



IEC 61158-5-3

Edition 1.0 2007-12

INTERNATIONAL STANDARD

Industrial communication networks – Fieldbus specifications –
Part 5-3: Application layer service definition – Type 3 elements

(<https://standards.iteh.ai>)

Document Preview

IEC 61158-5-3:2007

<https://standards.iteh.ai/coding/standards/iec/8e02834-4e55-484d-871c-9d6b0202b506/iec-61158-5-3-2007>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2007 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.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/vstpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch

<https://standards.iec.ch/standard/8e02834-4e55-484d-871c-9d6b0202b506/iec-61158-5-3-2007>

Tel.: +41 22 919 02 11

Fax: +41 22 919 03 00



IEC 61158-5-3

Edition 1.0 2007-12

INTERNATIONAL STANDARD

Industrial communication networks – Fieldbus specifications –
Part 5-3: Application layer service definition – Type 3 elements

iTech standards
(<https://standards.iteh.ai>)

Document Preview

IEC 61158-5-3:2007

<https://standards.iteh.ai/catalog/standards/iec/8ec02834-4e55-484d-871c-9d6b0202b506/iec-61158-5-3-2007>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

XH

ICS 25.040.40; 35.100.70

ISBN 2-8318-9445-X

CONTENTS

FOREWORD	11
INTRODUCTION	13
1 Scope	14
1.1 General	14
1.2 Overview	14
1.3 Specifications	15
1.4 Conformance	15
2 Normative references	15
3 Terms, definitions, abbreviations, symbols and conventions	16
3.1 Referenced terms and definitions	16
3.2 Fieldbus Application Layer type 3 – specific terms and definitions	17
3.3 Abbreviations and symbols	25
3.4 Conventions	25
4 Concepts	32
5 Data type ASE	32
6 Communication model specification	32
6.1 DP concepts	32
6.2 ASEs	52
6.3 Summary of FAL classes	430
6.4 Permitted FAL services by AREP role	431
6.5 Conformance classes	435
6.6 Application characteristics	436
Bibliography	438

Figure 1 – Example of DP communication with a single controlling device	35
Figure 2 – Example of DP communication with several controlling devices	35
Figure 3 – Example of DP communication between field devices	36
Figure 4 – DP-slave model (modular DP-slave)	38
Figure 5 – DP-slave model (compact DP-slave)	39
Figure 6 – Overview of application processes	40
Figure 7 – DP-slave model (modular DP-slave)	41
Figure 8 – Application Service Elements (ASEs)	43
Figure 9 – Application Process with application Objects (APOs)	44
Figure 10 – Access to a remote APO	45
Figure 11 – Access to a remote APO for publisher/subscriber association	46
Figure 12 – Example of one AR with two AREPs	47
Figure 13 – Relation of a simple process data object to the real object	53
Figure 14 – Relation of a combined process data object to the real objects	55
Figure 15 – Sequence of an isochronous DP cycle with one DP-master (class 1)	86
Figure 16 – Additional time relationships in a DP system operating in isochronous mode	88
Figure 17 – DP system with optimized isochronous DP cycle	89
Figure 18 – Buffered synchronized isochronous mode at the DP-master (class 1)	91

Figure 19 – Enhanced synchronized isochronous mode at the DP-master (class 1).....	92
Figure 20 – Input, output and PLL state machine interaction	92
Figure 21 – PLL state diagram	98
Figure 22 – OUTPUT state diagram	102
Figure 23 – INPUT state diagram.....	106
Figure 24 – Treatment of an alarm in the DP system.....	139
Figure 25 – Load Region state diagram for erasable memory.....	237
Figure 26 – Load region state diagram for non erasable memory	238
Figure 27 – Function invocation state diagram	270
Figure 28 – System architecture.....	284
Figure 29 – Assignment of communication relationship to application relationship	291
Figure 30 – MS0 application relationship.....	297
Figure 31 – Output buffer model of a DP-slave without sync functionality.....	298
Figure 32 – Output buffer model of a DP-slave with sync functionality.....	298
Figure 33 – Input buffer model of a DP-slave without freeze functionality.....	299
Figure 34 – Input buffer model of a DP-slave with freeze functionality.....	299
Figure 35 – MS1 application relationship.....	300
Figure 36 – MS2 application relationship.....	300
Figure 37 – Example of inter-network communication.....	302
Figure 38 – Example without inter-network addressing.....	302
Figure 39 – First example with inter-network addressing.....	303
Figure 40 – Second example with inter-network addressing	304
Figure 41 – MS3 application relationship.....	305
Figure 42 – MM1 application relationship	305
Figure 43 – MM2 application relationship	306
Figure 44 – Cycle time of the DP system.....	437
Table 1 – Requirements and features of fieldbus DP	34
Table 2 – Status values of the service primitives	51
Table 3 – Access Rights MS1	54
Table 4 – Access Rights MS2	54
Table 5 – Access Rights MS1	57
Table 6 – Access Rights MS2	57
Table 7 – SCL matching rules	58
Table 8 – Read	58
Table 9 – Write	60
Table 10 – Data transport	61
Table 11 – Format (simple input data description).....	65
Table 12 – Consistency (simple input data description).....	65
Table 13 – Format (simple output data).....	67
Table 14 – Consistency (simple output data).....	67
Table 15 – Format (extended input data).....	68
Table 16 – Consistency (extended input data).....	69

Table 17 – Format (extended output data)	70
Table 18 – Consistency (extended output data)	71
Table 19 – Set Input	72
Table 20 – Read Input	72
Table 21 – Get Input	74
Table 22 – New Input.....	75
Table 23 – Set Output.....	76
Table 24 – Final.....	77
Table 25 – Read Output.....	77
Table 26 – Get Output	78
Table 27 – Clear Flag	78
Table 28 – New Flag	79
Table 29 – New Output	79
Table 30 – Clear Flag	79
Table 31 – Global Control	80
Table 32 – Clear Command	80
Table 33 – Sync Command	80
Table 34 – Freeze Command	81
Table 35 – New publisher data.....	81
Table 36 – Get publisher data.....	82
Table 37 – New Flag	82
Table 38 – SYNCH.....	83
Table 39 – SYNCH Delayed.....	83
Table 40 – DX Finished.....	84
Table 41 – SYNCH Event.....	84
Table 42 – Status.....	84
Table 43 – Primitives issued by the AL to the PLL state machine	94
Table 44 – Primitives issued by the user to the PLL state machine	94
Table 45 – Allowed values of Status	94
Table 46 – Primitives issued by the user to the input state machine	95
Table 47 – Primitives issued by the user to the output state machine	95
Table 48 – Primitives issued by the PLL to the output state machine	95
Table 49 – Primitives issued by the output to the PLL state machine	95
Table 50 – Primitives issued by the PLL to the input state machine.....	95
Table 51 – Primitives issued by the output to the input state machine	96
Table 52 – Primitives issued by the output state machine to the AL	96
Table 53 – Primitives issued by the AL to the output state machine	96
Table 54 – Primitives issued by the input state machine to the AL	96
Table 55 – Primitives issued by the AL to the input state machine	96
Table 56 – PLL state table	99
Table 57 – OUTPUT state table	103
Table 58 – INPUT state table	107
Table 59 – Identifier status.....	109

Table 60 – Channel type	110
Table 61 – IO type	111
Table 62 – Error type	111
Table 63 – Status type	112
Table 64 – Status specifier	112
Table 65 – Status specifier	113
Table 66 – Module status	113
Table 67 – Status specifier	114
Table 68 – Link status	115
Table 69 – Link error	115
Table 70 – Set Slave Diag	116
Table 71 – Ext Diag Flag	117
Table 72 – Get Slave Diag	119
Table 73 – Read Slave Diag	129
Table 74 – New Slave Diag	138
Table 75 – Alarm type	140
Table 76 – Add Ack	141
Table 77 – Alarm specifier	141
Table 78 – Alarm notification	142
Table 79 – Alarm Ack	143
Table 80 – Prm data type	148
Table 81 – Supported feature	158
Table 82 – Supported profile feature	158
Table 83 – Role	159
Table 84 – Check user Prm	160
Table 85 – Prm structure	161
Table 86 – MS1 Command	164
Table 87 – Check user Prm result	165
Table 88 – Status values	166
Table 89 – Check Ext user Prm	167
Table 90 – Check Ext user Prm result	170
Table 91 – Status values	171
Table 92 – Check Cfg	171
Table 93 – Check Cfg result	172
Table 94 – Status values	173
Table 95 – Set Cfg	173
Table 96 – Get Cfg	174
Table 97 – Set Slave Add	175
Table 98 – Initiate	176
Table 99 – Abort	179
Table 100 – Instance	179
Table 101 – MS0 init DP-slave	180
Table 102 – MS1 init DP-slave	180

Table 103 – MS2 init DP-slave	181
Table 104 – DP-slave started.....	181
Table 105 – Alarm limit	182
Table 106 – DP-slave stopped	182
Table 107 – Reset DP-slave	183
Table 108 – DP-slave fault.....	183
Table 109 – Application ready DP-slave.....	183
Table 110 – Start subscriber	184
Table 111 – Stop subscriber	184
Table 112 – Publisher active.....	185
Table 113 – Status.....	186
Table 114 – Init DP-master CI1	186
Table 115 – DP-master CI1 started	187
Table 116 – Alarm limit	188
Table 117 – DP-master CI1 stopped.....	188
Table 118 – Reset DP-master CI1	188
Table 119 – DP-master CI1 fault	189
Table 120 – DP-master CI1 reject	189
Table 121 – Set mode DP-master CI1	190
Table 122 – DP-master CI1 mode changed	191
Table 123 – Load bus Par DP-master CI1	192
Table 124 – Mark DP-master CI1.....	193
Table 125 – Abort DP-master CI1.....	193
Table 126 – Read value DP-master CI1	194
Table 127 – Delete SC DP-master CI1	194
Table 128 – DP-master CI1 event	195
Table 129 – Init DP-master CI2	196
Table 130 – Reset DP-master CI2	197
Table 131 – DP-master CI2 fault	197
Table 132 – DP-master CI2 reject	197
Table 133 – DP-master CI2 closed.....	198
Table 134 – DP-master CI2 event	198
Table 135 – USIF state	199
Table 136 – Data rate	203
Table 137 – USIF state	204
Table 138 – Isochronous mode	204
Table 139 – Slave type	207
Table 140 – Alarm mode	208
Table 141 – Get Master Diag	211
Table 142 – MDIAG identifier	211
Table 143 – Start Seq	212
Table 144 – Area code (start seq)	213
Table 145 – Download	214

Table 146 – Upload.....	215
Table 147 – End Seq	216
Table 148 – Act Para Brct	217
Table 149 – Area code (Act Para Brct).....	217
Table 150 – Act param.....	218
Table 151 – Area code (Act param).....	219
Table 152 – Activate	219
Table 153 – Access rights MS1	221
Table 154 – Access rights MS2.....	222
Table 155 – Load region state.....	222
Table 156 – Initiate load	224
Table 157 – Default values for the parameter Intersegment Request Timeout	225
Table 158 – Push segment.....	226
Table 159 – Pull segment	228
Table 160 – Terminate load	230
Table 161 – Primitives issued by the user to the Load Region state machine	232
Table 162 – Primitives issued by the Load Region state machine to the user	233
Table 163 – Primitives issued by the Function Invocation to the Load Region state machine	233
Table 164 – Primitives issued by the Load Region to the Function Invocation state machine	234
Table 165 – Load Region state definitions	234
Table 166 – Load Region function table	235
Figure 25 – Load Region state diagram for erasable memory.....	237
Table 167 – Load Region state table for erasable memory	238
Table 168 – Load Region state table for non erasable memory	251
Table 169 – Access rights MS1.....	255
Table 170 – Access rights MS2	255
Table 171 – Function Invocation state.....	256
Table 172 – Load Region object in use	256
Table 173 – Access rights MS1	258
Table 174 – Access rights MS2	258
Table 175 – Load Region object in use	258
Table 176 – Start	259
Table 177 – Stop	260
Table 178 – Resume	261
Table 179 – Reset.....	262
Table 180 – Get FI state	263
Table 181 – Call.....	264
Table 182 – Primitives issued by the user to the Function Invocation state machine	266
Table 183 – Primitives issued by the Function Invocation state machine to the user	267
Table 184 – Primitives issued by the Load Region to the Function Invocation state machine	267

Table 185 – Primitives issued by the Function Invocation to the Load Region state machine	268
Table 186 – Function Invocation state definitions	268
Table 187 – Function definitions	269
Table 188 – Function Invocation state table	270
Table 189 – CS status	286
Table 190 – Summertime	286
Table 191 – Synchronization active	287
Table 192 – Announcement hour	287
Table 193 – Summertime	288
Table 194 – Accuracy	288
Table 195 – Set time	289
Table 196 – Sync interval violation	290
Table 197 – Parameter of Initiate service without inter-network addressing	303
Table 198 – Parameter of Initiate service with inter-network addressing (first example)	303
Table 199 – Parameter of Initiate service with inter-network addressing (second example)	304
Table 200 – AR type	310
Table 201 – Sync supported	312
Table 202 – Freeze supported	312
Table 203 – Group identifier	314
Table 204 – DPV1 enabled	314
Table 205 – Fail safe	315
Table 206 – WD base	315
Table 207 – No Add change	317
Table 208 – Alarm mode supported	320
Table 209 – Isochronous mode supp	324
Table 210 – Isochronous mode	324
Table 211 – Alarm mode	325
Table 212 – Time device type	326
Table 213 – S_SAP_index	329
Table 214 – D_addr	330
Table 215 – Service_activate	330
Table 216 – Role_in_service	331
Table 217 – Indication_mode	332
Table 218 – Max_DLSDU_length_req_low	332
Table 219 – Max_DLSDU_length_req_high	333
Table 220 – Max_DLSDU_length_ind_low	333
Table 221 – Max_DLSDU_length_ind_high	334
Table 222 – S_SAP_index	339
Table 223 – D_SAP_index	339
Table 224 – D_addr	340
Table 225 – Service_activate	340

Table 226 – Role_in_service	341
Table 227 – Indication_mode	341
Table 228 – Max_DLSDU_length_req_low	342
Table 229 – Max_DLSDU_length_req_high	342
Table 230 – Max_DLSDU_length_ind_low	343
Table 231 – Max_DLSDU_length_ind_high	343
Table 232 – Sync	344
Table 233 – Freeze	345
Table 234 – DPV1 enabled	346
Table 235 – Fail safe	346
Table 236 – Enable publisher	347
Table 237 – WD base	347
Table 238 – Alarm mode	348
Table 239 – Fail safe	358
Table 240 – S_SAP_index	365
Table 241 – D_SAP_index	366
Table 242 – D_addr	366
Table 243 – Service_activate	366
Table 244 – Role_in_service	367
Table 245 – Max_DLSDU_length_req_low	367
Table 246 – Max_DLSDU_length_req_high	367
Table 247 – Max_DLSDU_length_ind_low	368
Table 248 – Max_DLSDU_length_ind_high	368
Table 249 – DLL init DP-slave	369
Table 250 – Load ARL DP-slave	370
Table 251 – Get ARL DP-slave	376
Table 252 – Set ARL isochronous mode	382
Table 253 – Load ARL DP-master CI1	383
Table 254 – Get ARL DP-master CI1	386
Table 255 – ARL Slave update DP-master CI1	388
Table 256 – Load ARL DP-master CI2	390
Table 257 – Get ARL DP-master CI2	391
Table 258 – Load CRL DP-slave	392
Table 259 – Load CRL DXB link entries	394
Table 260 – Get CRL DP-slave	395
Table 261 – Load CRL DP-master CI1	397
Table 262 – Get CRL DP-master CI1	410
Table 263 – CRL Slave activate	423
Table 264 – CRL Slave new Prm	424
Table 265 – CRL Slave new Prm data	425
Table 266 – Load CRL DP-master CI2	427
Table 267 – Get CRL DP-master CI2	429
Table 268 – Fieldbus AL class summary	430

Table 269 – Assignment of the services to DP-masters and DP-slaves	432
Table 270 – Support of AR types in the different DP-device types.....	433
Table 271 – Support of services at the different AREPs respectively CREPs	434
Table 272 – Conformance classes DP-master (class 1).....	436
Table 273 – Conformance classes DP-master (class 2).....	436



<https://standards.iteh.ai/coding/standards/iec/8e02834-4e55-484d-871c-9d6b0202b506/iec-61158-5-3-2007>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 5-3: Application Layer service definition – Type 3 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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.

NOTE Use of some of the associated protocol types is restricted by their intellectual-property-right holders. In all cases, the commitment to limited release of intellectual-property-rights made by the holders of those rights permits a particular data-link layer protocol type to be used with physical layer and application layer protocols in Type combinations as specified explicitly in the IEC 61784 series. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

International Standard IEC 61158-5-3 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition and its companion parts of the IEC 61158-5 subseries cancel and replace IEC 61158-5:2003. This edition of this part constitutes an editorial revision.

This edition of IEC 61158-5 includes the following significant changes from the previous edition:

- a) deletion of the former Type 6 fieldbus for lack of market relevance;
- b) addition of new types of fieldbuses;

c) partition of part 5 of the third edition into multiple parts numbered -5-2, -5-3, ...

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/475/FDIS	65C/486/RVD

Full information on the voting for the approval of this 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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

NOTE The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

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

<https://standards.iteh.ai/ctmg/standards/Ic/8e/02834-4e55-484d-871c-9d6b0202b506/iec-61158-5-3-2007>