

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Industrial communication networks – Fieldbus specifications –  
Part 5-10: Application layer service definition – Type 10 elements**

**Reseaux de communication industriels – Specifications des bus de terrain –  
Partie 5-10: Définition des services de la couche application – Eléments de  
type 10**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

#### IEC online collection - [oc.iec.ch](http://oc.iec.ch)

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC online collection - [oc.iec.ch](http://oc.iec.ch)

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Industrial communication networks – Fieldbus specifications –  
Part 5-10: Application layer service definition – Type 10 elements**

**Reseaux de communication industriels – Specifications des bus de terrain –  
Partie 5-10: Définition des services de la couche application – Éléments de  
type 10**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-4765-5

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	15
INTRODUCTION.....	17
1 Scope.....	18
1.1 General.....	18
1.2 Specifications .....	19
1.3 Conformance .....	19
2 Normative references .....	19
3 Terms, definitions, abbreviations, symbols and conventions .....	22
3.1 Referenced terms and definitions.....	22
3.1.1 ISO/IEC 7498-1 terms.....	22
3.1.2 ISO/IEC 8822 terms.....	22
3.1.3 ISO/IEC 9545 terms.....	22
3.1.4 ISO/IEC 8824-1 terms.....	23
3.2 Additional Type 10 terms and definitions.....	23
3.3 Additional Type 10 terms and definitions for media redundancy.....	30
3.4 Abbreviations and symbols .....	32
3.4.1 General .....	32
3.4.2 Additional Type 10 abbreviations and symbols.....	33
3.4.3 Abbreviations and symbols for services.....	34
3.5 Conventions.....	34
3.5.1 Overview .....	34
3.5.2 General conventions.....	34
3.5.3 Conventions for class definitions .....	34
3.5.4 Conventions for service definitions.....	36
3.5.5 Conventions used in state machines.....	37
4 Concepts.....	40
5 Data type ASE.....	40
5.1 General.....	40
5.1.1 Overview.....	40
5.1.2 Date and time type specifics.....	41
5.1.3 Transfer of user data .....	41
5.1.4 Data type overview .....	41
5.2 Formal definition of data type objects.....	44
5.2.1 Data type class.....	44
5.3 FAL defined data types .....	45
5.3.1 Fixed length types .....	45
5.3.2 Variable Length types.....	66
5.4 Data type ASE service specification.....	69
6 Communication model for common services .....	69
6.1 Concepts .....	69
6.1.1 Overview .....	69
6.1.2 Middle Layer ASEs .....	69
6.2 ASE data types.....	69
6.3 Application Service Elements.....	69
6.3.1 Remote procedure call ASE.....	69
6.3.2 Domain name system ASE .....	78

6.3.3	Simple network management ASE .....	79
6.3.4	IP suite ASE .....	80
6.3.5	Real time cyclic ASE .....	84
6.3.6	Real time acyclic ASE.....	100
6.3.7	Discovery and basic configuration ASE.....	110
6.3.8	Dynamic host configuration ASE.....	138
6.3.9	IEEE 802.1AB ASE.....	138
6.3.10	Media redundancy ASE .....	151
6.3.11	Precision time control ASE .....	158
6.3.12	IEEE 802.1AS ASE.....	172
6.3.13	Virtual Bridges ASE.....	175
6.3.14	MAC Bridges ASE .....	178
6.3.15	Fragmentation ASE .....	191
6.3.16	IEEE 802.3 ASE .....	192
6.3.17	Common DL mapping ASE .....	195
7	Communication model for decentralized periphery.....	200
7.1	Concepts .....	200
7.1.1	User requirements .....	200
7.1.2	Features .....	200
7.1.3	Associations .....	201
7.1.4	Device types.....	202
7.1.5	Instance model and device addresses .....	210
7.1.6	Application process .....	210
7.1.7	Application service element .....	217
7.1.8	Application relationship.....	219
7.2	ASE data types.....	220
7.3	ASEs .....	220
7.3.1	AR ASE.....	220
7.3.2	Real Identification ASE.....	355
7.3.3	Communication Interface Management ASE .....	445
7.3.4	Diagnosis ASE.....	516
7.3.5	PE ASE .....	561
7.3.6	LogBook ASE .....	571
7.3.7	RS ASE .....	574
7.3.8	Time ASE .....	599
7.4	Application characteristics .....	604
7.4.1	Device ident number.....	604
7.4.2	Network topology.....	604
7.5	Summary of FAL services .....	606
7.5.1	IO device.....	606
7.5.2	IO controller .....	607
7.5.3	IO Supervisor .....	607
Annex A (informative)	Device instances .....	608
Annex B (informative)	Components of an Ethernet interface .....	610
Annex C (informative)	Scheme of MAC address assignment .....	614
Annex D (informative)	Measurement of the fast startup time .....	615
Annex E (informative)	Dynamic Frame Packing.....	616
Annex F (informative)	Precondition for Diagnosis.....	624

Bibliography.....	629
Figure 1 – Middle Layer ASEs communication architecture .....	69
Figure 2 – Sequence Chart for reading the EndPointMapper .....	71
Figure 3 – Media redundancy diagnosis dependencies .....	157
Figure 4 – PTCP applications.....	158
Figure 5 – Example of periods at a local port .....	177
Figure 6 – Example of communication between controlling devices and field devices.....	201
Figure 7 – Example of communication between an engineering station and several controlling and field devices.....	202
Figure 8 – Example of communication between field devices and a server station .....	202
Figure 9 – Example of communication between field devices .....	202
Figure 10 – Data Objects and Diagnosis Data Model .....	206
Figure 11 – Example for channel modelling.....	207
Figure 12 – Mapping to PROFINET device model .....	208
Figure 13 – Identification hierarchy .....	208
Figure 14 – Application Process with application process objects (APOs) .....	211
Figure 15 – Access to a remote APO .....	212
Figure 16 – Access to a remote APO for provider/consumer association.....	213
Figure 17 – Overview of application processes .....	214
Figure 18 – IO device with APs, slots and subslots.....	214
Figure 19 – Example 1 structural units for interfaces and ports within API 0.....	216
Figure 20 – Example 2 structural units for interfaces and ports within API 0.....	217
Figure 21 – FAL ASEs communication architecture .....	218
Figure 22 – Example of one AR with two AREPs .....	220
Figure 23 – Example IO application relationship (one-to-one) .....	223
Figure 24 – Example IO application relationship one-to-many .....	224
Figure 25 – Implicit application relationship .....	225
Figure 26 – State transition diagram DEVSM .....	257
Figure 27 – State transition diagram CTLSM.....	265
Figure 28 – Assignment of Communication Relationship to Application Relationship.....	270
Figure 29 – Overview Communication Relationship Class service interactions .....	273
Figure 30 – Example for an intersection of IO device, slot, and AR .....	336
Figure 31 – Substitute Value.....	364
Figure 32 – State transition diagram RSMSM.....	372
Figure 33 – Ownership handling.....	376
Figure 34 – State transition diagram OWNSM.....	379
Figure 35 – State transition diagram ASSSM .....	380
Figure 36 – State transition diagram PLUGSM.....	392
Figure 37 – State transition diagram PULLSM.....	395
Figure 38 – Basic model for isochronous applications .....	424
Figure 39 – General isochronous application model (example CACF == 1) .....	425
Figure 40 – General isochronous application model (example CACF == 2) .....	426

Figure 41 – ASE relations in an IO device operating in isochronous mode for a submodule .....	432
Figure 42 – State transition diagram of ISOM_SYNC .....	434
Figure 43 – State transition diagram ISOM_OUT .....	437
Figure 44 – State transition diagram ISOM_IN .....	442
Figure 45 – State transition diagram SYNC_DIAG .....	484
Figure 46 – MRP interconnection .....	506
Figure 47 – Diagnosis Base Model .....	516
Figure 48 – Severity classification of fault, maintenance and qualified .....	517
Figure 49 – Data Base Model .....	518
Figure 50 – State transition diagram DIAG_DIAG .....	547
Figure 51 – State transition diagram DIAG_MR .....	551
Figure 52 – State transition diagram DIAG_MD .....	554
Figure 53 – State transition diagram DIAG_QUALIFIED .....	558
Figure 54 – Architecture .....	562
Figure 55 – State transition diagram PESM .....	570
Figure 56 – Reporting System components .....	575
Figure 57 – AR / ARSet and Reporting System .....	576
Figure 58 – Max Scan Delay .....	584
Figure 59 – RS Incident window .....	587
Figure 60 – State transition diagram RSOBS .....	592
Figure 61 – State transition diagram RSBUF .....	596
Figure 62 – State transition diagram TimeSM .....	602
Figure 63 – Example of network topology including slower wireless segments .....	605
Figure 64 – Example of media redundancy including wireless segments .....	605
Figure A.1 – Instance model .....	608
Figure B.1 – Scheme of an Ethernet interface .....	610
Figure B.2 – Scheme of an Ethernet interface with bridging ability .....	611
Figure B.3 – Scheme of an Ethernet interface with optical ports .....	612
Figure B.4 – Scheme of an Ethernet interface with bridging ability using radio communication .....	613
Figure B.5 – Scheme of an Ethernet interface with radio communication .....	613
Figure C.1 – Scheme of MAC address assignment .....	614
Figure D.1 – Measurement of the fast startup time .....	615
Figure E.1 – Frame Layout .....	616
Figure E.2 – Subframe Layout .....	617
Figure E.3 – End to End .....	618
Figure E.4 – Dynamic frame packing .....	618
Figure E.5 – Dynamic frame packing – Truncation of outputs .....	619
Figure E.6 – Dynamic frame packing – Outbound Pack .....	619
Figure E.7 – Dynamic frame packing – Concatenation of inputs .....	620
Figure E.8 – Dynamic frame packing – Inbound Pack .....	621
Figure E.9 – Dynamic frame packing – Distributed watchdog .....	623
Figure E.10 – Interrelation between IO CR and dynamically packed frame .....	623

Table 1 – State machine description elements .....	37
Table 2 – Description of state machine elements .....	38
Table 3 – Conventions used in state machines .....	38
Table 4 – Conventions for services used in state machines .....	39
Table 5 – Data type overview.....	41
Table 6 – V2 octets.....	46
Table 7 – L2 octets .....	46
Table 8 – E2 octets.....	47
Table 9 – E2 value range.....	47
Table 10 – Unipolar2.16 octets .....	48
Table 11 – Unipolar2.16 value range .....	48
Table 12 – N2 value range.....	49
Table 13 – N4 value range.....	50
Table 14 – X2 value range.....	51
Table 15 – X4 value range.....	52
Table 16 – C4 value range.....	53
Table 17 – T2 value range .....	54
Table 18 – T4 value range .....	55
Table 19 – D2 value range.....	56
Table 20 – R2 value range.....	56
Table 21 – Status value range.....	57
Table 22 – Status value range.....	58
Table 23 – F message trailer with 4 octets.....	62
Table 24 – Unsigned16_S octets .....	64
Table 25 – Unsigned16_S meaning.....	64
Table 26 – Integer16_S octets .....	65
Table 27 – Integer16_S meaning .....	65
Table 28 – Unsigned8_S octets .....	65
Table 29 – Unsigned8_S meaning .....	65
Table 30 – OctetString_S octets .....	66
Table 31 – OctetString_S status bits.....	67
Table 32 – Connect.....	72
Table 33 – Release.....	73
Table 34 – Read .....	74
Table 35 – Write .....	75
Table 36 – Control .....	76
Table 37 – ReadImplicit .....	77
Table 38 – Add Static ARP Cache Entry .....	83
Table 39 – Remove Static ARP Cache Entry.....	83
Table 40 – PPM Set Prov Data .....	89
Table 41 – PPM Set Prov Status.....	90
Table 42 – PPM Activate.....	91

Table 43 – PPM Close .....	93
Table 44 – PPM Start.....	94
Table 45 – PPM Error .....	94
Table 46 – Get Cons Data .....	94
Table 47 – CPM Get cons status.....	95
Table 48 – CPM Set RedRole .....	96
Table 49 – CPM Activate .....	97
Table 50 – CPM NoData .....	99
Table 51 – CPM Stop.....	99
Table 52 – CPM New Data Indication.....	100
Table 53 – APMS Activate .....	103
Table 54 – APMR Activate .....	104
Table 55 – APMS A Data .....	106
Table 56 – APMR A Data .....	107
Table 57 – APMR Ack.....	107
Table 58 – APMS Error.....	108
Table 59 – APMS Error ERRCLS/ERRCODE .....	108
Table 60 – APMR Error.....	109
Table 61 – APMR Error ERRCLS/ERRCODE.....	109
Table 62 – APMS_Close.....	109
Table 63 – APMR_Close.....	110
Table 64 – Get.....	118
Table 65 – Set.....	123
Table 66 – Local Set Command.....	128
Table 67 – Identify.....	130
Table 68 – Hello .....	136
Table 69 – System capabilities .....	144
Table 70 – Auto negotiation support and status .....	145
Table 71 – MDI Power Support .....	146
Table 72 – Link aggregation status .....	146
Table 73 – Remote systems data change.....	150
Table 74 – Start bridge .....	165
Table 75 – Start slave .....	166
Table 76 – Start master .....	167
Table 77 – Stop bridge.....	168
Table 78 – Stop slave .....	169
Table 79 – Stop master.....	170
Table 80 – Sync state change.....	170
Table 81 – Line Delay change.....	171
Table 82 – Local Get Time.....	174
Table 83 – Local time state info .....	174
Table 84 – Allowed values of Forwarding Mode .....	181
Table 85 – Allowed values of Fast Forwarding Multicast MAC Add.....	181

Table 86 – Tx Port Entry .....	184
Table 87 – Dependencies of RedPeriodBegin and GreenPeriodBegin .....	187
Table 88 – Port state change .....	190
Table 89 – Set port state .....	190
Table 90 – Flush filtering data base .....	191
Table 91 – MAU Type change .....	194
Table 92 – Set MAU Type .....	194
Table 93 – P Data .....	195
Table 94 – N Data .....	197
Table 95 – A Data .....	198
Table 96 – C Data .....	199
Table 97 – Requirements and features .....	200
Table 98 – Binding application relationship services .....	226
Table 99 – Device Access .....	229
Table 100 – Companion AR .....	229
Table 101 – Acknowledge Companion AR .....	230
Table 102 – Startup Mode .....	230
Table 103 – Pull Module Alarm Allowed .....	230
Table 104 – Input Valid on Backup AR .....	233
Table 105 – Mode .....	234
Table 106 – APStructureIdentifier with API != 0 .....	234
Table 107 – APStructureIdentifier with API != 0 .....	235
Table 108 – RS Alarm Transport Mode .....	235
Table 109 – Connect .....	237
Table 110 – Connect Device Access .....	243
Table 111 – Release .....	244
Table 112 – Prm Begin .....	246
Table 113 – Prm End .....	248
Table 114 – Application Ready .....	249
Table 115 – Abort .....	250
Table 116 – Local AR Abort .....	251
Table 117 – Local Set AR State .....	251
Table 118 – Local AR In Data .....	251
Table 119 – Data elements of Read AR Data .....	252
Table 120 – Data elements of Expected Fast Startup Data .....	254
Table 121 – Remote primitives issued or received by DEVSM .....	255
Table 122 – Local primitives issued or received by DEVSM .....	256
Table 123 – State table DEVSM .....	258
Table 124 – Functions, Macros, Timers and Variables by DEVSM .....	263
Table 125 – Remote primitives issued or received by CTLISM .....	264
Table 126 – Local primitives issued or received by CTLISM .....	264
Table 127 – State table CTLISM .....	266
Table 128 – Functions, Macros, Timers and Variables used by CTLISM .....	268

Table 129 – Binding communication relationship services .....	274
Table 130 – Traffic Classes versus RT Class .....	276
Table 131 – Local Set Input .....	284
Table 132 – Local Set Input IOCS .....	285
Table 133 – Local Get Input .....	286
Table 134 – Local Get Input IOCS .....	287
Table 135 – Local New Input .....	288
Table 136 – Local Set Output .....	289
Table 137 – Local Set Output IOCS .....	290
Table 138 – Local Get Output .....	291
Table 139 – Local Get Output IOCS .....	292
Table 140 – Local New Output .....	293
Table 141 – Local Set Provider State .....	294
Table 142 – Local Set Redundancy .....	295
Table 143 – Local Set State .....	295
Table 144 – Local Data State Changed .....	296
Table 145 – Binding expected identification services .....	303
Table 146 – Module State .....	305
Table 147 – AR Info .....	308
Table 148 – Ident Info .....	309
Table 149 – General Data definition for identification services .....	309
Table 150 – Data elements of Read Module Diff Block .....	311
Table 151 – Alarm type .....	315
Table 152 – Alarm types attached to diagnosis ASE .....	317
Table 153 – Alarm types attached to ownership .....	317
Table 154 – Alarm types attached to common profiles, profiles, and application .....	318
Table 155 – Binding Alarm services .....	318
Table 156 – Alarm Notification .....	322
Table 157 – Channel Diagnosis .....	324
Table 158 – Manufacturer Specific Diagnosis .....	324
Table 159 – Submodule Diagnosis State .....	325
Table 160 – AR Diagnosis State .....	325
Table 161 – User Structure Identifier .....	326
Table 162 – Semantics of Specifier .....	328
Table 163 – Binding Record Data services .....	336
Table 164 – Read .....	338
Table 165 – Read Services .....	340
Table 166 – Read Implicit .....	342
Table 167 – Read Query .....	343
Table 168 – Write .....	344
Table 169 – Write Services .....	345
Table 170 – Data elements of Write Combined Object Container .....	346
Table 171 – Local Write Multiple .....	347

Table 172 – Local New Write Multiple .....	350
Table 173 – Binding real identification services.....	356
Table 174 – Local Add Submodule.....	359
Table 175 – Local Remove Submodule .....	360
Table 176 – Local Update Submodule.....	360
Table 177 – Data elements of Read API Data .....	362
Table 178 – Data elements of Read Record Input Data Object Element .....	363
Table 179 – Data elements of Read Record Output Data Object Element .....	366
Table 180 – Data elements of Read Substitute Value.....	367
Table 181 – Selector for Read GSD Data.....	369
Table 182 – Data elements of Read GSD Data .....	369
Table 183 – Remote primitives issued or received by RSMSM .....	371
Table 184 – Local primitives issued or received by RSMSM.....	371
Table 185 – State table RSMSM .....	372
Table 186 – Functions, Macros, Timers and Variables used by RSMSM .....	374
Table 187 – Rules for Submodule State.Ident Info .....	374
Table 188 – Remote primitives issued or received by OWNSM and ASSSM.....	378
Table 189 – Local primitives issued or received by OWNSM.....	379
Table 190 – State table OWNSM .....	380
Table 191 – State table ASSSM.....	387
Table 192 – Functions, Macros, Timers and Variables used by OWNSM.....	388
Table 193 – Functions, Macros, Timers and Variables used by ASSSM .....	389
Table 194 – Rules for Submodule State.AR Info .....	389
Table 195 – Remote primitives issued or received by PLUGSM .....	390
Table 196 – Local primitives issued or received by PLUGSM.....	391
Table 197 – State table PLUGSM .....	393
Table 198 – Functions, Macros, Timers and Variables used by PLUGSM.....	394
Table 199 – Remote primitives issued or received by PULLSM .....	395
Table 200 – Local primitives issued or received by PULLSM.....	395
Table 201 – State table PULLSM .....	396
Table 202 – Functions, Macros, Timers and Variables used by PULLSM .....	397
Table 203 – Binding I&M data services .....	399
Table 204 – Data elements of Read I&M0 Filter Data.....	412
Table 205 – Data elements of Read I&M0 Data.....	415
Table 206 – Data elements of Write I&M1 Data.....	416
Table 207 – Data elements of Write I&M2 Data.....	417
Table 208 – Data elements of Write I&M3 Data.....	418
Table 209 – Data elements of Write I&M4 Data.....	418
Table 210 – Data elements of Read I&M5 Data.....	419
Table 211 – Data elements of Read Asset Management Data .....	422
Table 212 – Binding Isochronous Mode Application services.....	426
Table 213 – Data elements of Write Isochronous Mode Data .....	431
Table 214 – Remote primitives issued or received by ISOM_SYNC.....	433

Table 215 – Local primitives issued or received by ISOM_SYNC .....	433
Table 216 – State table ISOM_SYNC .....	434
Table 217 – Functions, Macros, Timers and Variables used by the ISOM_SYNC .....	435
Table 218 – Remote primitives issued or received for ISOM_OUT .....	435
Table 219 – Local primitives issued or received for ISOM_OUT .....	436
Table 220 – State table ISOM_OUT .....	438
Table 221 – Functions, Macros, Timers and Variables used by the ISOM_OUT .....	440
Table 222 – Remote primitives issued or received for ISOM_IN .....	441
Table 223 – Local primitives issued or received for ISOM_IN .....	441
Table 224 – State table ISOM_IN .....	443
Table 225 – Functions, Macros, Timers and Variables used by the ISOM_IN .....	444
Table 226 – Binding Communication Interface Management services .....	446
Table 227 – Subslot number for interface submodules .....	449
Table 228 – Subslot number for port submodules .....	453
Table 229 – Data elements of Read PDev Data .....	458
Table 230 – Data elements of Read PD Real Data .....	458
Table 231 – Data elements of Read PD Expected Data .....	460
Table 232 – Data elements of Read PD Interface Data Real .....	461
Table 233 – Data elements of Write PD Interface Adjust .....	462
Table 234 – Data elements of Write PD Interface FSU Data Adjust .....	463
Table 235 – Data elements of Write PD NC Data Check .....	464
Table 236 – Data elements of Read PD Port Data Real .....	465
Table 237 – Data elements of Read PD Port Data Real Extended .....	466
Table 238 – Data elements of Write PD Port Data Check .....	467
Table 239 – Data elements of Write PD Port Data Adjust .....	469
Table 240 – Data elements of Read Port FO Data Real .....	470
Table 241 – Data elements of Write PD Port FO Data Check .....	471
Table 242 – Data elements of Write PD Port FO Data Adjust .....	471
Table 243 – Data elements of Read PD Port Statistic .....	472
Table 244 – Binding PTCF services .....	475
Table 245 – Sync Properties Role .....	478
Table 246 – Sync Class .....	478
Table 247 – Data elements of Write PD Sync Data .....	479
Table 248 – Local Sync State Info .....	481
Table 249 – Local SYNCH Event .....	482
Table 250 – Remote primitives issued or received by SYNC_DIAG .....	483
Table 251 – Local primitives issued or received by SYNC_DIAG .....	483
Table 252 – State table SYNC_DIAG .....	485
Table 253 – Functions, Macros, Timers and Variables used by SYNC_DIAG .....	486
Table 254 – Binding MAC Bridge services .....	487
Table 255 – Distributed Watchdog Factor .....	489
Table 256 – Restart Factor For Distributed Watchdog .....	489
Table 257 – DFP Mode .....	490

Table 258 – SFIOCRProperties.DFPRedundantPathLayout.....	490
Table 259 – SFCRC16 .....	490
Table 260 – Data elements of Write PD IR Data .....	491
Table 261 – Data elements of Write PD IR Subframe Data.....	493
Table 262 – Binding Media Redundancy services .....	494
Table 263 – Data elements of Read PD Interface MRP Data Real.....	496
Table 264 – Data elements of Write PD Interface MRP Data Check .....	498
Table 265 – Data elements of Write PD Interface MRP Data Adjust .....	499
Table 266 – Data elements of Read PD Port MRP Data Real .....	501
Table 267 – Data elements of Write PD Port MRP Data Adjust .....	501
Table 268 – Data elements of Read PD Port MRPIC Data Real .....	502
Table 269 – Data elements of Write PD Port MRPIC Data Check.....	503
Table 270 – Data elements of Write PD Port MRPIC Data Adjust .....	503
Table 271 – Binding IEEE 802.1AS services .....	507
Table 272 – Data elements of Write PD Time Data .....	509
Table 273 – List of supported MIBs.....	509
Table 274 – Cross-referencing of MIB-II objects .....	510
Table 275 – Cross-referencing of LLDP-MIB objects.....	510
Table 276 – Cross-referencing of LLDP-EXT-PNIO MIB objects .....	510
Table 277 – Cross-referencing of LLDP-EXT-DOT3 MIB objects .....	511
Table 278 – Binding Autoconfiguration Data services.....	511
Table 279 – Data elements of Read Autoconfiguration Data .....	514
Table 280 – Binding Diagnosis services.....	521
Table 281 – General Data definition for Diagnosis services.....	527
Table 282 – Local Add Diagnosis Entry.....	530
Table 283 – Local Remove Diagnosis Entry .....	531
Table 284 – Local Update Diagnosis Entry.....	532
Table 285 – Remote primitives issued or received by DIAG_DIAG .....	547
Table 286 – Local primitives issued or received by DIAG_DIAG .....	547
Table 287 – State table DIAG_DIAG .....	548
Table 288 – Functions, Macros, Timers and Variables used by DIAG_DIAG .....	549
Table 289 – Remote primitives issued or received by DIAG_MR .....	550
Table 290 – Local primitives issued or received by DIAG_MR.....	551
Table 291 – State table DIAG_MR .....	552
Table 292 – Functions, Macros, Timers and Variables used by DIAG_MR.....	552
Table 293 – Remote primitives issued or received by DIAG_MD .....	554
Table 294 – Local primitives issued or received by DIAG_MD .....	554
Table 295 – State table DIAG_MD .....	555
Table 296 – Functions, Macros, Timers and Variables used by the maintenance demanded entry.....	556
Table 297 – Remote primitives issued or received by DIAG_QUALIFIED .....	557
Table 298 – Local primitives issued or received by DIAG_QUALIFIED .....	557
Table 299 – State table DIAG_QUALIFIED .....	559

Table 300 – Functions, Macros, Timers and Variables used by DIAG_QUALIFIED .....	559
Table 301 – Binding PE services .....	563
Table 302 – Local Add PE Entity .....	564
Table 303 – Local Remove PE Entity .....	565
Table 304 – Local Update PE_OperationalMode .....	566
Table 305 – PE Entity Filter Data definition .....	567
Table 306 – PE Entity Filter Data definition .....	568
Table 307 – Remote primitives issued or received by PESM .....	570
Table 308 – Local primitives issued or received by PESM .....	570
Table 309 – State table PESM .....	571
Table 310 – Functions, Macros, Timers and Variables used by PESM .....	571
Table 311 – Binding LogBook services .....	572
Table 312 – Data elements of Read LogBook Data .....	573
Table 313 – Local Create LogBook Entry .....	574
Table 314 – Binding RS services .....	581
Table 315 – Immanent observers .....	583
Table 316 – Configured observers .....	583
Table 317 – Data elements of Local Add RS Event .....	589
Table 318 – Data elements of RS Get Event .....	590
Table 319 – Data elements of RS Ack Event .....	590
Table 320 – Data elements of RS Adjust Observer .....	591
Table 321 – Local primitives issued or received by RSOBS .....	592
Table 322 – State table RSOBS .....	594
Table 323 – Functions, Macros, Timers and Variables used by RSOBS .....	595
Table 324 – Local primitives issued or received by RSBUF .....	596
Table 325 – State table RSBUF .....	597
Table 326 – Functions, Macros, Timers and Variables used by RSBUF .....	599
Table 327 – Binding Time services .....	600
Table 328 – Local Get Time .....	601
Table 329 – Local primitives issued or received by TimeSM .....	602
Table 330 – State table TimeSM .....	603
Table 331 – Functions, Macros, Timers and Variables used by TimeSM .....	604
Table 332 – FAL services of the IO device .....	606
Table 333 – FAL services of the IO controller .....	607
Table F.1 – ChannelErrorType .....	624
Table F.2 – Preconditions ChannelErrorType 0 – 0xFF .....	625
Table F.3 – Preconditions for ChannelErrorType 0x0100 – 0x7FFF, 0x9000 – 0x9FFF .....	625
Table F.4 – Preconditions for ChannelErrorType “Data transmission impossible” .....	625
Table F.5 – Preconditions for ChannelErrorType “Remote mismatch” .....	626
Table F.6 – Preconditions for ChannelErrorType “Media redundancy mismatch – ring” .....	626
Table F.7 – Preconditions for ChannelErrorType “Media redundancy mismatch - interconnection” .....	627
Table F.8 – Preconditions for ChannelErrorType “Sync mismatch” .....	627

Table F.9 – Preconditions for ChannelErrorType “Isochronous mode mismatch” ..... 627

Table F.10 – Preconditions for ChannelErrorType “Multicast CR mismatch” ..... 627

Table F.11 – Preconditions for ChannelErrorType “Fiber optic mismatch” ..... 628

Table F.12 – Preconditions for ChannelErrorType “Network component function mismatch” ..... 628

Table F.13 – Preconditions for ChannelErrorType “Dynamic Frame Packing function mismatch” ..... 628

Table F.14 – Preconditions for ChannelErrorType “Media redundancy with planned duplication mismatch” ..... 628

Table F.15 – Preconditions for ChannelErrorType “Multiple interface mismatch” ..... 628

Withdrawn

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELDBUS SPECIFICATIONS –****Part 5-10: Application layer service definition –  
Type 10 elements**

## 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.

This International Standard IEC 61158-5-10 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 2014. This edition constitutes a technical revision.

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

- integration of system redundancy basic functionality;
- integration of dynamic reconfiguration basic functionality;
- integration of reporting system basic functionality;

- integration of asset management basic functionality;
- integration of media redundancy ring interconnection basic functionality.

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

FDIS	Report on voting
65C/947/FDIS	65C/950/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 publication has been drafted in accordance with ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61158 series, published under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

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

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

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

## INTRODUCTION

This part of IEC 61158 is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC 61158-1.

The application service is provided by the application protocol making use of the services available from the data-link or other immediately lower layer. This document defines the application service characteristics that fieldbus applications and/or system management may exploit.

Throughout the set of fieldbus standards, the term “service” refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the application layer service defined in this document is a conceptual architectural service, independent of administrative and implementation divisions.

Withdrawing