

Industrial communication networks - Installation of
communication networks in industrial premises

This document is a preview generated by EVS

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 61918:2018 sisaldab Euroopa standardi EN IEC 61918:2018 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 61918:2018 consists of the English text of the European standard EN IEC 61918:2018.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 09.11.2018.	Date of Availability of the European standard is 09.11.2018.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 25.040.40, 33.020, 35.240.50

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

EUROPEAN STANDARD

EN IEC 61918

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2018

ICS 25.040.40; 33.020; 35.240.50

Supersedes EN 61918:2013

English Version

**Industrial communication networks - Installation of
communication networks in industrial premises
(IEC 61918:2018)**

Réseaux de communication industriels - Installation de
réseaux de communication dans des locaux industriels
(IEC 61918:2018)

Industrielle Kommunikationsnetze - Installation von
Kommunikationsnetzen in Industrieanlagen
(IEC 61918:2018)

This European Standard was approved by CENELEC on 2018-10-25. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 65C/928/FDIS, future edition 4 of IEC 61918, 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 IEC 61918:2018.

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) 2019-07-25
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2021-10-25

This document supersedes 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 shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61918:2018 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 60060-1	NOTE	Harmonized as EN 60060-1
IEC 60079-11:2011	NOTE	Harmonized as EN 60079-11:2012 (not modified)
IEC 60079-14	NOTE	Harmonized as EN 60079-14
IEC 60228	NOTE	Harmonized as EN 60228
IEC 60332-1 (series)	NOTE	Harmonised as EN 60332-1 (series)
IEC 60364 (series)	NOTE	Harmonised as HD 60364 (series)
IEC 60512-4 (series)	NOTE	Harmonised as EN 60512-4 (series)
IEC 60529	NOTE	Harmonized as EN 60529
IEC 60664-1	NOTE	Harmonized as EN 60664-1

IEC 60670-1:2015	NOTE	Harmonized as EN IEC 60670-1:— ¹ (not modified)
IEC 60950-21	NOTE	Harmonized as EN 60950-21
IEC 61000-4-4	NOTE	Harmonized as EN 61000-4-4
IEC 61000-6-2	NOTE	Harmonized as EN 61000-6-2
IEC 61000-6-4	NOTE	Harmonized as EN 61000-6-4
IEC 61010-2-201	NOTE	Harmonized as EN IEC 61010-2-201
IEC 61131-2:2017	NOTE	Harmonized as EN 61131-2:— ² (not modified)
IEC 61158-1	NOTE	Harmonized as EN 61158-1
IEC 61508-4	NOTE	Harmonized as EN 61508-4
IEC 61984:2008	NOTE	Harmonized as EN 61984:2009 (not modified)
IEC 62026-3	NOTE	Harmonized as EN 62026-3

¹ Under preparation. Stage at the time of publication: prEN IEC 60670-1

² Under preparation. Stage at the time of publication: FprEN 61131-2:2017

CONTENTS

FOREWORD.....	11
INTRODUCTION.....	13
1 Scope.....	16
2 Normative references	16
3 Terms, definitions, and abbreviated terms	19
3.1 Terms and definitions.....	19
3.2 Abbreviated terms.....	31
3.3 Conventions for installation profiles	32
4 Installation planning.....	33
4.1 General.....	33
4.1.1 Objective	33
4.1.2 Cabling in industrial premises	33
4.1.3 The planning process	35
4.1.4 Specific requirements for CPs.....	36
4.1.5 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3	36
4.2 Planning requirements	36
4.2.1 Safety.....	36
4.2.2 Security	37
4.2.3 Environmental considerations and EMC.....	37
4.2.4 Specific requirements for generic cabling in accordance with ISO/IEC 11801-3	39
4.3 Network capabilities	39
4.3.1 Network topology.....	39
4.3.2 Network characteristics.....	41
4.4 Selection and use of cabling components	44
4.4.1 Cable selection.....	44
4.4.2 Connecting hardware selection.....	48
4.4.3 Connections within a channel/permanent link	50
4.4.4 Terminators	55
4.4.5 Device location and connection	56
4.4.6 Coding and labelling	56
4.4.7 Earthing and bonding of equipment and devices and shielded cabling	57
4.4.8 Storage and transportation of cables	67
4.4.9 Routing of cables.....	67
4.4.10 Separation of circuits	69
4.4.11 Mechanical protection of cabling components	70
4.4.12 Installation in special areas	71
4.5 Cabling planning documentation	71
4.5.1 Common description	71
4.5.2 Cabling planning documentation for CPs	71
4.5.3 Network certification documentation	72
4.5.4 Cabling planning documentation for generic cabling in accordance with ISO/IEC 11801-3	72
4.6 Verification of cabling planning specification	72
5 Installation implementation	72
5.1 General requirements	72

5.1.1	Common description	72
5.1.2	Installation of CPs	72
5.1.3	Installation of generic cabling in industrial premises	72
5.2	Cable installation	72
5.2.1	General requirements for all cabling types	72
5.2.2	Installation and routing	78
5.2.3	Specific requirements for CPs.....	80
5.2.4	Specific requirements for wireless installation.....	80
5.2.5	Specific requirements for generic cabling in accordance with ISO/IEC 11801-3	80
5.3	Connector installation	80
5.3.1	Common description	80
5.3.2	Shielded connectors	81
5.3.3	Unshielded connectors	81
5.3.4	Specific requirements for CPs.....	81
5.3.5	Specific requirements for wireless installation.....	81
5.3.6	Specific requirements for generic cabling in accordance with ISO/IEC 11801-3	81
5.4	Terminator installation	82
5.4.1	Common description	82
5.4.2	Specific requirements for CPs.....	82
5.5	Device installation.....	82
5.5.1	Common description	82
5.5.2	Specific requirements for CPs.....	82
5.6	Coding and labelling	82
5.6.1	Common description	82
5.6.2	Specific requirements for CPs.....	82
5.7	Earthing and bonding of equipment and devices and shield cabling	82
5.7.1	Common description	82
5.7.2	Bonding and earthing of enclosures and pathways.....	83
5.7.3	Earthing methods	85
5.7.4	Shield earthing methods	87
5.7.5	Specific requirements for CPs.....	89
5.7.6	Specific requirements for generic cabling in accordance with ISO/IEC 11801-3	89
5.8	As-implemented cabling documentation	90
6	Installation verification and installation acceptance test.....	90
6.1	General.....	90
6.2	Installation verification	90
6.2.1	General	90
6.2.2	Verification according to cabling planning documentation	91
6.2.3	Verification of earthing and bonding.....	92
6.2.4	Verification of shield earthing	93
6.2.5	Verification of cabling system	93
6.2.6	Cable selection verification.....	93
6.2.7	Connector verification.....	94
6.2.8	Connection verification	94
6.2.9	Terminator verification	96
6.2.10	Coding and labelling verification	96

6.2.11	Verification report	96
6.3	Installation acceptance test.....	96
6.3.1	General	96
6.3.2	Acceptance test of Ethernet-based cabling	98
6.3.3	Acceptance test of non-Ethernet-based cabling	100
6.3.4	Specific requirements for wireless installation.....	101
6.3.5	Acceptance test report.....	101
7	Installation administration	102
7.1	General.....	102
7.2	Fields covered by the administration	102
7.3	Basic principles for the administration system	102
7.4	Working procedures	102
7.5	Device location labelling	103
7.6	Component cabling labelling	103
7.7	Documentation.....	104
7.8	Specific requirements for administration	105
8	Installation maintenance and installation troubleshooting.....	105
8.1	General.....	105
8.2	Maintenance	105
8.2.1	Scheduled maintenance.....	105
8.2.2	Condition-based maintenance.....	107
8.2.3	Corrective maintenance	108
8.3	Troubleshooting	108
8.3.1	General description	108
8.3.2	Evaluation of the problem	108
8.3.3	Typical problems	109
8.3.4	Troubleshooting procedure	110
8.3.5	Simplified troubleshooting procedure	111
8.4	Specific requirements for maintenance and troubleshooting.....	112
Annex A (informative)	Overview of generic cabling for industrial premises	113
Annex B (informative)	MICE description methodology	114
B.1	General.....	114
B.2	Overview of MICE	114
B.3	Examples of use of the MICE concept.....	115
B.3.1	Common description	115
B.3.2	Examples of mitigation.....	115
B.4	Determining E classification	117
B.5	The MICE table.....	120
Annex C (informative)	Network topologies.....	122
C.1	Common description	122
C.2	Total cable demand	122
C.3	Maximum cable segment length	122
C.4	Maximum network length	122
C.5	Fault tolerance.....	122
C.5.1	General	122
C.5.2	Use of redundancy.....	122
C.5.3	Failure analysis for networks with redundancy	122
C.6	Network access for diagnosis convenience	123

C.7	Maintainability and on-line additions	123
Annex D (informative)	Connector tables	124
Annex E (informative)	Power networks with respect to electromagnetic interference – TN-C and TN-S approaches.....	137
Annex F (informative)	Conductor sizes in electrical cables.....	139
Annex G (informative)	Installed cabling verification checklists.....	141
G.1	General.....	141
G.2	Copper cabling verification checklist	141
G.3	Optical fibre cabling verification checklist.....	144
Annex H (normative)	Cord sets	146
H.1	General.....	146
H.2	Constructing cord sets	146
H.2.1	Straight through cord sets with M12-4 D-coding connectors.....	146
H.2.2	Crossover cord sets with M12-4 D-coding connectors.....	147
H.2.3	Straight through cord sets with 8-way modular connectors.....	147
H.2.4	Crossover cord sets with 8-way modular connectors.....	148
H.2.5	Straight conversion from one connector family to another.....	149
H.2.6	Crossover conversion from one connector family to another	149
H.2.7	Assignment of PMA signal to MDI and MDI-X in outs	150
H.2.8	Signal and pin assignment for MDI and TIA568A	151
H.2.9	Signal and pin assignment for MDIX and TIA568B	151
H.2.10	Signal and pin assignment for MDIX and TIA568A.....	152
Annex I (informative)	Guidance for terminating cable ends.....	153
I.1	General.....	153
I.2	Guidance for terminating shielded twisted pair cable ends for 8-way modular plugs.....	153
I.3	Guidance for terminating unshielded twisted pair cable ends for 8-way modular plugs	155
I.4	Guidance for M12-4 D-coding connector installation	156
I.5	Guidance for terminating optical fibre cable ends.....	159
Annex J (informative)	Recommendations for bulkhead connection performance and channel performance with more than 4 connections in the channel.....	160
J.1	General.....	160
J.2	Recommendations	160
Annex K (informative)	Fieldbus data transfer testing	161
K.1	Background.....	161
K.2	Allowable error rates for control systems	161
K.2.1	Bit errors	161
K.2.2	Burst errors	161
K.3	Testing channel performance.....	162
K.4	Testing cable parameters.....	162
K.4.1	General	162
K.4.2	Generic cable testing.....	162
K.4.3	Fieldbus cable testing.....	162
K.5	Testing fieldbus data rate performance	163
K.5.1	General	163
K.5.2	Fieldbus test.....	163
K.5.3	Planning for fieldbus data rate testing.....	163
K.5.4	Fieldbus data rate test reporting template.....	164

K.5.5	Values for acceptable fieldbus performance.....	164
Annex L (informative)	Communication network installation work responsibility	165
L.1	General.....	165
L.2	Installation work responsibility	165
L.3	Installation work responsibility table.....	165
Annex M (informative)	Trade names of communication profiles	166
Annex N (informative)	Validation measurements	169
N.1	General.....	169
N.2	DCR measurements.....	169
N.2.1	Purpose of test	169
N.2.2	Assumptions	169
N.2.3	Measurements.....	169
N.2.4	Calculations.....	171
N.2.5	Measurement results	171
Annex O (informative)	End-to-end link	175
O.1	General.....	175
O.2	End-to-end link	175
O.3	E2E link normative description.....	176
O.4	E2E link measurement	178
Annex P (normative)	Temperature rise of cabling with remote powering.....	179
P.1	General.....	179
P.2	Scope	179
P.3	Temperature de-rating calculation.....	179
Bibliography.....		181
Figure 1 – Industrial network installation life cycle		14
Figure 2 – Standards relationships.....		15
Figure 3 – Automation island cabling attached to elements of generic cabling.....		33
Figure 4 – Automation islands.....		34
Figure 5 – Automation island network external connections		35
Figure 6 – How to meet environmental conditions		38
Figure 7 – How enhancement, isolation and separation work together		39
Figure 8 – Basic physical topologies for passive networks		40
Figure 9 – Basic physical topologies for active networks.....		40
Figure 10 – Example of combination of basic topologies		40
Figure 11 – Basic reference implementation model		51
Figure 12 – Enhanced reference implementation model		52
Figure 13 – Equalisation and earthing conductor cross-sectional versus maximum length		58
Figure 14 – Selection of the earthing and bonding systems.....		59
Figure 15 – Placement of equalisation conductors		61
Figure 16 – Impedance of the earthing conductors and equalisation conductors versus noise frequency		62
Figure 17 – Wiring for bonding and earthing in an equipotential configuration		63
Figure 18 – Wiring of the earths in a star earthing configuration.....		64
Figure 19 – Schematic diagram of a field device with direct earthing.....		65

Figure 20 – Schematic diagram of a field device with parallel RC circuit earthing.....	65
Figure 21 – Insert edge protector	74
Figure 22 – Use an uncoiling device and avoid forming loop	75
Figure 23 – Avoid torsion	75
Figure 24 – Maintain minimum bending radius	76
Figure 25 – Do not pull by the individual wires	76
Figure 26 – Use cable clamps with a large (wide) surface	76
Figure 27 – Cable gland with bending protection.....	77
Figure 28 – Spiral tube	77
Figure 29 – Separate cable pathways	80
Figure 30 – Impedance of the earthing circuit as a function of distance from the metallic pathway	83
Figure 31 – Use of flexible bonding straps at movable metallic pathways.....	84
Figure 32 – Surface preparation for earthing and bonding electromechanical connections	85
Figure 33 – Example of isolated bus bar	86
Figure 34 – Example of isolator for mounting DIN rails.....	87
Figure 35 – Parallel RC shield earthing.....	87
Figure 36 – Direct shield earthing	88
Figure 37 – Examples for shielding application	88
Figure 38 – Voltage offset mitigation.....	89
Figure 39 – First example of derivatives of shield earthing.....	89
Figure 40 – Second example of derivatives of shield earthing	89
Figure 41 – Installation verification process	91
Figure 42 – Test of earthing connections	92
Figure 43 – Pin and pair grouping assignments for two eight position IEC 60603-7 subparts and four position IEC 60603 series to IEC 61076-2-101 connectors.....	95
Figure 44 – Two pair 8-way modular connector.....	95
Figure 45 – Transposed pairs, split pairs and reversed pair	95
Figure 46 – Validation process.....	97
Figure 47 – Schematic representation of the channel.....	98
Figure 48 – Schematic representation of the permanent link	98
Figure 49 – Schematic representation of an E2E link	99
Figure 50 – Communication network maintenance	107
Figure 51 – Troubleshooting procedure.....	111
Figure 52 – Fault detection without special tools	112
Figure B.1 – MICE classifications.....	114
Figure B.2 – Example MICE classifications within a facility	115
Figure B.3 – Enhancement, isolation and separation.....	115
Figure B.4 – Example 1 of mitigation.....	116
Figure B.5 – Example 2 of mitigation.....	117
Figure B.6 – Frequency range of electromagnetic disturbance from common industrial devices	117
Figure B.7 – Example of a general guidance for separation versus EFT value.....	119

Figure E.1 – Four-wire power network (TN-C).....	137
Figure E.2 – Five wire power network (TN-S).....	138
Figure H.1 – Straight through cord sets with M12-4 D-coding connectors.....	146
Figure H.2 – Straight through cord sets with 8-way modular connectors, 8 poles	147
Figure H.3 – Straight through cord sets with 8-way modular connectors, 4 poles	148
Figure H.4 –M12-8 X-coding connector	150
Figure I.1 – Stripping the cable jacket.....	153
Figure I.2 – Example of wire preparation for type A cables.....	154
Figure I.3 – 8-way modular plug.....	154
Figure I.4 – Inserting the cable into the connector body	155
Figure I.5 – Crimping the connector	155
Figure I.6 – Example of a cable preparation for type A wiring.....	156
Figure I.7 – Connector components	157
Figure I.8 – Cable preparation	157
Figure I.9 – Connector wire gland, nut and shell on the cable	157
Figure I.10 – Conductors preparation.....	157
Figure I.11 – Jacket removal.....	157
Figure I.12 – Shield preparation.....	158
Figure I.13 – Conductors preparation.....	158
Figure I.14 – Installing conductors in connector.....	158
Figure I.15 – Assembling the body of the connector.....	158
Figure I.16 – Final assembling	159
Figure N.1 – Loop resistance measurement wire to wire	169
Figure N.2 – Loop resistance measurement wire 1 to shield.....	170
Figure N.3 – Loop resistance measurement wire 2 to shield.....	170
Figure N.4 – Resistance measurement for detecting wire shorts	170
Figure N.5 – Resistance measurement between wire 1 and wire 2	170
Figure N.6 – Validation of the cable DCR.....	172
Figure N.7 – Conclusions for cable open or shorts	173
Figure N.8 – Determination of proper cable terminator value.....	174
Figure O.1 – Channel according to ISO/IEC 11801	175
Figure O.2 – End-to-end link.....	176
Figure O.3 – One segment, two Connection E2E link	176
Figure O.4 – Two Segment, three Connection E2E link	176
Figure O.5 – Three Segment, one Connection bulkheads, four Connection E2E link	177
Figure O.6 – Three Segment, two Connection, six Connection E2E link	177
Figure O.7 – Three Segment, four Connection E2E link	177
Figure O.8 – Four Segment, five Connection E2E link.....	177
Figure O.9 – Five Segment, six Connection E2E link	177
Table 1 – Basic network characteristics for balanced cabling not based on Ethernet.....	42
Table 2 – Network characteristics for balanced cabling based on Ethernet.....	42
Table 3 – Network characteristics for optical fibre cabling	43

Table 4 – Information relevant to copper cable: fixed cables	45
Table 5 – Information relevant to copper cable: cords	45
Table 6 – Information relevant to optical fibre cables	46
Table 7 – Connectors for balanced cabling CPs based on Ethernet.....	48
Table 8 – Connectors for copper cabling CPs not based on Ethernet.....	49
Table 9 – Optical fibre connecting hardware	49
Table 10 – Relationship between FOC and fibre types (CP x/y)	49
Table 11 – Basic reference implementation formulas	51
Table 12 – Enhanced reference implementation formulas	53
Table 13 – Correction factor Z for operating temperature above 20 °C.....	53
Table 14 – Equalisation and earthing conductor sizing and length	60
Table 15 – Bonding straps cross-section.....	60
Table 16 – Bonding plates surface protection.....	60
Table 17 – Cable circuit types and minimum distances	70
Table 18 – Parameters for balanced cables	73
Table 19 – Parameters for silica optical fibre cables	73
Table 20 – Parameters for POF optical fibre cables	73
Table 21 – Parameters for hard clad silica optical fibre cables	74
Table 22 – Typical problems in a network with balanced cabling.....	109
Table 23 – Typical problems in a network with optical fibre cabling.....	110
Table B.1 – Example 1 of targeted MICE area	116
Table B.2 – Example 2 of targeted MICE area	116
Table B.3 – Relationship between electromagnetic disturbance-generating devices and “E” classification	118
Table B.4 – Coupling mechanism for some interfering devices.....	119
Table B.5 – MICE definition	120
Table D.1 – Conventions for colour code used in the connector table	124
Table D.2 – Pin/pair assignment and colour scheme	125
Table D.3 – 8-way modular connector	126
Table D.4 – M12-4 A-coding connector	127
Table D.5 – M12-4 D-coding connector	128
Table D.6 – M12-5 A-coding connector	129
Table D.7 – M12-5 B-coding connector	130
Table D.8 – SubD connector	131
Table D.9 – 7/8-16 UN-2B THD / M18 connector	132
Table D.10 – Open style connector	133
Table D.11 – M12-8 X-coding connector	134
Table D.12 – BNC connector.....	135
Table D.13 – TNC connector.....	136
Table F.1 – American wire gauge system and kcmil	139
Table G.1 – Copper cabling verification checklist.....	142
Table G.2 – Earthing and bonding measurements checklist	143
Table G.3 – Signatures for Table G.1 and Table G.2 checklists	143

Table G.4 – Checklist for special checks for non-Ethernet base CPs.....	144
Table G.5 – Signatures for Table G.4 checklist	144
Table G.6 – Optical fibre cabling verification checklist	145
Table G.7 – Signatures for Table G.6 checklist	145
Table H.1 – M12-4 D-coding pin/pair assignment.....	147
Table H.2 – M12-4 D-coding to M12-4 D-coding crossover pin/pair assignment	147
Table H.3 – 8-way modular pin/pair assignment.....	148
Table H.4 – 8-way modular crossover pin/pair assignment.....	149
Table H.5 – Connectivity pin assignment	149
Table H.6 – M12-4 to 8-way modular crossover pin pair assignment.....	150
Table H.7 – Assignment of PMA signal to MDI and MDI-X pin outs	150
Table H.8 – Signal and pin/pair assignment for MDI and TIA 568B.....	151
Table H.9 – Signal and pin/pair assignment for MDI and T568A.....	151
Table H.10 – Signal and pin/pair assignment for MDIX and T568B.....	152
Table H.11 – Signal and pin/pair assignment for MDIX and T568A.....	152
Table J.1 – Transmission requirements for more than 4 connections in a channel.....	160
Table M.1 – Trade names of CPFs and CPs	167
Table P.1 – Parameters used to calculate the temperature derating.....	180

preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS –**Installation of communication networks in industrial premises**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This fourth edition cancels and replaces the third edition published in 2013. This edition constitutes a technical revision.

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

- a) the reference to ISO/IEC 24702 has been replaced with reference to the new ISO/IEC 11801-3; this affects Table 2;
- b) some terms and abbreviated terms have been modified in Clause 3;
- c) Subclauses 4.1.2, 4.4.2.5, 4.4.3.4.1 and 5.7 have been updated;
- d) Figure 2 and Figure 3 have been updated; Figure 13, Figure 16, Figure 30 and Figure 49 have been added;

- e) Table 7 has been updated;
- f) Annex D and Annex M have been extended to cover additional communication profile families; Annex H has been extended to cover the M12-8 X-coding connector use;
- g) Annex O has been modified by including references to the new edition of the ISO/IEC 11801 series, ISO/IEC TR 11801-9902 and ISO/IEC 14763-4;
- h) Annex P has been added.

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

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

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

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

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

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

FDIS	Report on voting
65C/928/FDIS	65C/933/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.

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

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

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

INTRODUCTION

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

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

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

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

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

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

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

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

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

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

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

IEC 61918 Installation lifecycle

V2.0 /REL

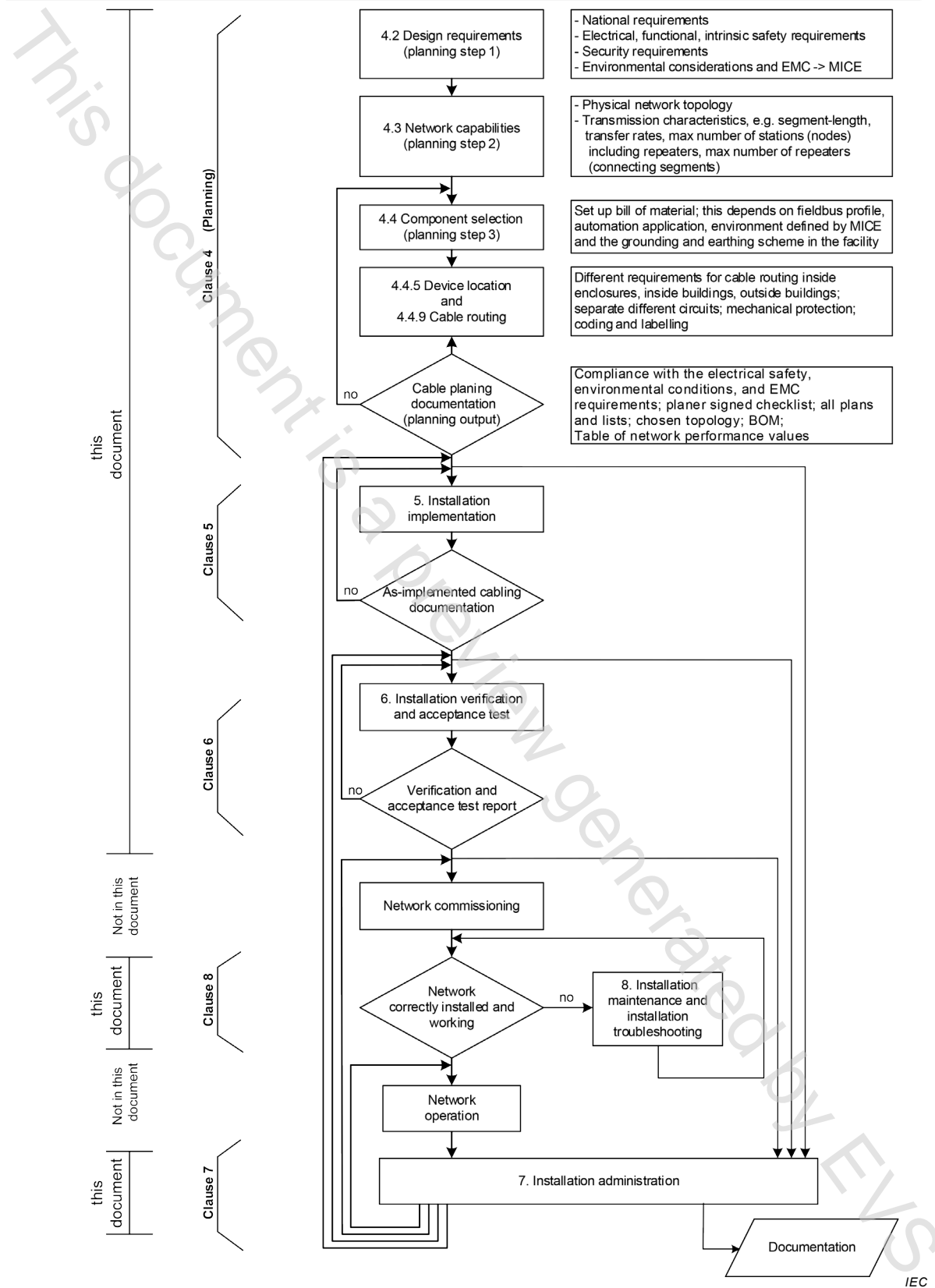


Figure 1 – Industrial network installation life cycle

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

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

For the fieldbuses that are defined in the IEC 61784 (all parts) as communication profiles (CPs) of the communication profile families (CPF), the installation is specified in the installation profiles that are available in the IEC 61784-5-n documents, where n is the CPF number.

IEC 61158-1 describes the relationship between the fieldbus and the CPs and the relevant installation profiles (see Figure 2).

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

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

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

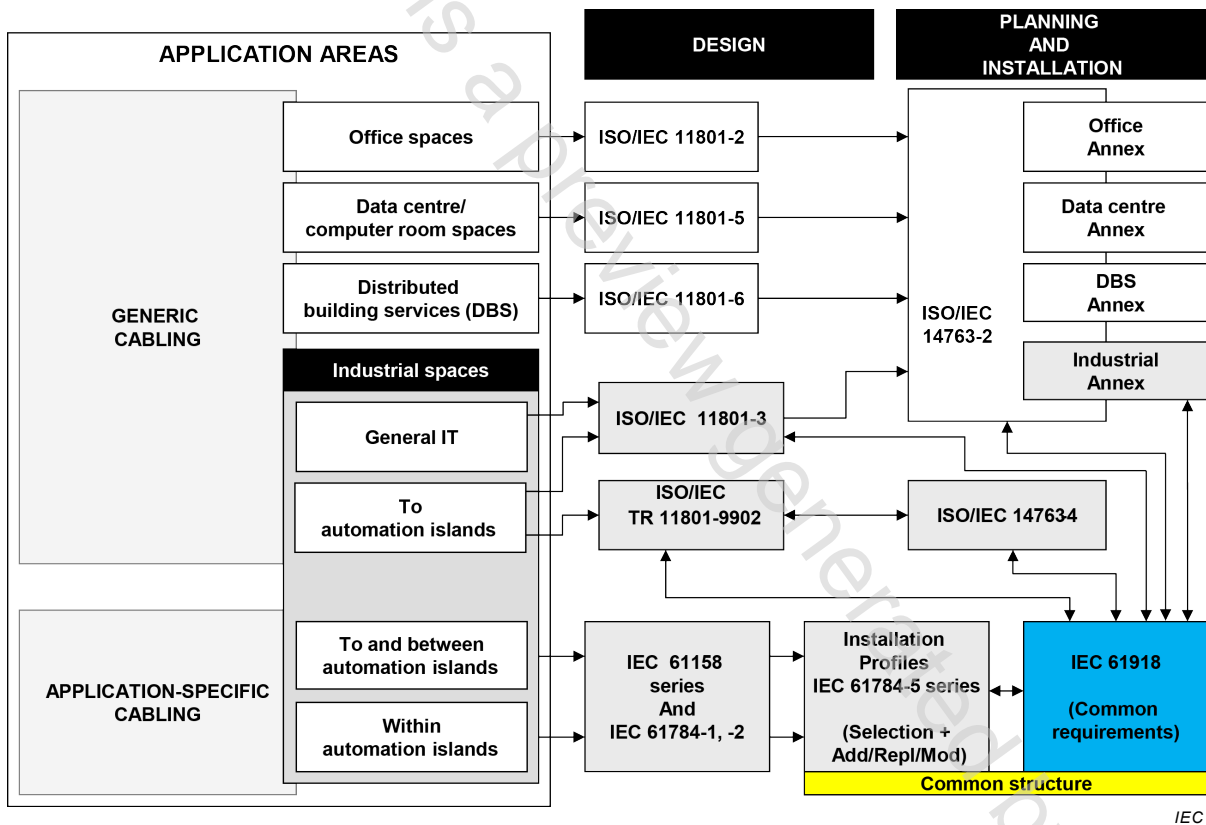


Figure 2 – Standards relationships

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

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

INDUSTRIAL COMMUNICATION NETWORKS –

Installation of communication networks in industrial premises

1 Scope

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

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

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

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

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

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

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

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

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

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

IEC 60757, *Code for designation of colours*

IEC 60793 (all parts), *Optical fibres*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IEC 61784-1:—, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles¹*

IEC 61784-2:—, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3²*

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

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

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

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

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

IEC 62443 (all parts), *Security for industrial automation and control systems³*

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

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

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

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

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

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

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

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

ISO/IEC 14763-2:2012, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*

ISO/IEC 14763-2:2012/AMD1:2015⁴

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

ISO/IEC 14763-4:2018, *Information technology – Implementation and operation of customer premises cabling – Part 4: Measurement of end-to-end (E2E)-Links*

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

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

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

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

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

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

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

³ Check <http://webstore.iec.ch> for the published parts. Other parts are under consideration.

⁴ A consolidated version of this publication exists, comprising ISO/IEC 14763-2:2012 and ISO/IEC 614763-2:2012/AMD 1:2015.