementing, modifying, or replacing the other requirements (see Figure 1).

For general background on fieldbuses, their profiles, and relationship between the installation profiles specified in this document, see IEC 61158-1.

Each CP installation profile is specified in a separate annex of this document. Each annex is structured exactly as the reference standard IEC 61918 for the benefit of the persons representing the roles in the fieldbus installation process as defined in IEC 61918 (planner, installer, verification personnel, validation personnel, maintenance personnel, administration personnel). By reading the installation profile in conjunction with IEC 61918, these persons immediately know which requirements are common for the installation of all CPs and which are modified or replaced. The conventions used to draft this document are defined in Clause 5.

The provision of the installation profiles in one standard for each CPF (for example IEC 61784-5-12 for CPF 12) allows readers to work with standards of a convenient size.

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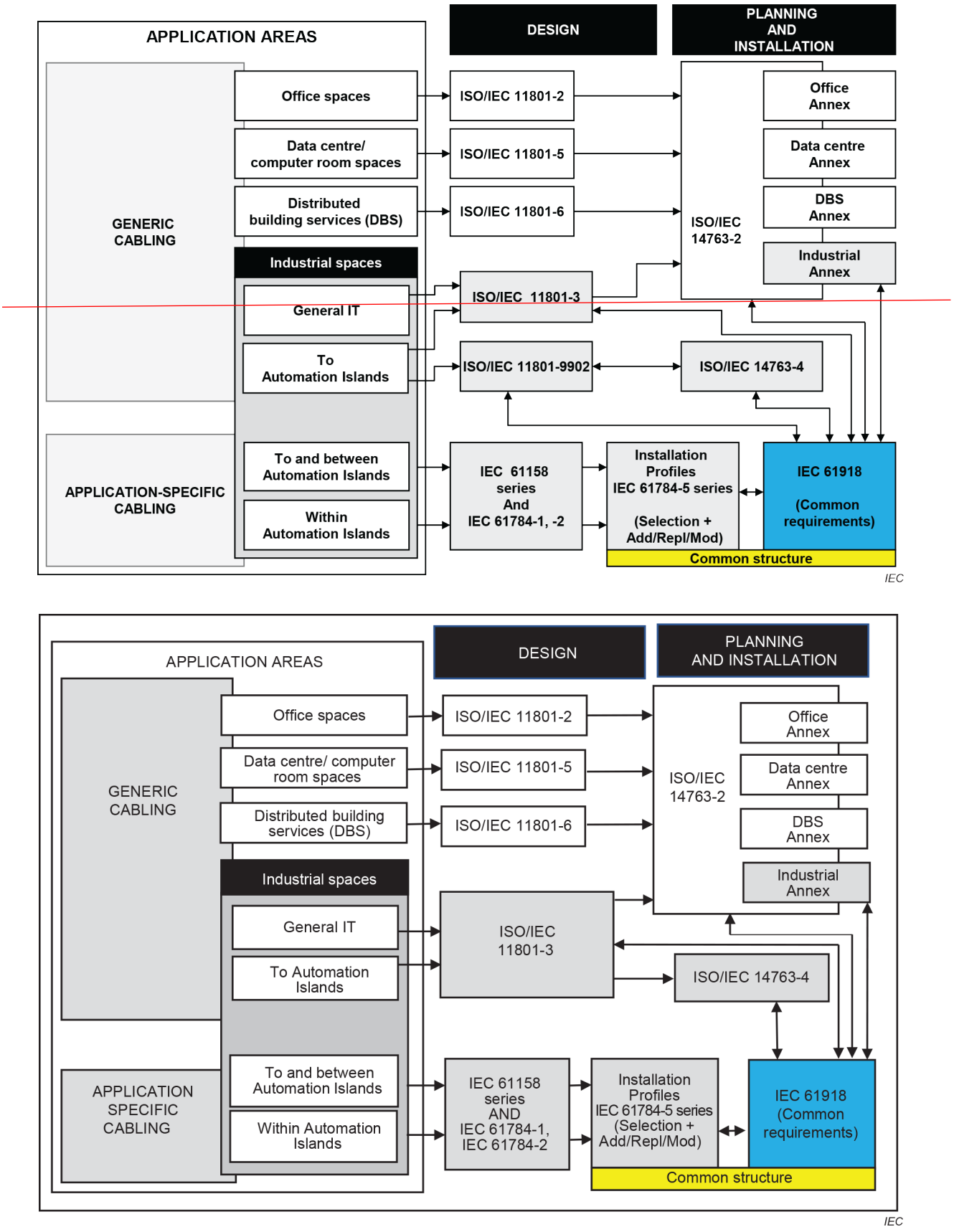

Figure 1 – Standards relationships

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~~Attention is drawn to the fact that the document IEC 61918 specifies all the installation requirements that apply to large part of the industrial communication networks and that these requirements automatically apply to each single network with the exception of those requirements that in the relevant document of the IEC 61784-5 series are explicitly defined as modified or replaced.~~

~~All the additions to the latest edition of the IEC 61918 apply to the networks of CPF 12.~~

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INDUSTRIAL ~~COMMUNICATION~~ NETWORKS – PROFILES –

Part 5-12: Installation of fieldbuses – Installation profiles for CPF 12

1 Scope

This part of IEC 61784-5 specifies the installation profile for CPF 12 (EtherCAT™[1]).

The installation profile is specified in Annex A. This annex is read in conjunction with IEC 61918:2018, IEC 61918:2018/AMD1:2022 and IEC 61918:2018/AMD2:2024.

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 61918:2018[2], *Industrial communication networks – Installation of communication networks in industrial premises*
IEC 61918:2018/AMD1:2022
IEC 61918:2018/AMD2:2024

~~The normative references of IEC 61918:2018, Clause 2, apply.~~

NOTE For profile specific normative references, see Clause A.2.

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms, definitions, and abbreviated terms given in IEC 61918:2018, Clause 3, IEC 61918:2018/AMD1:2022, Clause 3, and Clause A.3 of this document 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

~~NOTE For profile specific terms, definitions and abbreviated terms see Clauses A.3.~~

---

1 EtherCAT™ is a trade name of Beckhoff, Verl. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name. Use of the trade name requires permission of the trade name holder.

2 The normative references of IEC 61918:2018, Clause 2, IEC 61918:2018/AMD1:2022, Clause 2, and IEC 61918:2018/AMD2:2024, Clause 2, apply.

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4 CPF 12: Overview of installation profiles

CPF 12 consists of two communication profiles, as specified in IEC 61784-2: —.

The installation requirements for CP 12/1 (simple EtherCAT™ I/O devices) and CP 12/2 (EtherCAT™ devices with mailbox capabilities) are identical and are specified in Annex A.

5 Installation profile conventions

The numbering of the clauses and subclauses in the annexes of this document corresponds to the numbering of IEC 61918 main clauses and subclauses.

The annex clauses and subclauses of this document supplement, modify, or replace the respective clauses and subclauses in IEC 61918.

Where there is no corresponding subclause of IEC 61918:2018 in the normative annexes in this document, the subclause of IEC 61918 applies without modification.

The annex heading letter represents the installation profile assigned in Clause 4. The annex (sub)clause numbering following the annex letter shall represent the corresponding (sub)clause numbering of IEC 61918.

EXAMPLE "Subclause A.4.4" in IEC 61784-5-12 means that CP 12/1 and CP 12/2 specifies the Subclause 4.4 of IEC 61918.

All main clauses of IEC 61918 are cited and apply in full unless otherwise stated in each normative installation profile annex.

If all subclauses of a (sub)clause are omitted, then the corresponding IEC 61918 (sub)clause applies.

If in a (sub)clause it is written "Not applicable.", then the corresponding IEC 61918 (sub)clause does not apply.

If in a (sub)clause it is written "*Addition:*", then the corresponding IEC 61918 (sub)clause applies with the additions written in the profile.

If in a (sub)clause it is written "*Replacement:*", then the text provided in the profile replaces the text of the corresponding IEC 61918 (sub)clause.

NOTE A replacement can also comprise additions.

If in a (sub)clause it is written "*Modification:*", then the corresponding IEC 61918 (sub)clause applies with the modifications written in the profile.

If all (sub)clauses of a (sub)clause are omitted but in this (sub)clause it is written "*(Sub)clause x has addition*:" (or "*replacement*:") or "(Sub)clause x is not applicable.", then (sub)clause x becomes valid as declared and all the other corresponding IEC 61918 (sub)clauses apply.

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6 Conformance to installation profiles

Each installation profile within this document includes part of the IEC 61918:2018, IEC 61918:2018/AMD1:2022 and IEC 61918:2018/AMD2:2024. It may also include defined additional specifications.

A statement of compliance to an installation profile of this document shall be stated[3] as either

Compliance with IEC 61784-5-12:—[4]2024 for ~~CP 12/m~~ CPF 12 <name> or

Compliance with IEC 61784-5-12 (Ed.~~2.0~~3.0) for ~~CP 12/m~~ CPF 12 <name>.

where the name within the angle brackets < > is optional and the angle brackets ~~are~~ shall not ~~to~~ be included. ~~The m n within CP 12/m shall be replaced by the profile number 1 or 2.~~

NOTE The name ~~may~~ can be the name of the profile, for example EtherCAT™.

If the name is a trade name, then the permission of the trade name holder shall be required.

Product standards shall not include any conformity assessment aspects (including quality management provisions) neither normative nor informative, other than provisions for product testing (evaluation and examination).

~~3 In accordance with ISO/IEC Directives.~~

~~4 The date should not be used when the edition number is used.~~

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Annex A
(normative)

~~CP 12/1 + CP 12/2~~ CPF 12 (EtherCAT™) specific installation profile

A.1 Installation profile scope

Addition:

This annex specifies the installation profile ~~for Communication Profiles CP 12/1 and CP12/2~~ CPF 12 (EtherCAT™). ~~The CP12/1 and CP12/2 are~~ CPF 12 is specified in IEC 61784-2.

A.2 Normative references

~~*Addition:*~~

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

~~IEC 61076-2-114[5], *Connectors for electronic equipment – Circular connectors – Detail specification for data and power connectors with M8 screw-locking*~~

A.3 Installation profile terms, definitions, and abbreviated terms

A.3.1 Terms and definitions

A.3.2 Abbreviated terms

A.3.3 Conventions for installation profiles

Not applicable.

A.4 Installation planning

A.4.1 General

A.4.1.1 Objective

A.4.1.2 Cabling in industrial premises

A.4.1.3 The planning process

A.4.1.4 Specific requirements for CPs

Not applicable.

A.4.1.5 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

~~[5] Under preparation. Stage at the time of publication: IEC/CDV 61076-2-114:2017.~~

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A.4.2 Planning requirements

A.4.2.1 Safety

A.4.2.1.1 General

A.4.2.1.2 Electrical safety

A.4.2.1.3 Functional safety

A.4.2.1.4 Intrinsic safety

Not applicable.

A.4.2.1.5 Safety of optical fibre communication systems

A.4.2.2 Security

A.4.2.3 Environmental considerations and EMC

A.4.2.3.1 Description methodology

A.4.2.3.2 Use of the described environment to produce a bill of material

A.4.2.4 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

A.4.3 Network capabilities

A.4.3.1 Network topology

A.4.3.1.1 Common description

A.4.3.1.2 Basic physical topologies for passive networks

Not applicable.

A.4.3.1.3 Basic physical topologies for active networks

Addition:

Ring topologies shall be used when cable redundancy is required.

A.4.3.1.4 Combination of basic topologies

Replacement:

The combination of basic topologies is allowed according to A.4.3.1.5.

A.4.3.1.5 Specific requirements for CPs

Addition:

Slave devices with more than two ports shall be used to combine basic active topologies.

A.4.3.1.6 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

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A.4.3.2 Network characteristics

A.4.3.2.1 General

A.4.3.2.2 Network characteristics for balanced cabling not based on Ethernet

Not applicable.

A.4.3.2.3 Network characteristics for balanced cabling based on Ethernet

Replacement:

Table A.1 provides values based on the template given in IEC 61918:2018, Table 2.

Table A.1 – Network characteristics for balanced cabling based on Ethernet

Characteristic	~~CP 12/1, CP12/2 (EtherCAT)~~ CPF 12 (two pair)	CPF 12 (four pair)
Supported data rates (Mbit/s)	100	100-5 000
Supported channel length (m) [b]	100	100
Number of connections in the channel (max.) [a b]	6	6
Patch cord length (m) [a]	100 (AWG22)	100 (AWG23)
Channel class per ISO/IEC 11801-3 (min.) [b]	D	E_A
Cable category per ISO/IEC 11801-3 (min.) [c]	5	6_A
Connecting HW category per ISO/IEC 11801-3 (min.)	5	6_A
Cable types	No specific requirement; up to manufacturer's differentiation	No specific requirement; up to manufacturer's differentiation

[a] See A.4.4.3.2.

[b] For the purpose of this table, the channel definitions of ISO/IEC 11801-3 are applicable.

[c] For additional information, see IEC 61156 series.

A.4.3.2.4 Network characteristics for optical fibre cabling

Replacement:

Table A.2 provides values based on the template given in IEC 61918:2018, Table 3.

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Table A.2 – Network characteristics for optical fibre cabling

~~CP 12/1 and CP12/2~~ CPF 12 (EtherCAT)		
Optical fibre type	**Description**	
Single mode silica	Bandwidth (MHz) or equivalent at λ (nm)	300 at 1 310
	Minimum length (m)	0
	Maximum length [a] (m)	14 000
	Maximum channel insertion loss/optical power budget (dB)	6 See IEEE 802.3:2015, Clause 58 10 km specified
	Connecting hardware	See A.4.4.2.5
Multimode silica	Modal bandwidth (MHz × km) at λ (nm)	600 at 1 310
	Minimum length (m)	0
	Maximum length [a] (m)	2 000
	Maximum channel insertion loss/optical power budget (dB)	4,5
	Connecting hardware	See A.4.4.2.5
POF	Modal bandwidth (MHz × 100 m) at λ (nm)	35 at 650
	Minimum length (m)	0,055
	Maximum length [a] (m)	50
	Maximum channel insertion loss/optical power budget (dB)	4,2
	Connecting hardware	See A.4.4.2.5
Hard clad silica	Modal bandwidth (MHz × km) at λ (nm)	70 at 650
	Minimum length (m)	0
	Maximum length [a] (m)	100
	Maximum channel insertion loss/optical power budget (dB)	4
	Connecting hardware	See A.4.4.2.5

[a] This value is reduced by connections, splices and bends in accordance with IEC 61918:2018, Formula (1) in 4.4.3.4.1.

A.4.3.2.5 Specific network characteristics

A.4.3.2.6 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

A.4.4 Selection and use of cabling components

A.4.4.1 Cable selection

A.4.4.1.1 Common description

A.4.4.1.2 Copper cables

A.4.4.1.2.1 Balanced cables for Ethernet-based CPs

Replacement:

Table A.3, Table A.4 and Table A.5 provide values for different cable types based on the template given in IEC 61918:2018, Table 4.

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Table A.3 – Information relevant to copper cable: ~~CP12/1, CP12/2~~ CPF 12 fixed cables

Characteristic	~~CP 12/1, CP12/2 (EtherCAT) Type A cable~~ CPF 12 Type A cable (two pair)	CPF 12 Type A cable (four pair)
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω (IEC 61156-5)	100 Ω ± 15 Ω (IEC 61156-5)
Balanced or unbalanced	Balanced	Balanced
DCR of conductors	≤ 57,5 Ω/km	≤ 85 Ω/km
DCR of shield	-	-
Number of conductors	4	8
Shielding	S/FTP, S/FTQ, S/STP	S/FTP, S/STP
Colour code for conductor	WH, BU / YE, OG	WH|OG, OG / , WH|GR, GR / WH|BU, BU / , WH|BR, BR
Jacket colour requirements	-	-
Jacket material	-	-
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	Application dependent	Application dependent
~~Transfer Impedance~~	~~< 50 mΩ/m at 10 MHz~~	
Installation Type	Stationary, no movement after installation	Stationary, no movement after installation
Outer cable diameter	5,5 mm – 8 mm	max. 10 mm
Wire cross section	AWG 22/1	AWG 23/1
Wire diameter	1,5 mm ± 0,1 mm	1,0 mm to 1,6 mm
Delay scew [a]	≤ 20 ns/100 m	≤ 20 ns/100 m
[a] Relevant only for networks with time-based synchronization.		

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Table A.4 – Information relevant to copper cable: ~~CP12/1, CP12/2~~ CPF 12 flexible cables

Characteristic	~~CP 12/1, CP12/2 (EtherCAT) Type B cable~~ CPF 12 Type B cable (two pair)	CPF 12 Type B cable (four pair)
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω (IEC 61156-5)	100 Ω ± 15 Ω (IEC 61156-5)
Balanced or unbalanced	Balanced	Balanced
DCR of conductors	≤ 57,5 Ω/km	≤ 85 Ω/km
DCR of shield	-	-
Number of conductors	4	8
Shielding	S/FTP, S/FTQ, S/STP	S/FTP, S/STP
Colour code for conductor	WH, BU / YE, OG	WH|OG, OG / , WH|GR, GR / WH|BU, BU / , WH|BR, BR
Jacket colour requirements	-	-
Jacket material	-	-
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	Application dependent	Application dependent
~~Transfer Impedance~~	~~< 50 mΩ/m at 10 MHz~~	
Installation type	Flexible, occasional movement or vibration	Flexible, occasional movement or vibration
Outer cable diameter	5,5 mm – 8 mm	Max. 10 mm
Wire cross section	AWG 22/7	AWG 23/7
Wire diameter	1,5 mm ± 0,1 mm	1,0 mm to 1,6 mm
Delay screw [a]	≤ 20 ns/100 m	≤ 20 ns/100 m
[a] Relevant only for networks with time-based synchronization.		

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Table A.5 – Information relevant to copper cable: ~~CP12/1, CP12/2~~ CPF 12 special cables

Characteristic	~~CP 12/1, CP12/2 (EtherCAT) Type C cable~~ CPF 12 Type C cable (two pair)	CPF 12 Type C cable (four pair)
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω (IEC 61156-5)	100 Ω ± 15 Ω (IEC 61156-5)
Balanced or unbalanced	Balanced	Balanced
DCR of conductors	≤ 57,5 Ω/km	≤ 95 Ω/km
DCR of shield	-	-
Number of conductors	4	8
Shielding	S/FTP, S/FTQ, S/STP	S/FTP, S/STP
Colour code for conductor	WH, BU / YE, OG	WH|OG, OG / , WH|GR, GR / WH|BU, BU / , WH|BR, BR
Jacket colour requirements	-	-
Jacket material	-	-
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	Application dependent	Application dependent
~~Transfer Impedance~~	~~< 50 mΩ/m at 10 MHz~~	
Installation type	Special applications (e.g. permanent movement as in drag chains)	Special applications (e.g. permanent movement as in drag chains)
Outer cable diameter	Application dependent	Application dependent
Wire cross section	AWG 22/x (x: e.g. 7 / 19)	AWG 24/x (x: e.g. 7 / 19)
Wire diameter	~~1,5 mm ± 0,1 mm~~ Application dependent	Application dependent
Delay screw [a]	≤ 20 ns/100 m	≤ 20 ns/100 m
[a] Relevant only for networks with time-based synchronization.		

A.4.4.1.2.2 Copper cables for non-Ethernet-based CPs

Not applicable.

A.4.4.1.3 Cables for wireless installation

A.4.4.1.4 Optical fibre cables

Replacement:

Table A.6 provides values based on the template given in IEC 61918:2018, Table 6.

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Table A.6 – Information relevant to optical fibre cables: CPF 12

Characteristic	9..10/125 µm single mode silica	50/125 µm multimode silica	62,5/125 µm multimode silica	980/1 000 µm step index POF	200/230 µm step index hard clad silica
Standard	IEC 60793-2	IEC 60793-2	IEC 60793-2	IEC 60793-2	IEC 60793-2
Attenuation per km (650 nm)	–	–	–	≤ 160 dB	≤ 10 dB
Attenuation per km (820 nm)	–	–	–	–	–
Attenuation per km (1 310 nm)	≤ 0,5 dB	≤ 1,5 dB	≤ 1,5 dB	–	–
Number of optical fibres	2	2	2	2	2
Jacket colour requirements	–	–	–	–	–
Jacket material	–	–	–	–	–
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	Application dependent	Application dependent	Application dependent	Application dependent	Application dependent
Connector type (duplex or simplex)	SC-RJ, SC Duplex	SC-RJ, SC Duplex	SC-RJ, SC Duplex	SC-RJ, SC Duplex	SC-RJ, SC Duplex

A.4.4.1.5 Special purpose balanced and optical fibre cables

A.4.4.1.6 Specific requirements for CPs

Not applicable.

A.4.4.1.7 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

A.4.4.2 Connecting hardware selection

A.4.4.2.1 Common description

A.4.4.2.2 Connecting hardware for balanced cabling CPs based on Ethernet

Replacement:

Table A.7 provides values based on the template given in IEC 61918:2018, Table 7.

Table A.7 – Connectors for balanced cabling CPs based on Ethernet

	IEC 60603-7 series[a]		IEC 61076-3-106[b]		IEC 61076-3-117[b]	IEC 61076-2-101	IEC 61076-2-109	IEC 61076-2-104	IEC 61076-2-114[c]
	shielded	un-shielded	Var. 1	Var. 6	~~M12-8 with X-coding~~ Var. 14	M12-4 with D-coding	M12-8 with X-coding	M8-4 with A-coding	M8-4 with P-coding
~~CP 12/1, CP 12/2~~ CPF 12	IEC 60603-7-3	No	No	No	Yes	Yes	Yes	Yes	Yes

[a] For IEC 60603-7 series, the connector selection is based on the desired channel performance.

[b] Housings to protect connectors.

[c] Only applicable in conjunction with EtherCAT™ P.

A.4.4.2.3 Connecting hardware for copper cabling CPs not based on Ethernet

Not applicable.

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