



IEC 61158-6-2

Edition 3.0 2014-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –
Part 6-2: Application layer protocol specification – Type 2 elements

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-2: Spécification du protocole de la couche application – Eléments
de type 2

<https://standards.iteh.ai> IEC 61158-6-2:2014



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 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 Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
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.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - [www.iec.ch/searchpub](https://webstore.iec.ch/searchpub)

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 Just Published - webstore.iec.ch/jupublished

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

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - 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: csc@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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - [www.iec.ch/searchpub](https://webstore.iec.ch/searchpub)

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 Just Published - webstore.iec.ch/jupublished

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

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



IEC 61158-6-2

Edition 3.0 2014-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –
Part 6-2: Application layer protocol specification – Type 2 elements

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-2: Spécification du protocole de la couche application – Eléments
de type 2

<https://standards.iteh.ai/cod/standards/icc/0daa82fa-ffb1-49f6-928c-471309d186c5/iec-61158-6-2-2014>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX XH

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-1756-6

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.....	12
INTRODUCTION.....	14
1 Scope.....	15
1.1 General	15
1.2 Specifications	15
1.3 Conformance.....	16
2 Normative references	16
3 Terms, definitions, symbols, abbreviations and conventions	18
3.1 Terms and definitions from other ISO/IEC standards	18
3.2 Terms and definitions from IEC 61158-5-2.....	19
3.3 Additional terms and definitions.....	19
3.4 Abbreviations and symbols.....	26
3.5 Conventions	27
4 Abstract syntax.....	32
4.1 FAL PDU abstract syntax	32
4.2 Data abstract syntax specification	149
4.3 Encapsulation abstract syntax	154
5 Transfer syntax	171
5.1 Compact encoding.....	171
5.2 Data type reporting.....	179
6 Structure of FAL protocol state machines.....	186
7 AP-Context state machine	187
7.1 Overview	187
7.2 Connection object state machine.....	187
8 FAL service protocol machine (FSPM).....	195
8.1 General.....	195
8.2 Primitive definitions	195
8.3 Parameters of primitives.....	199
8.4 FSPM state machines.....	200
9 Application relationship protocol machines (ARPMs)	200
9.1 General	200
9.2 Connection-less ARPM (UCMM).....	201
9.3 Connection-oriented ARPMs (transports).....	210
10 DLL mapping protocol machine 1 (DMPM 1).....	238
10.1 General	238
10.2 Link producer	238
10.3 Link consumer.....	239
10.4 Primitive definitions	239
10.5 DMPM state machine	241
10.6 Data-link Layer service selection	243
11 DLL mapping protocol machine 2 (DMPM 2).....	243
11.1 General	243
11.2 Mapping of UCMM PDUs.....	243
11.3 Mapping of transport class 0 and class 1 PDUs	251
11.4 Mapping of transport class 2 and class 3 PDU's	252

11.5 Mapping of transport classes 4 to 6	253
11.6 IGMP Usage.....	253
11.7 Quality of Service (QoS) for CP 2/2 messages	254
11.8 Management of an encapsulation session	258
12 DLL mapping protocol machine 3 (DMPM 3).....	258
Bibliography.....	259
 Figure 1 – Attribute table format and terms	27
Figure 2 – Service request/response parameter.....	28
Figure 3 – Example of an STD	31
Figure 4 – Network connection parameters	54
Figure 5 – Time tick	57
Figure 6 – Connection establishment time-out	59
Figure 7 – Member ID/EX description (WORD)	71
Figure 8 – Transport Class Trigger attribute.....	103
Figure 9 – CP2/3_initial_comm_characteristics attribute format	107
Figure 10 – Segment type.....	116
Figure 11 – Port segment.....	117
Figure 12 – Logical segment encoding.....	119
Figure 13 – Extended network segment	124
Figure 14 – Symbolic segment encoding	125
Figure 15 – Encapsulation message	154
Figure 16 – FixedLengthBitString compact encoding bit placement rules	176
Figure 17 – Example compact encoding of a SWORD FixedLengthBitString.....	176
Figure 18 – Example compact encoding of a WORD FixedLengthBitString.....	176
Figure 19 – Example compact encoding of a DWORD FixedLengthBitString	176
Figure 20 – Example compact encoding of a LWORD FixedLengthBitString	176
Figure 21 – Example 1 of formal encoding of a structure type specification	181
Figure 22 – Example 2 of formal encoding of a structure type specification	182
Figure 23 – Example 3 of formal encoding of a handle structure type specification	182
Figure 24 – Example 4 of formal encoding of a handle structure type specification	183
Figure 25 – Example 5 of abbreviated encoding of a structure type specification	183
Figure 26 – Example 1 of formal encoding of an array type specification	184
Figure 27 – Example 2 of formal encoding of an array type specification	185
Figure 28 – Example 1 of abbreviated encoding of an array type specification	186
Figure 29 – Example 2 of abbreviated encoding of an array type specification	186
Figure 30 – I/O Connection object state transition diagram	187
Figure 31 – Bridged Connection object state transition diagram	191
Figure 32 – Explicit Messaging Connection object state transition diagram	192
Figure 33 – State transition diagram of UCMM client9.....	203
Figure 34 – State transition diagram of high-end UCMM server.....	205
Figure 35 – State transition diagram of low-end UCMM server	207
Figure 36 – Sequence diagram for a UCMM with one outstanding message.....	208
Figure 37 – Sequence diagram for a UCMM with multiple outstanding messages.....	209

Figure 38 – TPDU buffer	210
Figure 39 – Data flow diagram using a client transport class 0 and server transport class 0	213
Figure 40 – Sequence diagram of data transfer using transport class 0.....	213
Figure 41 – Class 0 client STD	214
Figure 42 – Class 0 server STD	215
Figure 43 – Data flow diagram using client transport class 1 and server transport class 1	216
Figure 44 – Sequence diagram of data transfer using client transport class 1 and server transport class 1	217
Figure 45 – Class 1 client STD	219
Figure 46 – Class 1 server STD	220
Figure 47 – Data flow diagram using client transport class 2 and server transport class 2	222
Figure 48 – Diagram of data transfer using client transport class 2 and server transport class 2 without returned data	223
Figure 49 – Sequence diagram of data transfer using client transport class 2 and server transport class 2 with returned data	224
Figure 50 – Class 2 client STD	225
Figure 51 – Class 2 server STD	227
Figure 52 – Data flow diagram using client transport class 3 and server transport class 3	230
Figure 53 – Sequence diagram of data transfer using client transport class 3 and server transport class 3 without returned data	231
Figure 54 – Sequence diagram of data transfer using client transport class 3 and server transport class 3 with returned data	232
Figure 55 – Class 3 client STD	234
Figure 56 – Class 3 server STD	236
Figure 57 – Data flow diagram for a link producer and consumer	238
Figure 58 – State transition diagram for a link producer	242
Figure 59 – State transition diagram for a link consumer.....	242
Figure 60 – DS field in the IP header	255
Figure 61 – IEEE 802.1Q tagged frame.....	256
Table 1 – Get_Attribute_All response service rules	28
Table 2 – Example class level object/service specific response data of Get_Attribute_All	29
Table 3 – Example Get_Attribute_All data array method	29
Table 4 – Set_Attribute_All request service rules	30
Table 5 – Example Set_Attribute_All attribute ordering method.....	30
Table 6 – Example Set_Attribute_All data array method.....	30
Table 7 – State event matrix format	32
Table 8 – Example state event matrix	32
Table 9 – UCMM_PDU header format	36
Table 10 – UCMM command codes.....	36
Table 11 – Transport class 0 header.....	37

Table 12 – Transport class 1 header.....	37
Table 13 – Transport class 2 header.....	37
Table 14 – Transport class 3 header.....	37
Table 15 – Real-time data header – exclusive owner	38
Table 16 – Real-time data header– redundant owner	38
Table 17 – Forward_Open request format	42
Table 18 – Forward_Open_Good response format	43
Table 19 – Forward_Open_Bad response format	44
Table 20 – Large_Forward_Open request format	44
Table 21 – Large_Forward_Open_Good response format	45
Table 22 – Large_Forward_Open_Bad response format.....	46
Table 23 – Forward_Close request format	46
Table 24 – Forward_Close_Good response format.....	47
Table 25 – Forward_Close_Bad response format.....	47
Table 26 – Unconnected_Send request format.....	48
Table 27 – Unconnected_Send_Good response format.....	49
Table 28 – Unconnected_Send_Bad response format.....	49
Table 29 – Unconnected_Send request format (modified).....	50
Table 30 – Unconnected_Send_Good response format (modified)	51
Table 31 – Unconnected_Send_Bad response format (modified).....	51
Table 32 – Get_Connection_Data request format.....	52
Table 33 – Get_Connection_Data response format.....	52
Table 34 – Search_Connection_Data request format	53
Table 35 – Get_Connection_Owner request format	53
Table 36 – Get_Connection_Owner response format	53
Table 37 – Time-out multiplier.....	57
Table 38 – Time tick units.....	57
Table 39 – Encoded application path ordering	62
Table 40 – Transport class, trigger and Is_Server format	63
Table 41 – MR_Request_Header format	63
Table 42 – MR_Response_Header format.....	64
Table 43 – Structure of Get_Attribute_All_ResponsePDU body.....	64
Table 44 – Structure of Set_Attribute_All_RequestPDU body.....	65
Table 45 – Structure of Get_Attribute_List_RequestPDU body	65
Table 46 – Structure of Get_Attribute_List_ResponsePDU body	65
Table 47 – Structure of Set_Attribute_List_RequestPDU body	65
Table 48 – Structure of Set_Attribute_List_ResponsePDU body.....	65
Table 49 – Structure of Reset_RequestPDU body.....	66
Table 50 – Structure of Reset_ResponsePDU body	66
Table 51 – Structure of Start_RequestPDU body	66
Table 52 – Structure of Start_ResponsePDU body	66
Table 53 – Structure of Stop_RequestPDU body.....	66
Table 54 – Structure of Stop_ResponsePDU body	67

Table 55 – Structure of Create_RequestPDU body	67
Table 56 – Structure of Create_ResponsePDU body.....	67
Table 57 – Structure of Delete_RequestPDU body	67
Table 58 – Structure of Delete_ResponsePDU body	67
Table 59 – Structure of Get_Attribute_Single_ResponsePDU body	68
Table 60 – Structure of Set_Attribute_Single_RequestPDU body	68
Table 61 – Structure of Set_Attribute_Single_ResponsePDU body	68
Table 62 – Structure of Find_Next_Object_Instance_RequestPDU body	68
Table 63 – Structure of Find_Next_Object_Instance_ResponsePDU body	68
Table 64 – Structure of Apply_Attributes_RequestPDU body	69
Table 65 – Structure of Apply_Attributes_ResponsePDU body.....	69
Table 66 – Structure of Save_RequestPDU body	69
Table 67 – Structure of Save_ResponsePDU body	69
Table 68 – Structure of Restore_RequestPDU body.....	69
Table 69 – Structure of Restore_ResponsePDU body	70
Table 70 – Structure of Get_Member_ResponsePDU body.....	70
Table 71 – Structure of Set_Member_RequestPDU body	70
Table 72 – Structure of Set_Member_ResponsePDU body.....	70
Table 73 – Structure of Insert_Member_RequestPDU body.....	70
Table 74 – Structure of Insert_Member_ResponsePDU body	71
Table 75 – Structure of Remove_Member_ResponsePDU body	71
Table 76 – Common structure of _Member_RequestPDU body (basic format).....	72
Table 77 – Common structure of _Member_ResponsePDU body (basic format)	72
Table 78 – Common structure of _Member_RequestPDU body (extended format).....	72
Table 79 – Common structure of _Member_ResponsePDU body (extended format)	73
Table 80 – Extended Protocol ID	73
Table 81 – Structure of _Member_RequestPDU body (Multiple Sequential Members)	73
Table 82 – Structure of _Member_ResponsePDU body (Multiple Sequential Members).....	74
Table 83 – Structure of _Member_RequestPDU body (International String Selection)	74
Table 84 – Structure of _Member_ResponsePDU body (International String Selection).....	74
Table 85 – Structure of Group_Sync_RequestPDU body.....	75
Table 86 – Structure of Group_Sync_ResponsePDU body	75
Table 87 – Identity object class attributes	75
Table 88 – Identity object instance attributes	75
Table 89 – Identity object bit definitions for status instance attribute	77
Table 90 – Default values for extended device status field (bits 4 to 7) of status instance attribute	77
Table 91 – Class level object/service specific response data of Get_Attribute_All	77
Table 92 – Instance level object/service specific response data of Get_Attribute_All	78
Table 93 – Object-specific parameter for Reset	78
Table 94 – Reset service parameter values	78
Table 95 – Message Router object class attributes	79
Table 96 – Message Router object instance attributes	79

Table 97 – Class level object/service specific response data of Get_Attribute_All	79
Table 98 – Instance level object/service specific response data of Get_Attribute_All	80
Table 99 – Structure of Symbolic_Translation_RequestPDU body.....	80
Table 100 – Structure of Symbolic_Translation_ResponsePDU body	80
Table 101 – Object specific status for Symbolic_Translation service	80
Table 102 – Assembly object class attributes.....	81
Table 103 – Assembly object instance attributes	81
Table 104 – Assembly Instance ID ranges	81
Table 105 – Acknowledge Handler object class attributes	82
Table 106 – Acknowledge Handler object instance attributes	83
Table 107 – Structure of Add_AckData_Path_RequestPDU body	83
Table 108 – Structure of Remove_AckData_Path_RequestPDU body	83
Table 109 – Time Sync object class attributes	84
Table 110 – Time Sync object instance attributes	84
Table 111 – ClockIdentity encoding for different network implementations.....	87
Table 112 – ClockClass values	88
Table 113 – TimeAccuracy values.....	88
Table 114 – TimePropertyFlags bit values.....	89
Table 115 – TimeSource values	89
Table 116 – Types of Clock	89
Table 117 – Network protocol to PortPhysicalAddressInfo mapping	89
Table 118 – Parameter object class attributes.....	90
Table 119 – Parameter Class Descriptor bit values	90
Table 120 – Parameter object instance attributes	91
Table 121 – Semantics of Descriptor_Instance attribute	92
Table 122 – Minimum and Maximum Value semantics.....	92
Table 123 – Scaling Formula attributes	93
Table 124 – Scaling links	94
Table 125 – Class level object/service specific response data of Get_Attribute_All	95
Table 126 – Instance level object/service specific response data of Get_Attribute_All (Parameter object stub)	95
Table 127 – Instance level object/service specific response data of Get_Attribute_All (full Parameter object)	96
Table 128 – Structure of Get_Enum_String_RequestPDU body	97
Table 129 – Structure of Get_Enum_String_ResponsePDU body	97
Table 130 – Enumerated strings Type versus Parameter data type	97
Table 131 – Connection Manager object class attributes.....	98
Table 132 – Connection Manager object instance attributes.....	98
Table 133 – Class level object/service specific response data of Get_Attribute_All	99
Table 134 – Instance level object/service specific response data of Get_Attribute_All	99
Table 135 – Instance level object/service specific request data of Set_Attribute_All	100
Table 136 – Connection object class attributes	101
Table 137 – Connection object instance attributes	101
Table 138 – Values assigned to the state attribute	102

Table 139 – Values assigned to the instance_type attribute	103
Table 140 – Possible values within Direction Bit	104
Table 141 – Possible values within Production Trigger Bits	104
Table 142 – Possible values within Transport Class Bits	105
Table 143 – TransportClass_Trigger attribute values summary	105
Table 144 – Transport Class 0 client behavior summary	106
Table 145 – Transport Class 1, 2 and 3 client behavior summary	106
Table 146 – Values defined for the CP2/3_produced_connection_id attribute	106
Table 147 – Values defined for the CP2/3_consumed_connection_id attribute	107
Table 148 – Values for the Initial Production Characteristics nibble	108
Table 149 – Values for the Initial Consumption Characteristics nibble	109
Table 150 – Values for the watchdog_timeout_action	112
Table 151 – Structure of Connection_Bind_RequestPDU body	114
Table 152 – Object specific status for Connection_Bind service	114
Table 153 – Structure of Producing_Application_Lookup_RequestPDU body	114
Table 154 – Structure of Producing_Application_Lookup_ResponsePDU body	114
Table 155 – Producing_Application_Lookup Service status codes	115
Table 156 – Possible port segment examples	117
Table 157 – TCP/IP link address examples	118
Table 158 – Extended Logical Type	119
Table 159 – Electronic key segment format	121
Table 160 – Logical segments examples	122
Table 161 – Network segments	122
Table 162 – Extended subtype definitions	124
Table 163 – Symbolic segment examples	125
Table 164 – Data segment	126
Table 165 – ANSI_Extended_Symbol segment	126
Table 166 – Addressing categories	129
Table 167 – Class code ID ranges	129
Table 168 – Attribute ID ranges	130
Table 169 – Service code ranges	130
Table 170 – Class codes	131
Table 171 – Reserved class attributes for all object class definitions	131
Table 172 – Common services list	132
Table 173 – Message Router object specific services list	133
Table 174 – Acknowledge Handler object specific services list	133
Table 175 – Parameter object specific services list	133
Table 176 – Services specific to Connection Manager	133
Table 177 – Services specific to Connection object	134
Table 178 – Device type numbering	134
Table 179 – Connection Manager service request error codes	136
Table 180 – General status codes	144
Table 181 – Extended status code for a general status of "Key Failure in path"	146

Table 182 – Identity object status codes	147
Table 183 – Encapsulation header.....	155
Table 184 – Encapsulation command codes	155
Table 185 – Encapsulation status codes	157
Table 186 – Nop request encapsulation header	158
Table 187 – RegisterSession request encapsulation header	158
Table 188 – RegisterSession request data portion	158
Table 189 – RegisterSession reply encapsulation header	159
Table 190 – RegisterSession reply data portion	159
Table 191 – UnRegisterSession request encapsulation header	160
Table 192 – ListServices request encapsulation header	160
Table 193 – ListServices reply encapsulation header.....	161
Table 194 – ListServices reply data portion.....	161
Table 195 – Communications capability flags.....	162
Table 196 – ListIdentity request encapsulation header.....	162
Table 197 – ListIdentity reply encapsulation header.....	163
Table 198 – ListIdentity reply data portion (successful).....	163
Table 199 – CPF 2 identity item	164
Table 200 – ListInterfaces request encapsulation header	164
Table 201 – ListInterfaces reply encapsulation header	165
Table 202 – SendRRData request encapsulation header	165
Table 203 – SendRRData request data portion	166
Table 204 – SendRRData reply encapsulation header	166
Table 205 – SendUnitData request encapsulation header	167
Table 206 – SendUnitData request data portion.....	167
Table 207 – Common packet format.....	167
Table 208 – CPF Item format	168
Table 209 – Item Type ID numbers	168
Table 210 – Null address item	169
Table 211 – Connected address item	169
Table 212 – Sequenced address item	169
Table 213 – Unconnected data item	169
Table 214 – Connected data item	170
Table 215 – Sockaddr info items	170
Table 216 – Usage of CPF items	171
Table 217 – BOOLEAN encoding	172
Table 218 – Example compact encoding of a BOOL value	172
Table 219 – Encoding of SignedInteger values	173
Table 220 – Example compact encoding of a SignedInteger value	173
Table 221 – UnsignedInteger values	173
Table 222 – Example compact encoding of an UnsignedInteger	173
Table 223 – FixedLengthReal values	173
Table 224 – Example compact encoding of a REAL value	174

Table 225 – Example compact encoding of a LREAL value	174
Table 226 – FixedLengthReal values	174
Table 227 – STRING value	174
Table 228 – STRING2 value	175
Table 229 – STRINGN value	175
Table 230 – SHORT_STRING value	175
Table 231 – Example compact encoding of a STRING value	175
Table 232 – Example compact encoding of STRING2 value	175
Table 233 – SHORT_STRING type	175
Table 234 – Example compact encoding of a single dimensional ARRAY	177
Table 235 – Example compact encoding of a multi-dimensional ARRAY	178
Table 236 – Example compact encoding of a STRUCTURE	178
Table 237 – Identification codes and descriptions of elementary data types	179
Table 238 – Identification codes and descriptions of constructed data types	180
Table 239 – Formal structure encoding definition	181
Table 240 – Formal structure with handles encoding definition	182
Table 241 – Abbreviated structure encoding definition	183
Table 242 – Formal array encoding definition	184
Table 243 – Abbreviated array encoding definition	185
Table 244 – I/O Connection state event matrix	188
Table 245 – Bridged Connection state event matrix	191
Table 246 – Explicit Messaging Connection state event matrix	193
Table 247 – Primitives issued by FAL user to FSPM	196
Table 248 – Primitives issued by FAL user to FSPM	196
Table 249 – Primitives issued by FSPM to FAL user	198
Table 250 – Parameters used with primitives exchanged between FAL user and FSPM	200
Table 251 – Primitives issued by FSPM to ARPM	202
Table 252 – Primitives issued by ARPM to FSPM	202
Table 253 – Parameters used with primitives exchanged between FSPM and ARPM	202
Table 254 – UCMM client states	203
Table 255 – State event matrix of UCMM client	204
Table 256 – High-end UCMM server states	205
Table 257 – State event matrix of high-end UCMM server	206
Table 258 – Low-end UCMM server states	207
Table 259 – State event matrix of low-end UCMM server	207
Table 260 – Notification	210
Table 261 – Transport classes	211
Table 262 – Primitives issued by FSPM to ARPM	211
Table 263 – Primitives issued by ARPM to FSPM	212
Table 264 – Parameters used with primitives exchanged between FSPM and ARPM	212
Table 265 – Class 0 transport client states	214
Table 266 – Class 0 client SEM	214
Table 267 – Class 0 transport server states	215

Table 268 – Class 0 server SEM	215
Table 269 – Class 1 transport client states	218
Table 270 – Class 1 client SEM	219
Table 271 – Class 1 transport server states	220
Table 272 – Class 1 server SEM	221
Table 273 – Class 2 transport client states	225
Table 274 – Class 2 client SEM	226
Table 275 – Class 2 transport server states	227
Table 276 – Class 2 server SEM	228
Table 277 – Class 3 transport client states	233
Table 278 – Class 3 client SEM	234
Table 279 – Class 3 transport server states	235
Table 280 – Class 3 server SEM	237
Table 281 – Primitives issued by ARPM to DMPM	239
Table 282 – Primitives issued by DMPM to ARPM	239
Table 283 – Parameters used with primitives exchanged between ARPM and DMPM	239
Table 284 – Primitives exchanged between data-link layer and DMPM	240
Table 285 – Parameters used with primitives exchanged between DMPM and Data-link	240
Table 286 – Selection of connection ID	241
Table 287 – Link producer states	241
Table 288 – State event matrix of link producer	242
Table 289 – Link consumer states	242
Table 290 – State event matrix of link consumer	243
Table 291 – UCMM request	243
Table 292 – UCMM reply	244
Table 293 – Network Connection ID selection	246
Table 294 – Sockaddr_Info usage	247
Table 295 – Example multicast assignments	250
Table 296 – UDP data format for class 0 and class 1	251
Table 297 – Transport class 2 and class 3 connected data	252
Table 298 – Default DSCP and IEEE 802.1D mapping	256

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 6-2: Application layer protocol specification –
Type 2 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.

Attention is drawn to the fact that the use of the associated protocol type is restricted by its 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 layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

NOTE Combinations of protocol types are specified in IEC 61784-1 and IEC 61784-2.

International Standard IEC 61158-6-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.