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Edition 1.1 2024-03
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Industrial communication networks – Profiles –
Part 5-21: Installation of fieldbuses – Installation profiles for CPF 21

IEC 61784-5-21:2018-08+AMD1:2024-03 CSV(en)

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FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61784-5-21 edition 1.1 contains the first edition (2018-08) [documents 65C/924/FDIS and 65C/925/RVD] and its amendment 1 (2024-03) [documents 65C/1283/FDIS and 65C/1297/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. 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 61784-5-21 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

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

FDIS	Report on voting
65C/924/FDIS	65C/925/RVD

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

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

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

The committee has decided that the contents of this document and its amendment 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- withdrawn, or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

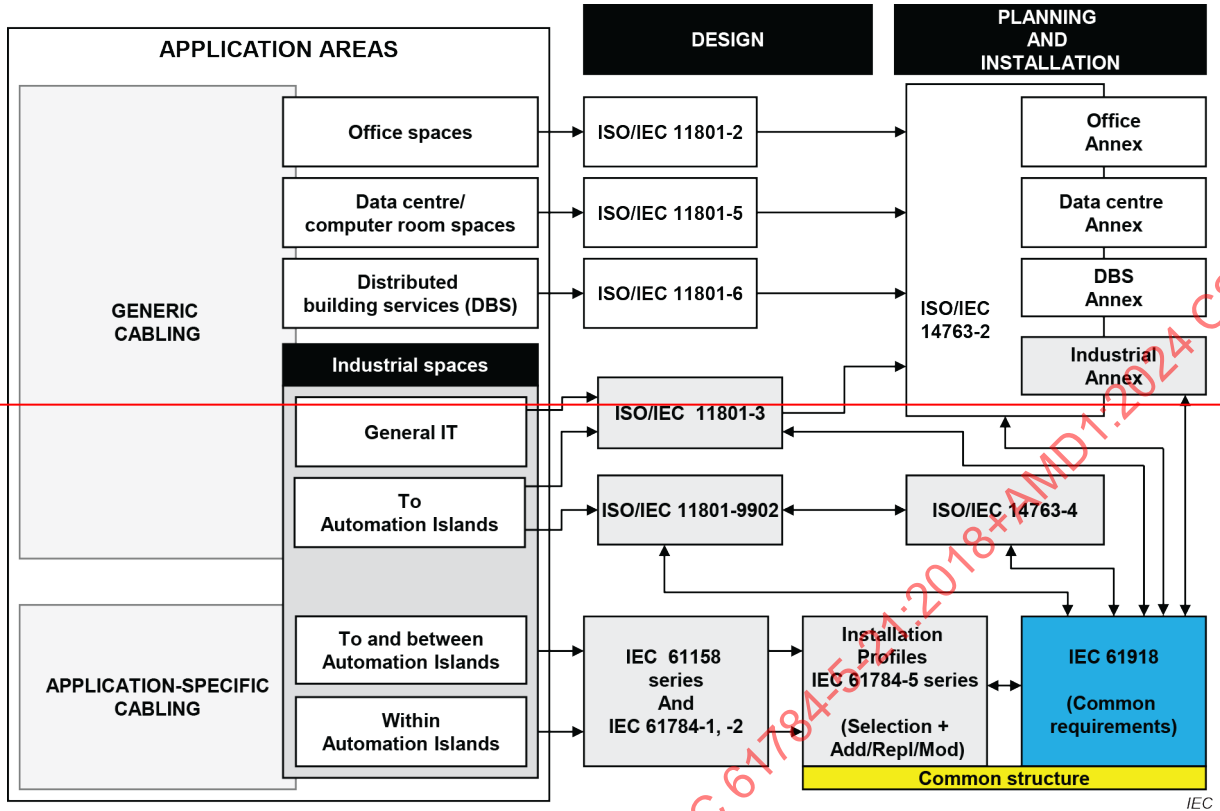
This ~~International Standard~~ document is one of a series produced to facilitate the use of communication networks in industrial control systems.

IEC 61918:2018, IEC 61918:2018/AMD1:2022 and IEC 61918:2018/AMD2:2024 provide~~s~~ 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 document for each CPF (for example IEC 61784-5-21 for CPF 21)~~,~~ allows readers to work with documents of a convenient size.



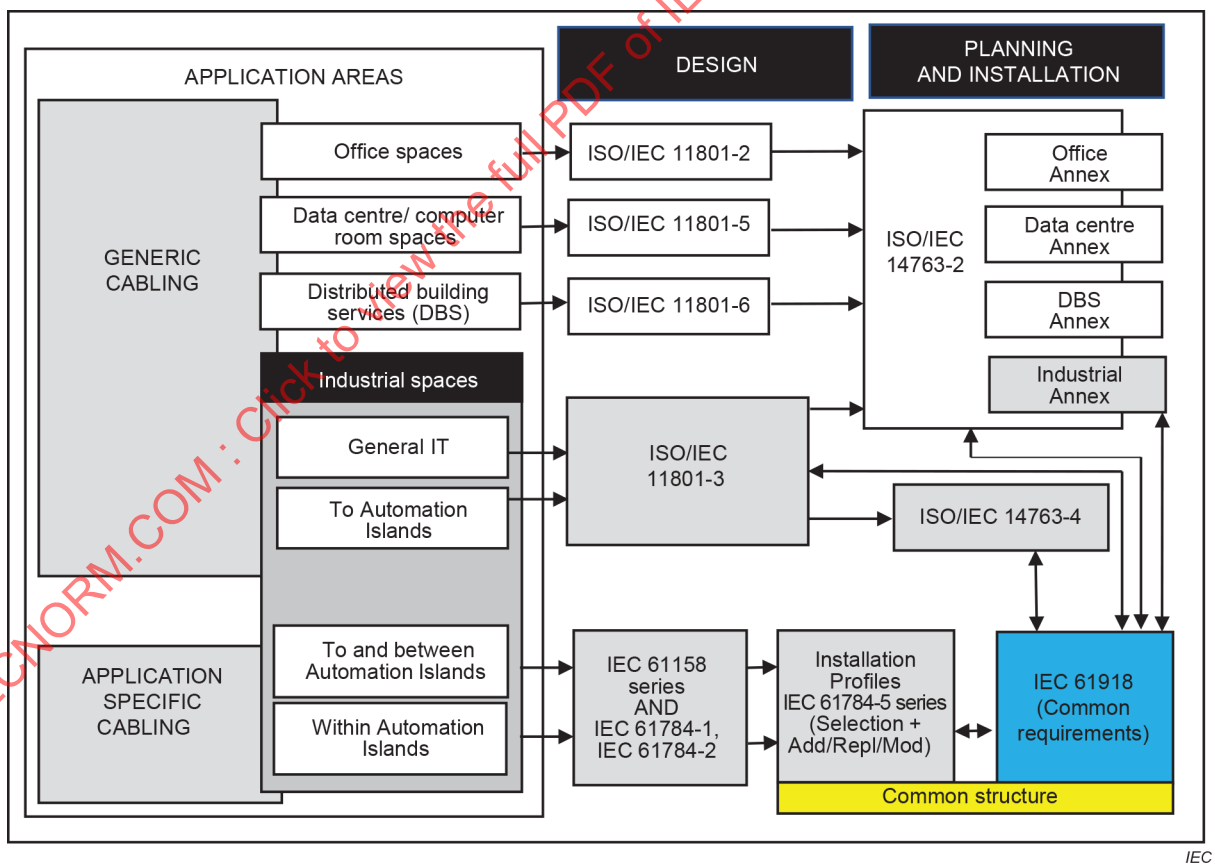


Figure 1 – Standards relationships

INTRODUCTION to Amendment 1

This Amendment 1 includes the following significant technical changes with respect to IEC 61784-5-21:2018:

a) in A.4.3.2.3, Table A.1:
   - 1 000 (Mbit/s) is added to "Supported data rates (Mbit/s)",
   - Category 5e is added to "Cable category per ISO/IEC 11801-3",
   - Category 5e is added to "Connecting HW category per ISO/IEC 11801-3";

b) in A.4.3.2.4, Table A.2, Single mode silica:
   - "Bandwidth (MHz) or equivalent at λ (nm)" is changed to 120 and 1 500,
   - "Maximum channel Insertion loss/optical power budget (dB)" is changed to 10,5.

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 5-21: Installation of fieldbuses – Installation profiles for CPF 21

1 Scope

This part of IEC 61784 specifies the installation profile for CPF 21 (FL-net[1]).

The installation profile is specified in ~~Annex A~~ the annex. The 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, and IEC 61918:2018/AMD1:2022, Clause 3 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

4 CPF 21: Overview of installation profiles

CPF 21 consists of one communication profile as specified in IEC 61784-2.

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1 FL-net is the trade name of JEMA/FL-net: The Japan Electrical Manufacturers' Association / the Factory Automation Link network. 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 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.

The installation requirements for CP 21/1 (FL-net) are specified in Annex A.

5 Installation profile conventions

The numbering of the clauses and subclauses in the annex 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 in the normative annex 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 61784-5-21 means that CP 21/1 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 apply.

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.

6 Conformance to installation profiles

Each installation profile within this document includes part of the IEC 61918:2018. It may also include defined additional specifications.

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

[3] In accordance with ISO/IEC Directives.

Compliance ~~to~~ with IEC 61784-5-21:~~—4~~2018 and IEC 61784-5-21:2018/AMD1:2024 for CP 21/m <name> or

Compliance ~~to~~ with IEC 61784-5-21 (Ed.~~1.0~~1.1) for CP 21/m <name>

where the name within the angle brackets < > is optional and the angle brackets ~~are~~ shall not ~~to~~ be included. The m within CP 21/m shall be replaced by the profile number 1.

NOTE The name ~~may~~ can be the name of the profile, for example FL-net.

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).

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

Annex A
(normative)

CP 21/1 (FL-net) specific installation profile

A.1 Installation profile scope

Addition:

This annex specifies the installation profile for Communication Profile CP 21/1 (FL-net). The CP 21/1 is specified in IEC 61784-2.

A.2 Normative references

Addition:

IEC 61754-18:2001, *Fibre optic connector interfaces – Part 18: Type MT-RJ connector family*

IEC 60793-2-50:~~2015~~2018, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60603-7-2:2010, *Connectors for electronic equipment – Part 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz*

IEC 60603-7-3:2010, *Connectors for electronic equipment – Part 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 100 MHz*

IEC 60603-7-4:2010, *Connectors for electronic equipment – Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-5:2010, *Connectors for electronic equipment – Part 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

ANSI/TIA/EIA-568-B, *Commercial building telecommunications cabling standard*

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

Subclause 3.3 is not applicable.

A.4 Installation planning

A.4.1 General

Subclause 4.1.4 is not applicable.

A.4.2 Planning requirements

A.4.2.1 Safety

Subclause 4.2.1.3 is not applicable.

Subclause 4.2.1.4 is not applicable.

A.4.2.2 Security

Not applicable.

A.4.2.3 Environmental considerations and EMC

Subclause 4.2.3.2 has addition:

Only the products that are declared by the manufacturers as applicable to CP 21/1 fieldbus network shall be used and included in the 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

Subclause 4.3.1.4 is not applicable.

Subclause 4.3.1.5 has addition:

Star topology applies to CP 21/1 fieldbus networks.

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 21/1
Supported data rates (Mbit/s)	100, 1 000
Supported channel length (m) [b]	100
Number of connections in the channel (max.) [a b]	4
Patch cord length (m) [a]	100
Channel class per ISO/IEC 11801-3 (min.) [b]	D
Cable category per ISO/IEC 11801-3 (min.) [c]	5, 5e
Connecting HW category per ISO/IEC 11801-3 (min.)	5, 5e
Cable types	– [d]

[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 the IEC 61156 series.

[d] As specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801.

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.

Table A.2 – Network characteristics for optical fibre cabling

CP 21/1		
Optical fibre type	**Description**	
Single mode silica	Bandwidth (MHz) or equivalent at λ (nm)	~~100~~ 120, 1 500
	Minimum length (m)	0
	Maximum length[a] (m)	10 000
	Maximum channel Insertion loss/optical power budget (dB)	~~8,5~~ 10,5 [b]
	Connecting hardware	See A.4.4.2.5
Multimode silica	Modal bandwidth (MHz x 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 [b]
	Connecting hardware	See A.4.4.2.5
Multimode silica	Modal bandwidth (MHz x km) at λ (nm)	500 at 1 310
	Minimum length (m)	0
	Maximum length[a] (m)	2 000
	Maximum channel Insertion loss/optical power budget (dB)	8 [b]
	Connecting hardware	See A.4.4.2.5
POF	Modal bandwidth (MHz x 100 m) at λ (nm)	–
	Minimum length (m)	–
	Maximum length[a] (m)	–
	Maximum channel Insertion loss/optical power budget (dB)	–
	Connecting hardware	–
Hard clad silica	Modal bandwidth (MHz x km) at λ (nm)	–
	Minimum length (m)	–
	Maximum length[a] (m)	–
	Maximum channel Insertion loss/optical power budget (dB)	–
	Connecting hardware	–

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

[b] According to ISO/IEC 11801; see manufacturer's data sheet.

A.4.3.2.5 Specific network characteristics

Not applicable.

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 provides values based on the template given in IEC 61918:2018, Table 4.

Table A.3 – Information relevant to copper cable: fixed cables

Characteristic	CP 21/1
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω
DCR of conductors	< 9,38 Ω /100 m
DCR of shield	–
Number of conductors	8
Shielding	S/FTP, S/FTQ, S/STP
Colour code for conductor	T568A, T568B
Jacket colour requirements	–
Jacket material	–
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	–
Agency ratings	–

Replacement:

Table A.4 provides values based on the template given in IEC 61918:2018, Table 5.

Table A.4 – Information relevant to copper cable: cords

Characteristic	CP 21/1
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω
DCR of conductors	< 9,38 Ω /100 m
DCR of shield	–
Number of conductors	8
Length	≤ 100 m
Shielding	S/FTP, S/FTQ, S/STP
Colour code for conductor	T568A, T568B
Jacket colour requirements	–
Jacket material	–
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	–
Agency ratings	–

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

Table A.5 – Information relevant to optical fibre cables

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 60793-2-50 Type B1.1	IEC 60793-2-10 Type A1a.1	IEC 60793-2-10 Type A1b	–	–
Attenuation per km (650 nm)	–	–	–	–	–
Attenuation per km (820 nm)	–	–	–	–	–
Attenuation per km (1 310 nm)	≤ 0,5 dB [a]	≤ 1,5 dB [b]	≤ 1,5 dB [c]	–	–
Number of optical fibres	2	2	2	–	–
Jacket colour requirements	–	–	–	–	–
Jacket material	–	–	–	–	–
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	–	–	–	–	–

[a] As specified in IEC 60793-2-50, ~~B1.1~~ B-652.B and by the cable manufacturer.

[b] As specified in IEC 60793-2-10, ~~A1a.1~~ A1-OM2 and by the cable manufacturer.

[c] As specified in IEC 60793-2-10, ~~A1b~~ A1-OM1 and by the cable manufacturer.

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

Table A.6 – 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
	shielded	unshielded	Var. 1	Var. 6	Var. 14	M12-4 with D-coding	M12-8 with X-coding
CP 21/1	IEC 60603 -7-3, -7-5	IEC 60603 -7-2, -7-4	No	No	No	No	No

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

[b] Housings to protect connectors.

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

Not applicable.

A.4.4.2.4 Connecting hardware wireless installation

A.4.4.2.5 Connecting hardware for optical fibre cabling

Replacement:

Table A.7 provides values based on the template given in IEC 61918:2018, Table 9.

Table A.7 – Optical fibre connecting hardware

	IEC 61754-2	IEC 61754-4	IEC 61754-24	IEC 61754-20	IEC 61754-22	IEC 61754-18
	BFOC 2.5	SC	SC-RJ	LC	F-SMA	MT–RJ
CP 21/1	No	Yes	Yes	Yes	No	Yes
NOTE The IEC 61754 series defines the optical fibre connector mechanical interfaces; performance specifications for optical fibre connectors terminated to specific fibre types are standardised in the IEC 61753 series.						

Replacement:

Table A.8 provides values based on the template given in IEC 61918:2018, Table 10.

Table A.8 – Relationship between FOC and fibre types (CP 21/1)

FOC	Fibre type					
	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	Others
BFOC/2,5	No	No	No	No	No	No
SC	Yes	Yes	Yes	No	No	No
SC-RJ	Yes	Yes	Yes	No	No	No
LC	Yes	Yes	Yes	No	No	No
F-SMA	No	No	No	No	No	No
MT-RJ	No	Yes	Yes	No	No	No

A.4.4.2.6 Specific requirements for CPs

Not applicable.

A.4.4.2.7 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

A.4.4.3 Connections within a channel/permanent link

A.4.4.4 Terminators

Subclause 4.4.4.2 is not applicable.

A.4.4.5 Device location and connection

Subclause 4.4.5.2 is not applicable.

A.4.4.6 Coding and labelling

A.4.4.7 Earthing and bonding of equipment and devices and shielded cabling

Subclause 4.4.7.5 has addition:

Communication cabling shields shall be earthed in accordance with the manufacturer's installation instructions and the planner's documentation.

A.4.4.8 Storage and transportation of cables

Subclause 4.4.8.2 is not applicable.

A.4.4.9 Routing of cables

Subclause 4.4.9.6 has addition:

Redundant communication cables of CP 21/1 fieldbus network should have jacket of different colours and be fixed with labels that indicate that these cables are for use with the CP 21/1 fieldbus network. Labels for easy identification shall be provided.

A.4.4.10 Separation of circuits

Addition:

The cabling outside the enclosure shall be separated in accordance with the manufacturer's installation instructions.

A.4.4.11 Mechanical protection of cabling components

Subclause 4.4.11.2 is not applicable.

A.4.4.12 Installation in special areas

Subclause 4.4.12.2 is not applicable.

A.4.5 Cabling planning documentation

A.4.6 Verification of cabling planning specification

A.5 Installation implementation

A.5.1 General requirements

A.5.2 Cable installation

A.5.2.1 General requirements for all cabling types

Subclause 5.2.1.2 has replacement:

Table A.9 provides values based on the template given in IEC 61918:2018, Table 18.

Table A.9 – Parameters for balanced cables

Characteristic		Value
Mechanical force	Minimum bending radius, single bending (mm)	– [a]
	Bending radius, multiple bending (mm)	– [a]
	Pull forces (N)	– [a]
	Permanent tensile forces (N)	– [a]
	Maximum lateral forces (N/cm)	– [a]
	Temperature range during installation (°C)	– [a]
[a] Depending on cable type; see manufacturer's data sheet		

Table A.10 provides values based on the template given in IEC 61918:2018, Table 19.

Table A.10 – Parameters for silica optical fibre cables

Characteristic		Value
Mechanical force	Minimum bending radius, single bending (mm)	– [a]
	Bending radius, multiple bending (mm)	– [a]
	Pull forces (N)	– [a]
	Permanent tensile forces (N)	– [a]
	Maximum lateral forces (N/cm)	– [a]
	Temperature range during installation (°C)	– [a]
[a] Depending on cable type; see manufacturer's data sheet.		

A.5.2.2 Installation and routing

A.5.2.3 Specific requirements for CPs

Not applicable.

A.5.2.4 Specific requirements for wireless installation

A.5.2.5 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3

A.5.3 Connector installation

Subclause 5.3.4 is not applicable.

A.5.4 Terminator installation

Subclause 5.4.2 is not applicable.

A.5.5 Device installation

Subclause 5.5.2 is not applicable.

A.5.6 Coding and labelling

Subclause 5.6.2 has addition:

The installer shall use cables with labelling for CP 21/1 fieldbus networks and identify each of the cables allowable for CP 21/1 fieldbus networks.

A.5.7 Earthing and bonding of equipment and devices and shield cabling

Subclause 5.7.5 has addition:

Communication cabling shield shall be earthed in accordance with the manufacturer's installation instructions and the planner's documentation.

A.5.8 As-implemented cabling documentation

A.6 Installation verification and installation acceptance test

A.6.1 General

A.6.2 Installation verification

A.6.2.1 General

A.6.2.2 Verification according to cabling planning documentation

A.6.2.3 Verification of earthing and bonding

Subclause 6.2.3.2 is not applicable.

A.6.2.4 Verification of shield earthing

A.6.2.5 Verification of cabling system

A.6.2.6 Cable selection verification

Subclause 6.2.6.2 is not applicable.

A.6.2.7 Connector verification

Subclause 6.2.7.2 is not applicable.

A.6.2.8 Connection verification

A.6.2.9 Terminator verification

Subclause 6.2.9.2 is not applicable.

A.6.2.10 Coding and labelling verification

Subclause 6.2.10.2 has addition:

It shall be confirmed that each cable for CP 21/1 fieldbus networks is labelled as required.

A.6.2.11 Verification report

A.6.3 Installation acceptance test

A.6.3.1 General

A.6.3.2 Acceptance test of Ethernet-based cabling

Subclause 6.3.2.2.2 is not applicable.

A.6.3.3 Acceptance test of non-Ethernet-based cabling

Not applicable.

A.6.3.4 Specific requirements for wireless installation

Not applicable.

A.6.3.5 Acceptance test report

A.7 Installation administration

Subclause 7.8 is not applicable.

A.8 Installation maintenance and installation troubleshooting

Subclause 8.4 is not applicable.

Bibliography

Addition:

[40] JEM 1479:2012, *Protocol specification for FA control network standard V. 3.01*, available at http://www.jema-net.or.jp/English/businessfields/standarization/opcn/standard/

[41] JEM 1480:2012, *Testing specifications for FA control network [FL-net (OPCN-2)]*, available at http://www.jema-net.or.jp/English/businessfields/standarization/opcn/standard/

[42] JEM-TR 213:2011, *Implementation guidelines of FA control network [FL-net (OPCN-2)]*, available at http://www.jema-net.or.jp/English/businessfields/standarization/opcn/standard/

[43] JEM-TR 214:2000, *Device profile common specification for FA control network [FL-net (OPCN-2)]*, available at http://www.jema-net.or.jp/English/businessfields/standarization/opcn/standard/

[44] JIS B 3521:2004, *Protocol specification for FA control network standard, available at* http://www.jisc.go.jp/eng/index.html

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 5-21: Installation of fieldbuses – Installation profiles for CPF 21

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61784-5-21 edition 1.1 contains the first edition (2018-08) [documents 65C/924/FDIS and 65C/925/RVD] and its amendment 1 (2024-03) [documents 65C/1283/FDIS and 65C/1297/RVD].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 61784-5-21 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

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

FDIS	Report on voting
65C/924/FDIS	65C/925/RVD

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

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

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

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

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 61918:2018/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 document for each CPF (for example IEC 61784-5-21 for CPF 21) allows readers to work with documents of a convenient size.

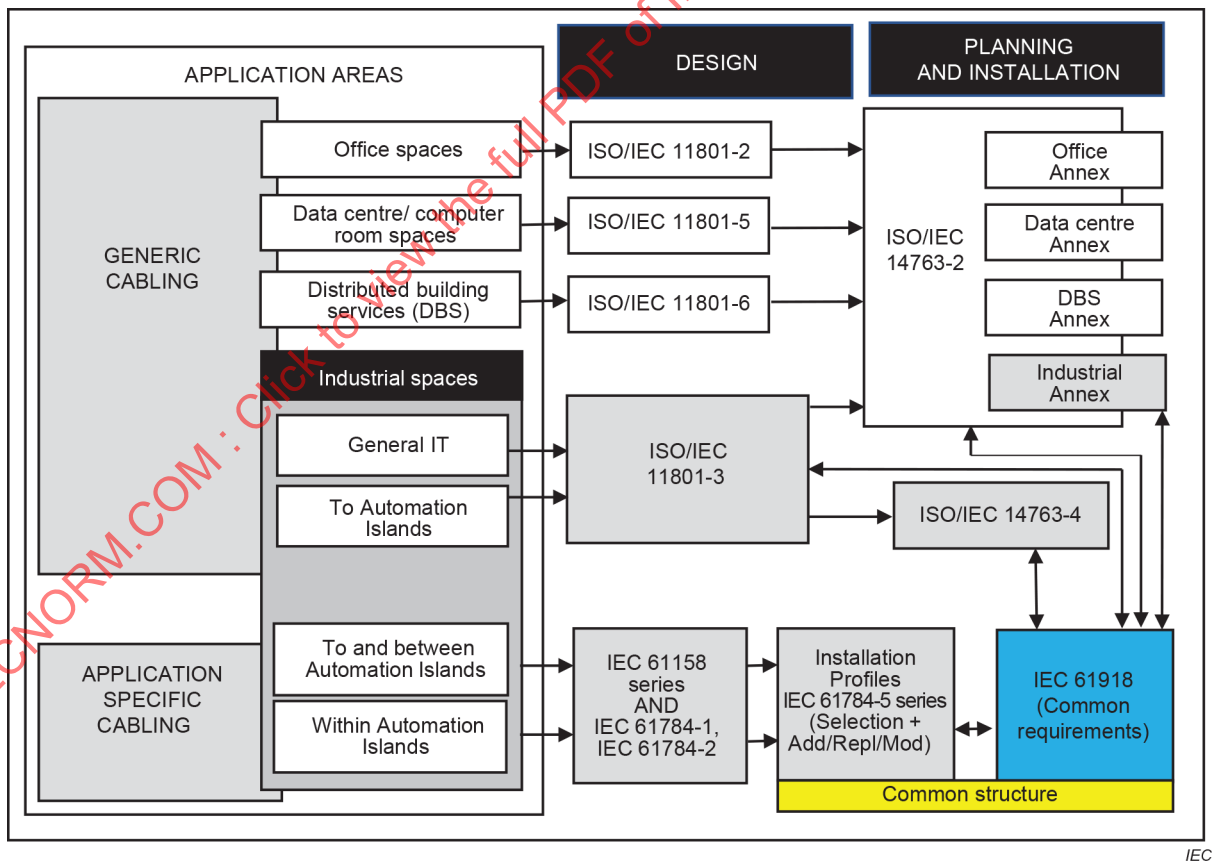

Figure 1 – Standards relationships

INTRODUCTION to Amendment 1

This Amendment 1 includes the following significant technical changes with respect to IEC 61784-5-21:2018:

a) in A.4.3.2.3, Table A.1:
   - 1 000 (Mbit/s) is added to "Supported data rates (Mbit/s)",
   - Category 5e is added to "Cable category per ISO/IEC 11801-3",
   - Category 5e is added to "Connecting HW category per ISO/IEC 11801-3";

b) in A.4.3.2.4, Table A.2, Single mode silica:
   - "Bandwidth (MHz) or equivalent at λ (nm)" is changed to 120 and 1 500,
   - "Maximum channel Insertion loss/optical power budget (dB)" is changed to 10,5.

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 5-21: Installation of fieldbuses – Installation profiles for CPF 21

1 Scope

This part of IEC 61784 specifies the installation profile for CPF 21 (FL-net[1]).

The installation profile is specified in the annex. The 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

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, and IEC 61918:2018/AMD1:2022, Clause 3 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

4 CPF 21: Overview of installation profiles

CPF 21 consists of one communication profile as specified in IEC 61784-2.

The installation requirements for CP 21/1 (FL-net) are specified in Annex A.

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1 FL-net is the trade name of JEMA/FL-net: The Japan Electrical Manufacturers' Association / the Factory Automation Link network. 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 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.

5 Installation profile conventions

The numbering of the clauses and subclauses in the annex 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 in the normative annex 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 61784-5-21 means that CP 21/1 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 apply.

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.

6 Conformance to installation profiles

Each installation profile within this document includes part of the IEC 61918:2018. It may also include defined additional specifications.

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

> Compliance with IEC 61784-5-21:2018 and IEC 61784-5-21:2018/AMD1:2024 for CP 21/m <name> or
>
> Compliance with IEC 61784-5-21 (Ed.1.1) for CP 21/m <name>

where the name within the angle brackets < > is optional and the angle brackets shall not be included. The m within CP 21/m shall be replaced by the profile number 1.

NOTE The name can be the name of the profile, for example FL-net.

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).

Annex A
(normative)

CP 21/1 (FL-net) specific installation profile

A.1 Installation profile scope

Addition:

This annex specifies the installation profile for Communication Profile CP 21/1 (FL-net). The CP 21/1 is specified in IEC 61784-2.

A.2 Normative references

Addition:

IEC 61754-18:2001, *Fibre optic connector interfaces – Part 18: Type MT-RJ connector family*

IEC 60793-2-50:2018, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60603-7-2:2010, *Connectors for electronic equipment – Part 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz*

IEC 60603-7-3:2010, *Connectors for electronic equipment – Part 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 100 MHz*

IEC 60603-7-4:2010, *Connectors for electronic equipment – Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-5:2010, *Connectors for electronic equipment – Part 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

ANSI/TIA/EIA-568-B, *Commercial building telecommunications cabling standard*

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

Subclause 3.3 is not applicable.

A.4 Installation planning

A.4.1 General

Subclause 4.1.4 is not applicable.

A.4.2 Planning requirements

A.4.2.1 Safety

Subclause 4.2.1.3 is not applicable.

Subclause 4.2.1.4 is not applicable.

A.4.2.2 Security

Not applicable.

A.4.2.3 Environmental considerations and EMC

Subclause 4.2.3.2 has addition:

Only the products that are declared by the manufacturers as applicable to CP 21/1 fieldbus network shall be used and included in the 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

Subclause 4.3.1.4 is not applicable.

Subclause 4.3.1.5 has addition:

Star topology applies to CP 21/1 fieldbus networks.

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 21/1
Supported data rates (Mbit/s)	100, 1 000
Supported channel length (m) [b]	100
Number of connections in the channel (max.) [a b]	4
Patch cord length (m) [a]	100
Channel class per ISO/IEC 11801-3 (min.) [b]	D
Cable category per ISO/IEC 11801-3 (min.) [c]	5, 5e
Connecting HW category per ISO/IEC 11801-3 (min.)	5, 5e
Cable types	– [d]

[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 the IEC 61156 series.

[d] As specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801.

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.

Table A.2 – Network characteristics for optical fibre cabling

CP 21/1		
Optical fibre type	**Description**	
Single mode silica	Bandwidth (MHz) or equivalent at λ (nm)	120, 1 500
	Minimum length (m)	0
	Maximum length[a] (m)	10 000
	Maximum channel Insertion loss/optical power budget (dB)	10,5 [b]
	Connecting hardware	See A.4.4.2.5
Multimode silica	Modal bandwidth (MHz x 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 [b]
	Connecting hardware	See A.4.4.2.5
Multimode silica	Modal bandwidth (MHz x km) at λ (nm)	500 at 1 310
	Minimum length (m)	0
	Maximum length[a] (m)	2 000
	Maximum channel Insertion loss/optical power budget (dB)	8 [b]
	Connecting hardware	See A.4.4.2.5
POF	Modal bandwidth (MHz x 100 m) at λ (nm)	–
	Minimum length (m)	–
	Maximum length[a] (m)	–
	Maximum channel Insertion loss/optical power budget (dB)	–
	Connecting hardware	–
Hard clad silica	Modal bandwidth (MHz x km) at λ (nm)	–
	Minimum length (m)	–
	Maximum length[a] (m)	–
	Maximum channel Insertion loss/optical power budget (dB)	–
	Connecting hardware	–

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

[b] According to ISO/IEC 11801; see manufacturer's data sheet.

A.4.3.2.5 Specific network characteristics

Not applicable.