BS EN 61784-5-6:2013

BSI Standards Publication

Industrial communication networks — Profiles

Part 5-6: Installation of fieldbuses — Installation profiles for CPF 6

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National foreword

This British Standard is the UK implementation of EN 61784-5-6:2013. It is identical to IEC 61784-5-6:2013. It supersedes BS EN 61784-5-6:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English version

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(IEC 61784-5-6:2013)

Réseaux de communication industriels - Profils - Partie 5-6: Installation des bus de terrain - Profils d'installation pour CPF 6 (CEI 61784-5-6:2013)

Industrielle Kommunikationsnetze - Profile - Teil 5-6: Feldbusinstallation - Installationsprofile für die Kommunikationsprofilfamilie 6 (IEC 61784-5-6:2013)

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Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 65C/738/FDIS, future edition 3 of IEC 61784-5-6, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61784-5-6:2013.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-07-22
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-10-22

This document supersedes EN 61784-5-6:2012.

EN 61784-5-6:2013 includes the following significant technical changes with respect to EN 61784-5-6:2012:

– alignment with EN 61918:2013;

– addition of new connectors.

This standard is to be used in conjunction with EN 61918:2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61784-5-6:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC/TR 61158-1	NOTE	Harmonized as CLC/TR 61158-1.
IEC 61158 Series	NOTE	Harmonized as EN 61158 Series (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Annex ZA of EN 61918:2013 applies, except as follows:

Publication	Year	Title	EN/HD	Year

Addition to Annex ZA of EN 61918:2013:

IEC 61918	2013	Industrial communication networks - Installation of communication networks in industrial premises	EN 61918	2013

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INTRODUCTION

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

IEC 61918:2013 provides the common requirements for the installation of communication networks in industrial control systems. This installation profile standard 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 standard, see IEC 61158-1.

Each CP installation profile is specified in a separate annex of this standard. 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 standard are defined in Clause 5.

The provision of the installation profiles in one standard for each CPF (for example IEC 61784-5-6 for CPF 6), allows readers to work with standards of a convenient size.

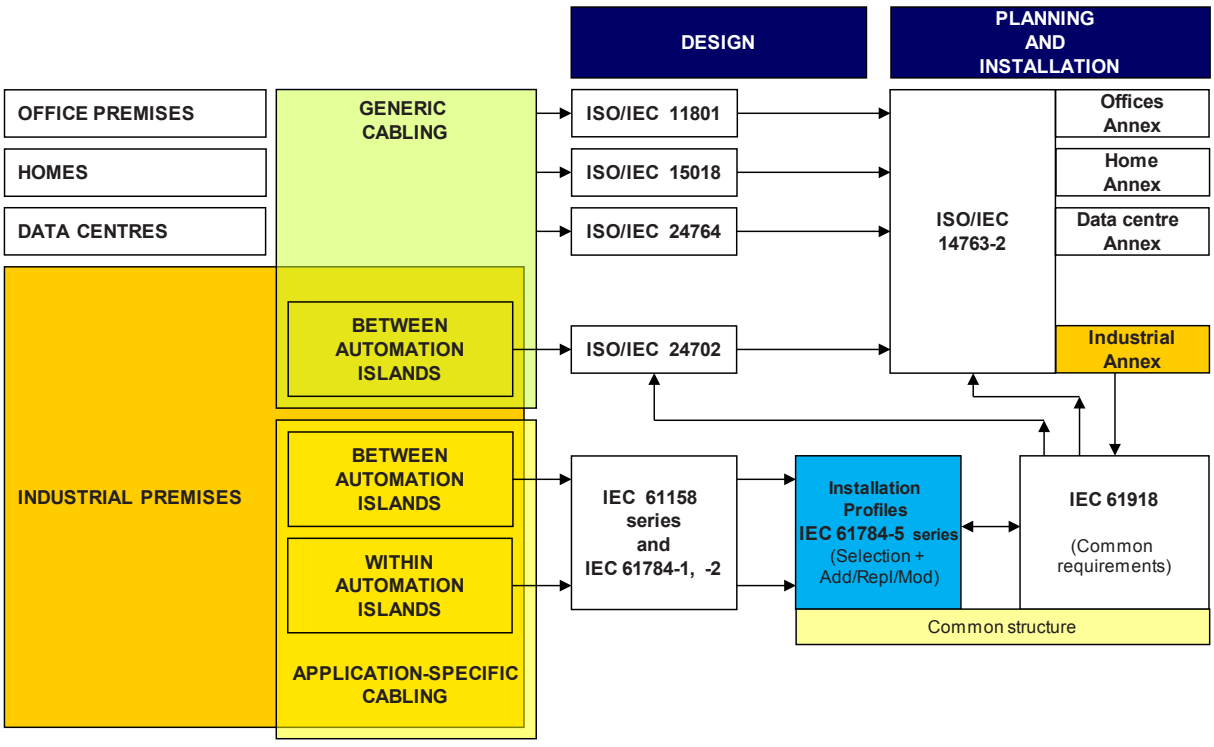

Figure 1 – Standards relationships

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 5-6: Installation of fieldbuses – Installation profiles for CPF 6

1 Scope

This part of IEC 61784-5 specifies the installation profiles for CPF 6 (INTERBUS)[1].

The installation profiles are specified in the annexes. These annexes are read in conjunction with IEC 61918:2013.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61918:2013, *Industrial communication networks – Installation of communication networks in industrial premises*

The normative references of IEC 61918:2013, Clause 2, apply. For profile specific normative references, see Clauses A.2 and B.2.

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms, definitions and abbreviated terms given in IEC 61918:2013, Clause 3, apply. For profile specific terms, definitions and abbreviated terms see Clauses A.3 and B.3.

4 CPF 6: Overview of installation profiles

CPF 6 consists of seven communication profiles (see IEC 61784-1 for CP 6/1, CP 6/2, CP 6/3, see IEC 61784-2 for CP 6/4, CP 6/5, CP 6/6, see IEC 61784-3-6 for FSCP 6/7).

The CPF 6 Type 8 network (non-Ethernet-based) installation profile is specified in Annex A.

The CPF 6 Ethernet network specific installation profile is specified in Annex B.

5 Installation profile conventions

The numbering of the clauses and subclauses in the annexes of this standard corresponds to the numbering of IEC 61918:2013 main clauses and subclauses.

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[1] INTERBUS is a trade name of INTERBUS Club, an independent organisation of users and vendors of INTERBUS products. This information is given for the convenience of users of this International Standard 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 INTERBUS. Use of the trade name INTERBUS requires permission of the trade name holder.

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

Where there is no corresponding subclause of IEC 61918 in the normative annexes in this standard, 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 B.4.4" in IEC 61784-5-6 means that CP 6/2 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.

6 Conformance to installation profiles

Each installation profile within this standard includes part of IEC 61918:2013. It may also include defined additional specifications.

A statement of compliance to an installation profile of this standard shall be stated[2] as either

Compliance to IEC 61784-5-6:2013 [3] for CP 6/m <name> or

Compliance to IEC 61784-5-6 (Ed.3.0) for CP 6/m <name>

where the name within the angle brackets < > is optional and the angle brackets are not to be included. The m within CP 6/m shall be replaced by the profile number 1 to 2.

NOTE The name can be the name of the profile, for example INTERBUS.

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

---

2 In accordance with ISO/IEC Directives.

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

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)

CPF 6 Type 8 network specific installation profile

A.1 Installation profile scope

Addition:

This standard specifies the installation profile for CPF 6 Type 8 networks and the related Communication Profiles:

- CP 6/1, CP 6/2, CP 6/3 – specified in IEC 61784-1;
- CP 6/4, CP 6/5, CP 6/6 – specified in IEC 61784-2;
- FSCP 6/7 – specified in IEC 61784-3-6.

A.2 Normative references

Addition:

IEC 60189-1:2007, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60794-1-2:2003, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

IEC/PAS 61076-2-109:2010, *Connectors for electronic equipment – Product requirements – Part 2-109: Circular connectors – Detail specification for connectors M 12 × 1 with screw-locking, for data transmissions with frequencies up to 500 MHz*

IEC 61156-1:2007, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC 61156-5:2002, *Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification*

IEC/PAS 61753-1-3:2009, *Fibre optic interconnecting devices and passive components performance standard – Part 1-3: General and guidance for performance standards – Single-mode fibre optic connector performance for harsh industrial operating conditions*

IEC 61754-1:2007, *Fibre optic connector interfaces – Part 1: General and guidance*

IEC 61754-27*, Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces – Part 27: Type M12-FO connector family*[4]

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

A.3.1 Terms and definitions

Addition:

[4] To be published.

A.3.1.79
bus coupler
device that divides the Type 8 network into segments by opening the ring and integrating another ring at this point

A.3.1.80
local bus
ring segment of a Type 8 network with alternate media specifications, which is coupled to a remote bus device via a bus coupler

A.3.1.81
local bus device
device that operates as a slave on a local bus

A.3.1.82
master
device that controls the data transfer on the Type 8 network and initiates the media access of the slaves by sending messages and that constitutes the interface to the control system

A.3.1.83
remote bus
ring segment of a network

A.3.1.84
remote bus
device operating as a slave on a remote bus

A.3.1.85
remote bus link
connection of two remote bus devices

A.3.1.86
ring segment
one section of a Type 8 network

A.3.1.87
slave
device that accesses the medium only after it has been initiated by the preceding slave or master

A.3.2 Abbreviated terms

Addition:

BC	Bus coupler
COM	Ground line
/DI	Incoming interface: send data line – Outgoing interface: receive data line –
DI	Incoming interface: send data line + Outgoing interface: receive data line +
/DO	Incoming interface: receive data line – Outgoing interface: send data line -
DO	Incoming interface: receive data line + Outgoing interface: send data line +
PELV	Protective extra low voltage
POF	Plastic optical fibre
SELV	Safety extra low voltage

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 24702

Not applicable.

A.4.2 Planning requirements

A.4.2.1 Safety

A.4.2.1.1 General

A.4.2.1.2 Electric safety

Addition:

The power distribution system shall comply with IEC 60364-1:2005, 312.2.1 TN-S systems, i.e. earthed by bonding of enclosures with separated conductors for neutral (N) and protection earth (PE). Otherwise there are additional efforts necessary to avoid currents on the shield, i.e. an a.c. earthed system on one end in a network with balanced cables or a network built with FO-cables. For networks built with OF-cables the power distribution system should comply with IEC 60364-1:2005, 312.2.1 TN-S systems.

PELV is the default version for the power supply with extra-low-voltage, but SELV may also be used. Temporary connected devices shall be powered by PELV or SELV.

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

Addition:

To make fieldbus installation work easier for inexperienced planners, the user shall determine suitability of the components for the targeted environment through agreements with the component providers. The planner shall also observe the related technical data from the active devices. Depending on the expected environment the planner should define additional requirements. Passive optical components in the harsh industrial environment should be protected with suitable mitigation techniques or tested according IEC/PAS 61753-1-3.

The planner shall take into account the mating or terminating interface of devices to be connected to the fieldbus network.

The planner also shall take care about the environmental conditions of the whole Type 8 network and select suitable mitigation techniques to meet the respective requirements. Products necessary for mitigation also shall be mentioned in the bill of material.

A.4.2.4 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

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

Replacement:

For Type 8 networks only the ring topology specified in IEC 61158-2:2013 shall be used.

NOTE The Type 8 ring topology is achieved with specific cables and resembles a linear tree topology. Further explanation of the physical layer of Type 8 networks can be found in IEC 61158-2.

A.4.3.1.4 Combination of basic topologies

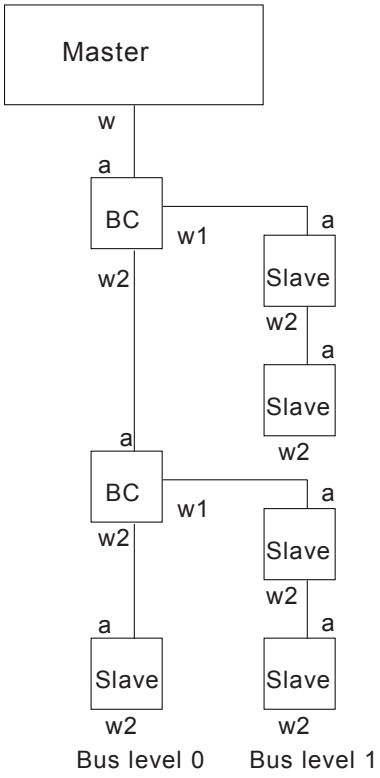
Replacement:

The combination of several topologies may also be used according to A.4.3.1.5

A.4.3.1.5 Specific requirements for CPs

Addition:

The general structure is a ring topology with special cables to build tree like configurations. Bus couplers allow a branch from the remote bus to the local bus or to a further remote bus. Figure A.1 shows a Type 8 network structure example. There is no limit for the sub-leveling of remote buses. Only one local bus can be connected to a remote bus. A maximum of 63 devices can be connected to one local bus.



Key

w outgoing interface of the master
a incoming interface of a slave
w1 first outgoing interface of a slave
w2 second outgoing interface of a slave

The ring segment level is increased when the devices are connected to w1.

Figure A.1 – Type 8 network structure example

The remote bus link length (i.e. the cable between two devices on a remote bus link) shall be between 0 m and the maximum length for the used bit rate (see Table A.1). The local bus link length (i.e. the cable between two devices on a local bus link) shall be between 0 m and 10 m. Figure A.2 shows a Type 8 network configuration example with bus length indications.

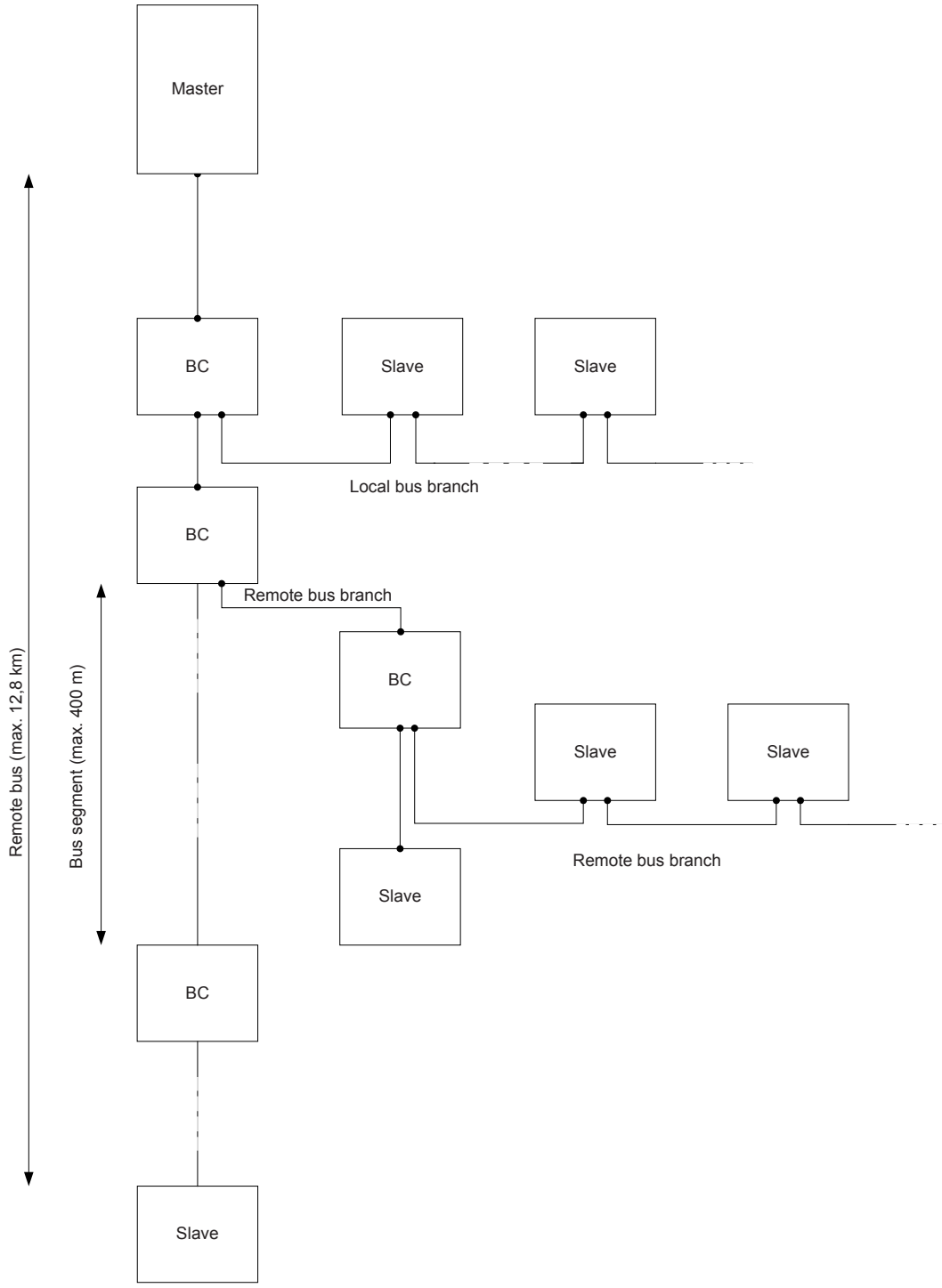


Figure A.2 – Example of a Type 8 network configuration

A.4.3.1.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

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

Replacement:

Table A.1 provides values based on the template given in IEC 61918:2013. Table 1.

Table A.1 – Basic network characteristics for balanced cabling not based on Ethernet

Characteristic	Type 8 network
Basic transmission technology	Type 8
Length / transmission speed	**Segment length** m
500 kbit/s	400 m between nodes [a]
2 Mbit/s	150 m between nodes [a]
8 Mbit/s	125 m between nodes [a]
16 Mbit/s	100 m between nodes [a]
Maximum capacity	**Max. No.**
Devices / segment	Remote bus: 256 [b] Local bus: 63 [b]
Number of devices / network	Remote bus: 256 [b] Local bus: 256 [b]
[a] The maximum length of a Type 8 network depends on the number of devices supported by the master and could be calculated by multiplication of link length by the number of devices. [b] The maximum number of all device in one Type 8 network is limited to 256.	

A.4.3.2.3 Network characteristics for balanced cabling based on Ethernet

Not applicable.

A.4.3.2.4 Network characteristics for optical fibre cabling

Replacement:

Table A.2 provides values based on the template given in IEC 61918:2013, Table 3.

Table A.2 – Network characteristics for optical fibre cabling

Type 8 network		
Optical fibre type	**Description**	
Single mode silica	Bandwidth (MHz) or equivalent at λ (nm)	1 310 nm
	Minimum length (m)	0
	Maximum length[a] (m)	15 000
	Maximum channel Insertion loss/optical power budget (dB)	See IEC 61158-2
	Connecting hardware	See A.4.4.2.5
Multimode silica	Modal bandwidth (MHz × km) at λ (nm)	1 300 nm
	Minimum length (m)	0
	Maximum length[a] (m)	3 000
	Maximum channel insertion loss/optical power budget (dB)	See IEC 61158-2
	Connecting hardware	See A.4.4.2.5
POF	Modal bandwidth (MHz × 100 m) at λ (nm)	650 nm
	Minimum length (m)	0
	Maximum length[a] (m)	70
	Maximum channel insertion loss/optical power budget (dB)	See IEC 61158-2
	Connecting hardware	See A.4.4.2.5
Hard clad silica	Modal bandwidth (MHz × km) at λ (nm)	650 nm
	Minimum length (m)	0
	Maximum length[a] (m)	400
	Maximum channel insertion loss/optical power budget (dB)	See IEC 61158-2
	Connecting hardware	See A.4.4.2.5
[a] This value is reduced by connections, splices and bends in accordance with formula (1) in 4.4.3.4.1 of IEC 61918:2013.		

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 24702

Not applicable.

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

Not applicable.

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

Replacement:

Table A.3 and Table A.4 provide values based on the template given in IEC 61918:2013, Table 4 and Table 5.

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

Characteristic	Type 8 network
Nominal impedance of cable (tolerance)	120 Ω ± 20 % at f = 0,064 MHz 100 Ω ± 15 Ω at f > 1 MHz Test method IEC 61156-1:2007, 6.3.1
DCR of conductors	max. 9,6 Ω / 100 m Test method IEC 60189-1:2007, 8.1
DCR of shield	-
Number of conductors	3 × 2, twisted pair
Shielding	Yes
Colour code for conductor	DO = yellow /DO = green DI = gray /DI = pink COM = brown
Jacket colour requirements	Green, RAL 6017
Jacket material	Application dependant
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	Cable types for different applications available
Agency ratings	Cable types with different ratings available
Cross section	min. 0,20 mm^2
Dielectric strength - Conductor/conductor - Conductor/shield	1 000 V r.m.s, 1 min 1 000 V r.m.s, 1 min Test method IEC 60189-1:2007, 8.2
Insulation resistance (after dielectric strength test)	min 150 MΩ for a cable of 1 km in length Test method IEC 60189-1:2007, 8.3
Maximum transfer impedance - at 30 MHz	 250 mΩ/m
Mutual capacitance (at 800 Hz)	Max 60 nF for a cable of 1 km in length Test method IEC 60189-1:2007, 8.4

Characteristic	Type 8 network
Min. near end cross talk loss (NEXT) for a cable of 100 m	
- at 0,772 MHz	61 dB
- at 1 MHz	59 dB
- at 2 MHz	55 dB
- at 4 MHz	50 dB
- at 8 MHz	46 dB
- at 10 MHz	44 dB
- at 16 MHz	41 dB
- at 20 MHz	40 dB
	Test method IEC 61156-1:2007, 6.3.5
Max. attenuation for a cable of 100 m	
- at 0,256 MHz	1,5 dB
- at 0,772 MHz	2,4 dB
- at 1 MHz	2,7 dB
- at 4 MHz	5,2 dB
- at 10 MHz	8,4 dB
- at 16 MHz	11,2 dB
- at 20 MHz	11,9 dB
	Test method IEC 61156-1:2007, 6.3.3

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

Characteristic	Type 8 network
Nominal impedance of cable (tolerance)	120 Ω ± 20 % at f = 0,064 MHz 100 Ω ± 15 Ω at f > 1 MHz Test method IEC 61156-1:2007, 6.3.1
DCR of conductors	max. 9,6 Ω / 100 m Test method IEC 60189-1:2007, 8.1
DCR of shield	-
Number of conductors	3 × 2, twisted pair
Shielding	Yes
Colour code for conductor	DO = yellow /DO = green DI = gray /DI = pink COM = brown
Jacket colour requirements	Green, RAL 6017
Jacket material	Application dependant
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	Cable types for different applications available
Agency ratings	Cable types with different ratings available
Cross section	min. 0,20 mm^2
Dielectric strength - Conductor/conductor - Conductor/shield	1 000 V r.m.s, 1 min 1 000 V r.m.s, 1 min Test method IEC 60189-1:2007, 8.2

Characteristic	Type 8 network
Insulation resistance (after dielectric strength test)	min 150 MΩ for a cable of 1 km in length Test method IEC 60189-1:2007, 8.3
Maximum transfer impedance - at 30 MHz	 250 mΩ/m
Mutual capacitance (at 800 Hz)	Max 60 nF for a cable of 1 km in length Test method IEC 60189-1:2007, 8.4
Min. near end cross talk loss (NEXT) for a cable of 100 m - at 0,772 MHz - at 1 MHz - at 2 MHz - at 4 MHz - at 8 MHz - at 10 MHz - at 16 MHz - at 20 MHz	 61 dB 59 dB 55 dB 50 dB 46 dB 44 dB 41 dB 40 dB Test method IEC 61156-1:2007, 6.3.5
Max. attenuation for a cable of 100 m - at 0,256 MHz - at 0,772 MHz - at 1 MHz - at 4 MHz - at 10 MHz - at 16 MHz - at 20 MHz	 1,5 dB 2,4 dB 2,7 dB 5,2 dB 8,4 dB 11,2 dB 11,9 dB Test method IEC 61156-1:2007, 6.3.3

A.4.4.1.3 Cables for wireless installation

A.4.4.1.4 Optical fibre cables

Replacement:

The planner shall select the appropriate optical fibre cable to support the required channel lengths and number of connections to be installed.

The cable shall be according to IEC 61158-2:2013, 27.7.2 and 28.1.

Polymer optical fibre cable shall be detailed according to IEC 61158-2:2013, 28.6.2.

Polymer clad optical fibre cable shall be detailed according to IEC 61158-2:2013, 28.6.3.

A.4.4.1.5 Special purpose balanced and optical fibre cables

Addition:

The specification from additional mechanical data depends on the application. The electrical or optical data apply also for specific cabling (see Table A.5).

Table A.5 – Remote bus fibre optic cable length

Fibre type	Minimum length	Maximum length
Polymer optical fibre	0 m	50 m (see notes 1, 2)
Plastic clad silica fibre	0 m	300 m (see notes 1, 2)
NOTE 1 This does not exclude longer distances between two devices e.g. by using receive circuits with a lower minimum optical receiver sensitivity than specified. NOTE 2 The maximum length can be reduced in cases where special cables with higher attenuation than the standard cables specified are used.		

A.4.4.1.6 Specific requirements for CPs

Addition:

The specification from additional mechanical data depends on the application. The electrical or optical data apply also for specific cabling.

A.4.4.1.7 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

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

Not applicable.

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

Replacement:

Table A.6 provides values based on the template given in IEC 61918:2013, Table 8.

Table A.6 – Connectors for copper cabling CPs not based on Ethernet

	IEC 60807-2 or IEC 60807-3	IEC 61076-2-101			IEC 61169-8	ANSI/NFPA T3.5.29 R1-2007		Others		
	Sub-D	M12-5 with A-coding	M12-5 with B-coding	M12-n with X-coding	Coaxial (BNC)	M 18	7/8-16 UN-2B THD	Open style	Terminal block	M23, 9 pos
CPF 6 Type 8 net work	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes [a]
NOTE For M12-5 connectors, there are many applications using these connectors that are not compatible and when mixed can cause damage to the applications.										
[a] Hybrid connector as specified in IEC 61158-2:2013, M.3.										

A.4.4.2.4 Connecting hardware for 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 61918:2013 Table 9.

Table A.7 – Optical fibre connecting hardware

	IEC 61754 -2	IEC 61754 -4	IEC 61754 -24	IEC 61754 -24-21	IEC 61754 -20	IEC 61754 -22	Others	
	BFOC 2,5	SC	SC-RJ	Sealed SC-RJ	LC	F-SMA	Hybrid connector	M12-FO
CPF 6 Type 8 network	Yes	No	Yes	Yes	No	Yes	Yes [a]	Yes [b]
NOTE IEC 61754 series defines the optical fibre connector mechanical interfaces; performance specifications for optical fibre connectors terminated to specific fibre types are standardised in IEC 61753 series.								
[a] As specified in IEC 61158-2:2013, M.3.								
[b] The planner shall use the specification defined in Figure B.1 and Figure B.2 until the standard IEC 61754-27 is published.								

Replacement:

Table A.8 provides values based on the template given in IEC 61918:2013, Table 10.

Table A.8 – Relationship between FOC and fibre types (Type 8 networks)

	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
BFOC/2,5	No	No	Yes	No	Yes
SC	No	No	No	No	No
SC-RJ	Yes	Yes	Yes	Yes	Yes
LC	No	No	No	No	No
F-SMA	No	No	No	Yes	Yes
Hybrid connector	No	No	No	Yes	Yes
M12-FO	Yes	Yes	Yes	Yes	Yes

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 24702

Not applicable.

A.4.4.3 Connections within a channel/permanent link

A.4.4.3.1 Common description

Not applicable.

A.4.4.3.2 Balanced cabling connections and splices for CPs based on Ethernet

Not applicable.

A.4.4.3.3 Copper cabling connections and splices for CPs not based on Ethernet

A.4.4.3.3.1 Common description

Addition:

Refer to the manufacturer's data sheet regarding the number of allowed connections. The number of allowed connections, adaptors and splices relates to the maximum channel attenuation.

A.4.4.3.3.2 Connections minimum distance

A.4.4.3.3.3 Copper cabling splices

A.4.4.3.3.4 Copper cabling bulkhead connections

A.4.4.3.3.5 Copper cabling J-J adaptors

A.4.4.3.4 Optical fibre cabling connections and splices for CPs based on Ethernet

Not applicable.

A.4.4.3.5 Optical fibre cabling connections and splices for CPs not based on Ethernet

Addition:

The number of allowed connections and splices relates to the maximum channel attenuation.

A.4.4.3.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.4.4.4 Terminators

Not applicable.

A.4.4.5 Device location and connection

A.4.4.5.1 Common description

A.4.4.5.2 Specific requirements for CPs

Not applicable.

A.4.4.5.3 Specific requirements for wireless installation

A.4.4.5.4 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.4.4.6 Coding and labelling

A.4.4.6.1 Common description

A.4.4.6.2 Additional requirements for CPs

A.4.4.6.3 Specific requirements for CPs

Addition:

For balanced cables, the signal wires shall comply with the colour codes specified in Table A.9.

Table A.9 – Colour code for balanced cables used by Type 8 networks

Signal	Colour code
DO	YE
/DO	GN
DI	GY
/DI	PK
COM	BN

A.4.4.6.4 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

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

A.4.4.7.1 Common description

A.4.4.7.1.1 Basic requirements

Replacement:

Earth potential differences between cabling end points will induce noise in the cabling system. This is especially true in shielded cabling systems. Controlling earth currents is extremely important in reducing interference caused by earth offsets. Shield currents shall be mitigated by using a proper earthing system and/or proper shield termination techniques as defined in this standard and the relevant CPs. If this requirement cannot be met, then alternate media, such as optical fibre cables, or wireless, shall be considered. UTP cables shall not be used.

A.4.4.7.1.2 Planner tasks

A.4.4.7.1.3 Methods for controlling potential differences in the earth system

A.4.4.7.1.4 Selection of the earthing and bonding systems

A.4.4.7.2 Bonding and earthing of enclosures and pathways

A.4.4.7.2.1 Equalisation and earthing conductor sizing and length

A.4.4.7.2.2 Bonding straps and sizing

A.4.4.7.2.3 Surface preparation and methods

A.4.4.7.2.4 Bonding and earthing

A.4.4.7.3 Earthing methods

A.4.4.7.4 Shield earthing

A.4.4.7.4.1 Non-earthing or parallel RC

Replacement:

A parallel RC circuit is located in the devices. Otherwise an equipotential cable between any two devices shall be installed according to IEC 61918:2013, 4.4.7.2.1.

A.4.4.7.4.2 Direct

Not applicable.

A.4.4.7.4.3 Derivatives of direct and parallel RC

Not applicable.

A.4.4.7.5 Specific requirements for CPs

Not applicable.

A.4.4.7.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.4.4.8 Storage and transportation of cables

A.4.4.9 Routing of cables

A.4.4.10 Separation of circuit

A.4.4.11 Mechanical protection of cabling components

A.4.4.11.1 Common description

A.4.4.11.2 Specific requirements for CPs

A.4.4.11.3 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.4.4.12 Installation in special areas

Subclause 4.4.12.3 is not applicable.

A.4.5 Cabling planning documentation

A.4.5.1 Common description

A.4.5.2 Cabling planning documentation for CPs

Addition:

The device documentation shall be observed for additional rules.

A.4.5.3 Network certification documentation

A.4.5.4 Cabling planning documentation for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.4.6 Verification of cabling planning specification

A.5 Installation implementation

A.5.1 General requirements

A.5.1.1 Common description

A.5.1.2 Installation of CPs

A.5.1.3 Installation of generic cabling in industrial premises

Not applicable.

A.5.2 Cable installation

A.5.2.1 General requirements for all cabling types

A.5.2.1.1 Storage and installation

A.5.2.1.2 Protecting communication cables against potential mechanical damage

Replacement:

Table A.10 provide values based on the template given in IEC 61918:2013, Table 18.

Table A.10 – Parameters for balanced cables

Characteristic		Type 8 network
Mechanical force	Minimum bending radius, single bending	64 mm [a]
	Bending radius, multiple bending	64 mm [a]
	Pull forces	N [a]
	Permanent tensile forces	N [a]
	Maximum lateral forces	N/cm
	Temperature range during installation	0 °C to 70 °C [a]
[a] Reference value, deviations are allowed, see manufacturer's data sheet.		

Replacement:

Table A.11 provide values based on the template given in IEC 61918:2013, Table 19.

Table A.11 – Parameters for silica optical fibre cables

Characteristic		Type 8 network
Mechanical force	Minimum bending radius, single bending	30 mm [a]
	Bending radius, multiple bending	50 mm [a]
	Pull forces	800 N [a]
	Permanent tensile forces	200 N [a]
	Maximum lateral forces	100 N/cm
	Temperature range during installation	5 °C to 50 °C [a]
[a] Reference value, deviations are allowed, see manufacturer's data sheet.		

Replacement:

Table A.12 provide values based on the template given in IEC 61918:2013, Table 20.

Table A.12 – Parameters for POF optical fibre cables

Characteristic		Type 8 network for permanent indoor installation	Type 8 network for indoor installations with movements
Mechanical force	Minimum bending radius, single bending	30 mm [a]	50 mm [a]
	Bending radius, multiple bending	50 mm [a]	65 mm [a]
	Pull forces	600 N [a]	300 N [a]
	Permanent tensile forces	100 N [a]	100 N [a]
	Maximum lateral forces	20 N/cm	20 N/cm
	Temperature range during installation	5 °C to 50 °C [a]	5 °C to 50 °C [a]
	Suitable for use as trailing cable	No	10 × d, at least 5 million cycles, Increase in attenuation ≤ 1dBm
[a] Reference value, deviations are allowed, see manufacturer's data sheet.			

Replacement:

Table A.13 provide values based on the template given in IEC 61918:2013, Table 21.

Table A.13 – Parameters for hard clad silica optical fibre cables

Characteristic		Type 8 network for permanent indoor installation	Type 8 network for permanent outdoor installation
Mechanical force	Minimum bending radius, single bending	30 mm [a]	150 mm [a]
	Bending radius, multiple bending	50 mm [a]	200 mm [a]
	Pull forces	800 N [a]	1 500 N [a]
	Permanent tensile forces	200 N [a]	200 N [a]
	Maximum lateral forces	100 N/cm	300 N/cm
	Temperature range during installation	5 °C to 50 °C [a]	–5 °C to 50 °C [a]
	Longitudinal water tightness	No	IEC 60794-1-2:2003 Method F5
[a] Reference value, deviations are allowed, see manufacturer's data sheet.			

A.5.2.1.3 Avoid forming loops

A.5.2.1.4 Torsion (twisting)

A.5.2.1.5 Tensile strength (on installed cables)

A.5.2.1.6 Bending radius

A.5.2.1.7 Pull force

A.5.2.1.8 Fitting strain relief

A.5.2.1.9 Installing cables in cabinet and enclosures

A.5.2.1.10 Installation on moving parts

A.5.2.1.11 Cable crush

A.5.2.1.12 Installation of continuous flexing cables

A.5.2.1.13 Additional instructions for the installation of optical fibre cables

A.5.2.2 Installation and routing

A.5.2.2.1 Common description

A.5.2.2.2 Separation of circuits

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 24702

Not applicable.

A.5.3 Connector installation

A.5.3.1 Common description

A.5.3.2 Shielded connectors

A.5.3.3 Unshielded connectors

Not applicable.

A.5.3.4 Specific requirements for CPs

Replacement:

Deviations from the mechanical specifications are permitted for special applications if the electrical features of the cable correspond to the data specified in A.4.4 (in the event of deviations, please see the data sheet). A cable connection method should be selected, which will not cause a marked deterioration in the specified electrical data. Particular attention should be paid when selecting the connection method for the shielding. The shielding shall be connected in such a way that the conductor cross section is not reduced and the wires are covered with as much of the shielding as possible. The shielding shall be led concentrically through the threaded joint as far as possible.

The wire pairs shall be twisted up to the connection contacts. Two cables should not be connected with each other as losses can be caused by reflections at the connection point and the effectiveness of the shielding could also deteriorate. This is especially relevant if different cable types are connected with one another.

If it is not possible to avoid connection points or the electrical data cannot be achieved for a special cable, an individual test should be carried out to determine whether, for example, the cable can still be used by reducing the permissible transmission distance.

Different connectors can be applied. The wiring schemes are shown in Figure A.3, Figure A.4 and Figure A.5

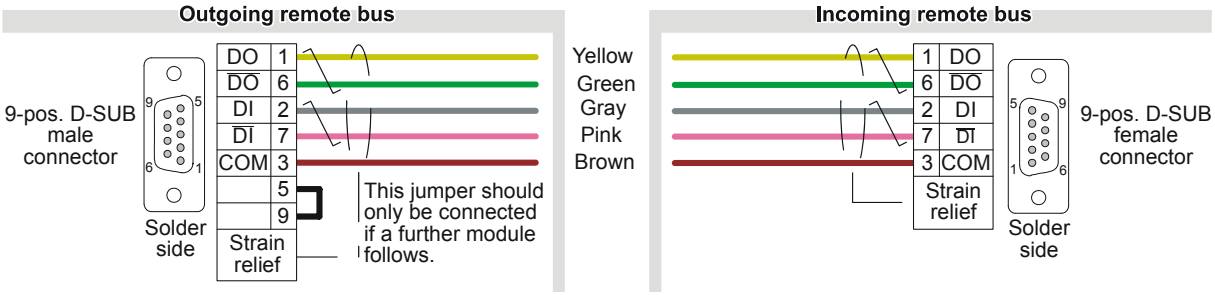


Figure A.3 – Sub-D connector pin assignment

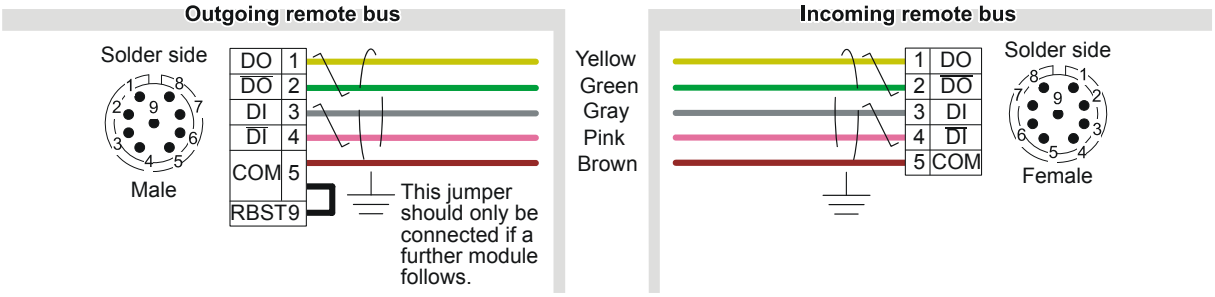


Figure A.4 – M23 circular connector pin assignment

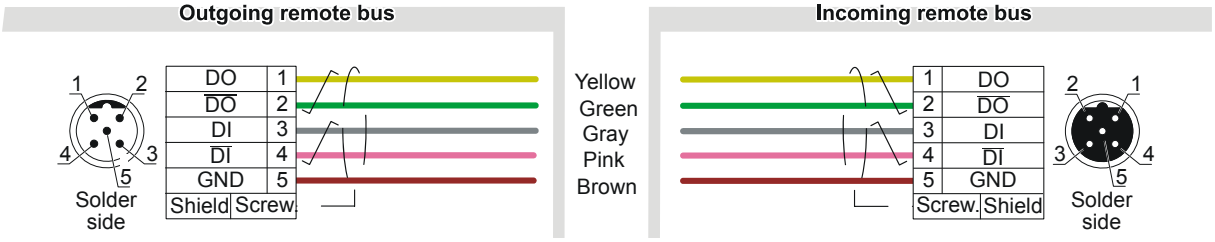


Figure A.5 – M12 circular connector pin assignment

Figure A.6 shows the terminal connector position at the device, and the pin assignments of the terminal connector are shown in Table A.14.

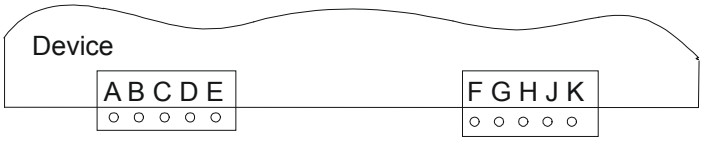


Figure A.6 – Terminal connector at the device

Table A.14 – Pin assignment of the terminal connector

Incoming interface		Outgoing interface	
Pin	**Standard**	**Pin**	**Standard**
A	/DO1	F	/DO2
B	DO1	G	DO2
C	/DI1	H	/DI2
D	DI1	J	DI2
E	GND1	K	GND

A separate terminal for protective earth shall be provided. The sequence of terminal points should be observed.

A.5.3.5 Specific requirements for wireless installation

A.5.3.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.5.4 Terminator installation

Not applicable.

A.5.5 Device installation

A.5.6 Coding and labelling

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

Subclause 5.7.6 is not applicable.

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

A.6.2.3.1 General

A.6.2.3.2 Specific requirements for earthing and bonding

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

A.6.2.6.1 Common description

A.6.2.6.2 Specific requirements for CPs

Not applicable.

A.6.2.6.3 Specific requirements for wireless installation

A.6.2.7 Connector verification

A.6.2.7.1 Common description

A.6.2.7.2 Specific requirements for CPs

Not applicable.

A.6.2.7.3 Specific requirements for wireless installation

A.6.2.8 Connection verification

A.6.2.8.1 Common description

A.6.2.8.2 Number of connections and connectors

A.6.2.8.3 Wire mapping

A.6.2.9 Terminators verification

Not applicable.

A.6.2.10 Coding and labelling verification

A.6.2.10.1 Common description

A.6.2.10.2 Specific coding and labelling verification requirements

Not applicable.

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

Not applicable.

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

A.6.3.3.1 Copper cabling for non-Ethernet-based CPs

A.6.3.3.1.1 Common description

A.6.3.3.1.2 Specific requirements for copper cabling for non-Ethernet-based CPs

Addition:

The installation shall be validated with a cable tester. The Type 8 network structure shall be checked.

Software support tools should be used for the network structure validation.

A.6.3.3.2 Optical fibre cabling for non-Ethernet-based CPs

A.6.3.3.2.1 Common description

A.6.3.3.2.2 Specific requirements for non-Ethernet-based CPs

Addition:

The Type 8 network structure and installation shall be checked.

Software support tools should be used for the network structure validation.

A.6.3.3.3 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

A.6.3.4 Specific requirements for wireless installation

A.6.3.5 Acceptance test report

Addition:

Software tools which generate test reports should be used. The test reports should be stored as a file or in a paper version.

A.7 Installation administration

Subclause 7.8 is not applicable.

A.8 Installation maintenance and installation troubleshooting

Subclause 8.4 has addition:

Inspection:

Software tools which allows a broad inspection of the system should be used for inspection.

Maintenance and repair: trained personnel shall be used.

Software tools which display the diagnostics results should be used.

Specific requirements for maintenance and troubleshooting:

Type 8 networks contain integrated diagnostic. Software tools which support a convenient presentation of the diagnostic results should be used.

Annex B
(normative)

CPF 6 Ethernet network specific installation profile

B.1 Installation profile scope

Addition:

This standard specifies the installation profile for the Ethernet network of devices applying to Communication Profile CP 6/2. CP 6/2 itself is defined in IEC 61784-1.

NOTE For the Type 8 network of devices applying CP 6/2 the installation profile specified in Annex A is used.

B.2 Normative references

Addition:

IEC 60794-1-2:2003, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

IEC 61156-1:2007, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC 61156-5:2002, *Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification*

IEC/PAS 61753-1-3:2009, *Fibre optic interconnecting devices and passive components performance standard – Part 1-3: General and guidance for performance standards – Single-mode fibre optic connector performance for harsh industrial operating conditions*

IEC 61754-27, *Fibre optic interconnecting devices and passive components – Fibreoptic connector interfaces – Part 27: Type M12-FO connector family*[5]

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

B.3.1 Terms and definitions

B.3.2 Abbreviated terms

Addition:

FO	Fibre optical
PELV	Protective extra low voltage
POF	Plastic optical fibre
SELV	Safety extra low voltage

B.3.3 Conventions for installation profiles

Not applicable.

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[5] To be published.

B.4 Installation planning

B.4.1 General

B.4.1.1 Objective

B.4.1.2 Cabling in industrial premises

B.4.1.3 The planning process

B.4.1.4 Specific requirements for CPs

Not applicable.

B.4.1.5 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

B.4.2 Planning requirements

B.4.2.1 Safety

B.4.2.1.1 General

B.4.2.1.2 Electric safety

Addition:

The power distribution system shall comply with IEC 60364-1:2005, 312.2.1 TN-S systems, i.e. earthed by bonding of bodies with separated conductors for neutral (N) and protection earth (PE). Otherwise there are additional efforts necessary to avoid currents on the shield, i.e. an a.c. earthed system on one end in a network with balanced cables or a network built with FO-cables. For networks built with FO-cables the power distribution system should comply with IEC 60364-1:2005, 312.2.1 TN-S systems.

PELV is the default version for the power supply with extra-low-voltage, but SELV may also be used. Temporary connected devices shall be powered by PELV or SELV.

B.4.2.1.3 Functional safety

B.4.2.1.4 Intrinsic safety

Not applicable.

B.4.2.1.5 Safety of optical fibre communication systems

B.4.2.2 Security

B.4.2.3 Environmental considerations and EMC

B.4.2.3.1 Description methodology

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

Addition:

To make fieldbus installation work easier for inexperienced planners, the user shall determine suitability of the components for the targeted environment through agreements with the component providers. The planner shall also observe the related technical data from the active devices. Depending on the expected environment the planner should define additional

requirements. Passive optical components in the harsh industrial environment should be protected with suitable mitigation techniques or tested according IEC/PAS 61753-1-3.

The planner shall take into account the mating or terminating interface of devices to be connected to the fieldbus network.

The planner shall take care about the environmental conditions of the whole network and select suitable mitigation techniques in addition to meet the respective requirements.

B.4.2.4 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.4.3 Network capabilities

B.4.3.1 Network topology

B.4.3.1.1 Common description

B.4.3.1.2 Basic physical topologies for passive networks

Not applicable.

B.4.3.1.3 Basic physical topologies for active networks

Replacement:

For the Ethernet network of devices applying CP 6/2 the following topologies are permitted:

- linear
- star

B.4.3.1.4 Combination of basic topologies

Not applicable.

B.4.3.1.5 Specific requirements for CPs

Not applicable.

B.4.3.1.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.4.3.2 Network characteristics

B.4.3.2.1 General

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

Not applicable.

B.4.3.2.3 Network characteristics for balanced cabling based on Ethernet

Replacement:

Table B.1 provides values based on the template given in IEC 61918:2013, Table 2.

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

Characteristic	CP 6/2 Ethernet network
Supported data rates (Mbit/s)	100
Supported channel length (m) [b]	100
Number of connections in the channel (max.) [a, b]	4
Patch cord length (m) [a]	82 (AWG 24)
Channel class per ISO/IEC 24702 (min.) [b]	D
Cable category per ISO/IEC 24702 (min.) [c]	5
Connecting HW category per ISO/IEC 24702 (min.)	5
Cable types	Shielded-TP, 2- or 4-pair, according to ISO/IEC 11801:2002, Annex E
[a] See B.4.4.3.2.	
[b] For the purpose of this table the channel definitions of ISO/IEC 24702 are applicable.	
[c] For additional information see IEC 61156 series.	

B.4.3.2.4 Network characteristics for optical fibre cabling

Replacement:

Table B.2 provides values based on the template given in IEC 61918:2013, Table 3.

Table B.2 – Network characteristics for optical fibre cabling

CP 6/2 Ethernet network		
Optical fibre type	**Description**	
Single mode silica	Bandwidth (MHz) or equivalent at λ (nm)	1 310 nm
	Minimum length (m)	0
	Maximum length[a] (m)	14 000
	Maximum channel Insertion loss/optical power budget (dB)	See ISO/IEC 24702
	Connecting hardware	See B.4.4.2.5
Multimode silica	Modal bandwidth (MHz × km) at λ (nm)	850
	Minimum length (m)	0
	Maximum length[a] (m)	2 000
	Maximum channel insertion loss/optical power budget (dB)	See ISO/IEC 24702
	Connecting hardware	See B.4.4.2.5
POF	Modal bandwidth (MHz × 100 m) at λ (nm)	650
	Minimum length (m)	0
	Maximum length[a] (m)	50

CP 6/2 Ethernet network		
Optical fibre type	**Description**	
	Maximum channel insertion loss/optical power budget (dB)	11,5
	Connecting hardware	See B.4.4.2.5
Hard clad silica	Modal bandwidth (MHz × km) at λ (nm)	650
	Minimum length (m)	0
	Maximum length[a] (m)	100
	Maximum channel insertion loss/optical power budget (dB)	4
	Connecting hardware	See B.4.4.2.5
[a] This value is reduced by connections, splices and bends in accordance with formula (1) in 4.4.3.4.1 of IEC 61918:2013.		

B.4.3.2.5 Specific network characteristics

Addition:

For CP 6/2 Ethernet networks neither patch cords/jumpers nor patch panels / outlets (TO or AO) are mandatory. CP6/2 Ethernet networks are often built with connection less links; not more than 4 connections shall be used.

CP 6/2 Ethernet networks shall be connected to the generic cabling as defined in IEC 24702 via an AO with a mating interface according to IEC 61076-3-106 variant 6 or IEC 61076-2-101.

B.4.3.2.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.4.4 Selection and use of cabling components

B.4.4.1 Cable selection

B.4.4.1.1 Common description

B.4.4.1.2 Copper cables

B.4.4.1.2.1 Balanced cables for Ethernet-based CPs

Addition:

For Ethernet networks for CP 6/2 a minimum of CAT 5 according to ISO/IEC 11801:2002 shall be used.

Replacement:

Table B.3 provides values based on the template given in IEC 61918:2013, Table 4.

Table B.3 – Information relevant to balanced cable: fixed cables

Characteristic	CP 6/2 Ethernet network
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω (IEC 61156-5)
DCR of conductors	≤ 9,38 Ω / 100 m
DCR of shield	–
Number of conductors	4 or 8
Shielding	S/FTP, S/FTQ, S/STP
Colour code for conductor	2 pairs: BU-WH/BU, OG-WH/OG 4 pairs: BU-WH/BU, OG-WH/OG, GN-WH/GN, BN-WH/BN Or: BU-WH, OG-WH, GN-WH, BN-WH
Jacket colour requirements	RAL 5021
Jacket material	To meet user requirement
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	–; Up to manufacturer's differentiation
Agency ratings	Local Government requirements
Transfer impedance	50 mΩ / m at 10MHz
Installation type	Stationary, no movement after installation
Outer cable diameter (max)	8,5 mm
Wire cross section	AWG 24 – 0,22 mm^2
Wire diameter (insulated)	≤ 1,6 mm

Replacement:

Table B.4 provides values based on the template given in IEC 61918:2013, Table 5.

Table B.4 – Information relevant to balanced cable: cords

Characteristic	CP 6/2 Ethernet network
Nominal impedance of cable (tolerance)	100 Ω ± 15 Ω (IEC 61156-5)
DCR of conductors	≤ 9,38 Ω / 100 m
DCR of shield	–
Number of conductors	4 or 8
Length	≤ 100 m
Shielding	S/FTP, S/FTQ, S/STP
Colour code for conductor	2 pairs: BU-WH/BU, OG-WH/OG 4 pairs: BU-WH/BU, OG-WH/OG, GN-WH/GN, BN-WH/BN Or: BU-WH, OG-WH, GN-WH, BN-WH
Jacket colour requirements	RAL 5021
Jacket material	To meet user requirement
Resistance to harsh environment (e.g. UV, oil resist, LS0H)	– ; Up to manufacturer's differentiation
Agency ratings	Local Government requirements
Transfer Impedance	50 mΩ/m at 10MHz
Installation Type	Stationary or with movement after installation
Outer cable diameter (max)	8,5 mm
Wire cross section	AWG 26 to 22 – 0,14 mm^2 to 0,35 mm^2
Wire diameter (insulated)	≤ 1,6 mm

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

Not applicable.

B.4.4.1.3 Cables for wireless installation

B.4.4.1.4 Optical fibre cables

Replacement:

Table B.5 provides values based on the template given in IEC 61918:2013, Table 6.

Table B.5 – Information relevant to optical fibre cables

Characteristics for CP 6/2 Ethernet network	9..10/125µm single mode silica	50/125µm multimode silica	62,5/125µm multimode silica	980/1 000µm step index POF	200/230µm step index hard clad silica
Standard	IEC 60793-2-50; Type B1	IEC 60793-2-10; Type A1a	IEC 60793-2-10; Type A1b	IEC 60793-2-40; Type A4a	IEC 60793-2-30; Type A3c
Attenuation per km (650 nm)	–	–	–	280 dB	10 dB
Attenuation per km (820 nm)	–	–	–	–	14 dB
Attenuation per km (1 310 nm)	1 dB/km	1,5 dB/km	1,5dB/km	–	–
Number of optical fibres	2	2	2	2	2
Jacket colour requirements	Red	Red	Red	Red	Red
Jacket material	To meet user requirements	To meet user requirements	To meet user requirements	Polyurethane	Polyurethane
Resistance to harsh environment (e.g.: UV, oil resist, LS0H)	To meet user requirements	To meet user requirements	To meet user requirements	To meet user requirements	To meet user requirements
Outer diameter	8 mm ± 0,5 mm	8 mm ± 0,5 mm	8 mm ± 0,5 m	8 mm ± 0,5 mm	8 mm ±- 0,5 mm
Bandwidth × length	–	–	–	> 10 MHz × 100 m	≥ 17 MHz × km at 650 nm
Wire material	–	–	–	Polyamide	Flame retardant non corrosive
Wire colour	–	–	–	Orange, black	Red, green or gray
Wire diameter	–	–	–	2,2 mm ± 0,07 mm	2,9 mm
Strain relief	Non-metal, aramide or wool	Non-metal, aramide or wool	Non-metal, aramide or wool	Non-metal, aramide or wool	Non-metal, aramide
Bending radius	–	–	–	30 mm	30 mm

B.4.4.1.5 Special purpose balanced and optical fibre cables

B.4.4.1.6 Specific requirements for CPs

B.4.4.1.7 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.4.4.2 Connecting hardware selection

B.4.4.2.1 Common description

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

Replacement:

Table B.6 provides values based on the template given in IEC 61918:2013, Table 7.

Table B.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/PAS 61076-2-109
	shielded	**unshielded**	**Var. 6**	**Var. 14**	**M12-4 with D-coding**	**M12-8 with X-coding**
CP 6/2 Ethernet network	IEC 60603-7-3 or IEC 60603-7-5 or IEC 60603-7-51	No	Yes	No	Yes	Yes
[a] With regards to IEC 60603-7series, the connector selection is based on the desired channel.						
[b] Housings to protect connectors.						

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

Not applicable.

B.4.4.2.4 Connecting hardware for wireless installation

B.4.4.2.5 Connecting hardware for optical fibre cabling

Replacement: Table B.7 provides values based on the template given in IEC 61918:2013, Table 9.

Table B.7 – Optical fibre connecting hardware

	IEC 61754-2	IEC 61754-4	IEC 61754-24	IEC 61754-24-21	IEC 61754-20	IEC 61754-22	Others
	BFOC 2,5	**SC**	**SC-RJ**	**Sealed SC-RJ**	**LC**	**F-SMA**	**M12-FO**
CP 6/2 Ethernet network	Yes	Yes	Yes	Yes [a]	No	Yes	Yes [b]
NOTE IEC 61754 series define the optical fibre connector mechanical interfaces; performance specifications for optical fibre connectors terminated to specific fibre types are standardised in IEC 61753 series.							
[a] The SC-RJ is the default connector.							
[b] The planner shall use the specification defined in Figure B.1 and Figure B.2 until the standard IEC 61754-27 is published.							

Figure B.1, Figure B.2, Table B.8 and Table B.9 specify the outline and dimensions of the M12-FO connector.

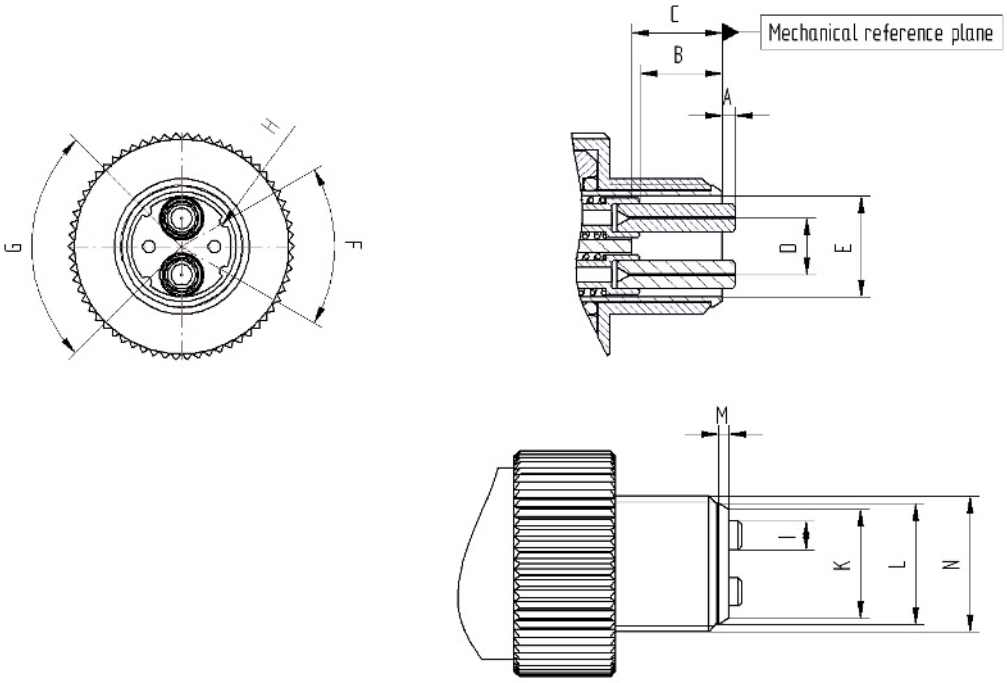

Figure B.1 – Plug connector interface M12-FO

Table B.8 – Dimensions of plug connector interface M12-FO

Key	Dimensions		Remarks	Unit
	Maximum	Minimum		
A	1,3	1,0	A + B = free ferrule length	mm
B	7,5	7,0		mm
C	8,2	8,0	–	mm
D	5,05	4,95	–	mm
E	9,0	8,8	–	mm
F	–	60	–	°
G	–	90	–	°
H	R0,5	R0,4	–	mm
I	2,499 5	2,497	–	mm
K	9,8	9,6	–	mm
L	10,8	10,3	–	mm
M	1,0	0,8	–	mm
N	–	M12	–	mm
Ferrule compression force shall be from 7,8 N to 11,8 N when the ferrule is compressed to a point where A is 0,50 mm ± 0,10 mm.				

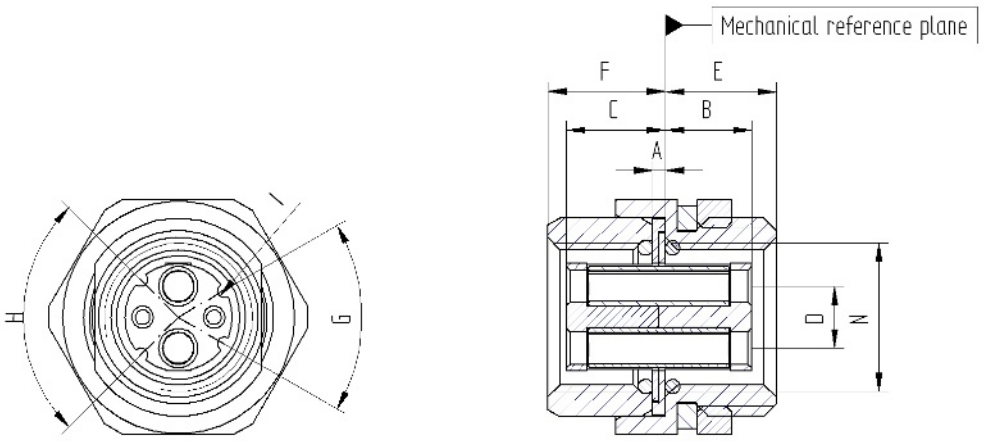

Figure B.2 – Adaptor connector interface M12-FO

Table B.9 – Dimensions of adaptor connector interface M12-FO

Key	Dimensions		Unit
	Maximum	Minimum	
A	1,2	1,0	mm
B	7,2	7,0	mm
C	8,2	8,0	mm
D	5,05	4,95	mm
E	9,0	8,8	mm
F	9,5	9,3	mm
G	–	60	°
H	–	90	°
I	R0,7	R0,6	mm
N	–	M12	mm

Replacement:

Table B.10 provides values based on the template given in IEC 61918:2013, Table 10.

Table B.10 – Relationship between FOC and fibre types (CP 6/2 Ethernet network)

	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**
BFOC/2,5	No	No	Yes	No	Yes
SC	Yes	Yes	Yes	Yes	Yes
SC-RJ	Yes	Yes	Yes	Yes	Yes
Sealed SC-RJ	Yes	Yes	Yes	Yes	Yes
LC	No	No	No	No	No
F-SMA	No	No	No	Yes	Yes
Others	Yes	Yes	Yes	Yes	Yes

B.4.4.2.6 Specific requirements for CPs

Not applicable

B.4.4.2.7 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable

B.4.4.3 Connections within a channel/permanent link

B.4.4.3.1 Common description

B.4.4.3.2 Balanced cabling connections and splices for CPs based on Ethernet

B.4.4.3.2.1 Common description

Addition:

Refer to the manufacturer’s data sheet regarding the number of allowed connections.

The number of allowed connections, adaptors and splices relates to the maximum channel attenuation.

B.4.4.3.2.2 Connections minimum distance

Replacement:

As defined in ISO/IEC 11801:2002.

B.4.4.3.2.3 Balanced cabling splices

Replacement:

As defined in ISO/IEC 11801:2002.

B.4.4.3.2.4 Balanced cabling bulkhead connections

Replacement:

As defined in ISO/IEC 11801:2002.

B.4.4.3.2.5 Balanced cabling J-J adaptors

Replacement:

As defined in ISO/IEC 11801:2002.

B.4.4.3.3 Copper cabling connections and splices for CPs not based on Ethernet

Not applicable.

B.4.4.3.4 Optical fibre cabling connections and splices for CPs based on Ethernet

B.4.4.3.5 Optical fibre cabling connections and splices for CPs not based on Ethernet

Not applicable.

B.4.4.3.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.4.4.4 Terminators

B.4.4.4.1 Common description

B.4.4.4.2 Specific requirements for CPs

Not applicable.

B.4.4.4.3 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.4.4.5 Device location and connection

B.4.4.6 Coding and labelling

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

B.4.4.8 Storage and transportation of cables

B.4.4.9 Routing of cables

B.4.4.10 Separation of circuit

B.4.4.11 Mechanical protection of cabling components

B.4.4.12 Installation in special areas

B.4.5 Cabling planning documentation

Addition:

The device documentation shall be observed for additional rules.

B.4.6 Verification of cabling planning specification

B.5 Installation implementation

B.5.1 General requirements

B.5.2 Cable installation

B.5.2.1 General requirements for all cabling types

Subclause 5.2.1.2 has replacement.

Table B.11 to Table B.14 provide values based on the template given in IEC 61918:2013, Table 18 to Table 21.

Table B.11 – Parameters for balanced cables

Characteristic		CP 6/2 Ethernet network
Mechanical force	Minimum bending radius, single bending	64 mm [a]
	Bending radius, multiple bending	64 mm [a]
	Pull forces	N [a]
	Permanent tensile forces	N [a]
	Maximum lateral forces	N/cm
	Temperature range during installation	0 °C to 70 °C [a]
[a] Reference value, deviations are allowed, see manufacturer's data sheet.		

Table B.12 – Parameters for silica optical fibre cables

Characteristic		CP 6/2 Ethernet network
Mechanical force	Minimum bending radius, single bending	30 mm [a]
	Bending radius, multiple bending	50 mm [a]
	Pull forces	800 N [a]
	Permanent tensile forces	200 N [a]
	Maximum lateral forces	100 N/cm
	Temperature range during installation	5 °C to 50 °C [a]
[a] Reference value, deviations are allowed, see manufacturer's data sheet.		

Table B.13 – Parameters for POF optical fibre cables

Characteristic		CP 6/2 Ethernet network for permanent indoor installation	CP 6/2 Ethernet network for permanent outdoor installation
Mechanical force	Minimum bending radius, single bending	30 mm [a]	50 mm [a]
	Bending radius, multiple bending	50 mm [a]	65 mm [a]
	Pull forces	600 N [a]	300 N [a]
	Permanent tensile forces	100 N [a]	100 N [a]
	Maximum lateral forces	20 N/cm	20 N/cm
	Temperature range during installation	5 °C to 50 °C [a]	5 °C to 50 °C [a]
	Suitable for use as trailing cable	No	10 × d, at least 5 million cycles, Increase in attenuation ≤ 1 dBm
[a] Reference value, deviations are allowed, see manufacturer's data sheet.			

Table B.14 – Parameters for hard clad silica optical fibre cables

Characteristic		CP 6/2 Ethernet network for permanent indoor installation	CP 6/2 Ethernet network for permanent outdoor installation
Mechanical force	Minimum bending radius, single bending	30 mm [a]	150 mm [a]
	Bending radius, multiple bending	50 mm [a]	200 mm [a]
	Pull forces	800 N [a]	1 500 N [a]
	Permanent tensile forces	200 N [a]	200 N [a]
	Maximum lateral forces	100 N/cm	300 N/cm
	Temperature range during installation	5 °C to 50 °C [a]	–5 °C to 50 °C [a]
	Longitudinal water tightness	No	IEC 60794-1-2:2003 Method F5
[a] Reference value, deviations are allowed, see manufacturer's data sheet.			

B.5.2.2 Installation and routing

B.5.2.3 Specific requirements for CPs

Not applicable.

B.5.2.4 Specific requirements for wireless installation

B.5.2.5 Specific requirements for generic cabling in accordance with ISO/IEC 24702

Not applicable.

B.5.3 Connector installation

B.5.3.1 Common description

B.5.3.2 Shielded connectors

B.5.3.3 Unshielded connectors

Not applicable.

B.5.3.4 Specific requirements for CPs

Addition:

Connectors should be equipped with a tool-less assembling technique, like the example in Figure B.3.

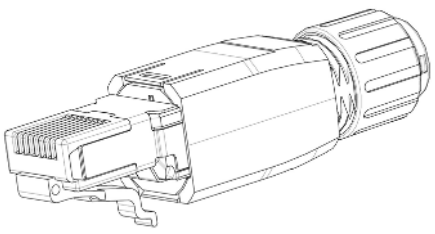

Figure B.3 – Terminal connector at the device

A crossover for changing the signal from transmitter to receiver should not be used. Network components for CP 6/2 Ethernet networks should be designed so that they carry out an automatic crossover.

B.5.3.5 Specific requirements for wireless installation

B.5.3.6 Specific requirements for generic cabling in accordance with ISO/IEC 24702

B.5.4 Terminator installation

Not applicable.

B.5.5 Device installation

B.5.6 Coding and labelling

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

Modification:

Subclause 5.7.5 is not applicable.

B.5.8 As-implemented cabling documentation

B.6 Installation verification and installation acceptance test

B.6.1 General

B.6.2 Installation verification

B.6.3 Installation acceptance test

Modification:

Subclause 6.3.3 is not applicable.

B.7 Installation administration

Subclause 7.8 is not applicable.

B.8 Installation maintenance and installation troubleshooting

Subclause 8.4 has addition:

Inspection:

Software tools which allow a broad inspection of the system should be used for inspection.

Maintenance and repair: trained personnel shall be used.

Software tools which display the diagnostics results should be used.

Bibliography

Addition:

[27] IEC 60050, *International Electrotechnical Vocabulary* (available at <http:www.electropedia.org>)

[28] IEC/TR 61158-1, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

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

[30] IBS SYS PRO INST UM E, *Configuring and Installing INTERBUS; Phoenix Contact GmbH & Co.KG; Prod.-Id. 27 43 802*
(can be downloaded from www.phoenixcontact.com)

[31] IBS IL SYS PRO UM E, *Configuring and Installing the INTERBUS Inline product range; Phoenix Contact GmbH & Co.KG; Prod.-Id. 27 43 048*
(can be downloaded from www.phoenixcontact.com)

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