

INTERNATIONAL STANDARD

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



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

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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	17
3.1 Terms and definitions from other ISO/IEC standards	17
3.2 Terms and definitions from IEC 61158-5-2.....	18
3.3 Additional terms and definitions.....	18
3.4 Abbreviations and symbols.....	24
3.5 Conventions	24
3.6 Conventions used in state machines	29
4 Abstract syntax.....	30
4.1 FAL PDU abstract syntax	30
4.2 Data abstract syntax specification	120
4.3 Encapsulation abstract syntax.....	124
5 Transfer syntax	138
5.1 Compact encoding.....	138
5.2 Data type reporting.....	145
6 Structure of FAL protocol state machines	150
7 AP-Context state machine	150
7.1 Overview	150
7.2 Connection object state machine.....	150
8 FAL service protocol machine (FSPM).....	160
8.1 General.....	160
8.2 Primitive definitions	160
8.3 Parameters of primitives.....	164
8.4 FSPM state machines.....	165
9 Application relationship protocol machines (ARPMs)	166
9.1 General.....	166
9.2 Connection-less ARPM (UCMM).....	166
9.3 Connection-oriented ARPMs (transports).....	176
10 DLL mapping protocol machine 1 (DMPM 1).....	247
10.1 General.....	247
10.2 Link producer	247
10.3 Link consumer.....	248
10.4 Primitive definitions	248
10.5 DMPM state machine	250
10.6 Data-link Layer service selection.....	251
11 DLL mapping protocol machine 2 (DMPM 2).....	251
11.1 General.....	251
11.2 Mapping of UCMM PDUs.....	252
11.3 Mapping of transport class 0 and class 1 PDUs.....	257

11.4 Mapping of transport class 2 and class 3 PDU's	258
11.5 Mapping of transport classes 4 to 6	258
11.6 IGMP Usage	258
11.7 Quality of Service (QoS) for CP 2/2 messages	259
11.8 Management of an encapsulation session	262
12 DLL mapping protocol machine 3 (DMPM 3)	263
Bibliography	264
Figure 1 – Attribute table format and terms	25
Figure 2 – Service request/response parameter	25
Figure 3 – Example of an STD	29
Figure 4 – Network connection parameters	49
Figure 5 – Time tick	51
Figure 6 – Connection establishment time-out	53
Figure 7 – Transport Class Trigger attribute	86
Figure 8 – CP2/3_initial_comm_characteristics attribute format	89
Figure 9 – Segment type	97
Figure 10 – Port segment	98
Figure 11 – Logical segment encoding	100
Figure 12 – Extended network segment	104
Figure 13 – Encapsulation message	124
Figure 14 – FixedLengthBitString compact encoding bit placement rules	142
Figure 15 – Example compact encoding of a SWORD FixedLengthBitString	142
Figure 16 – Example compact encoding of a WORD FixedLengthBitString	142
Figure 17 – Example compact encoding of a DWORD FixedLengthBitString	143
Figure 18 – Example compact encoding of a LWORD FixedLengthBitString	143
Figure 19 – Example 2 of formal encoding of a structure type specification	147
Figure 20 – Example of abbreviated encoding of a structure type specification	148
Figure 21 – Example 1 of formal encoding of an array type specification	148
Figure 22 – Example 2 of formal encoding of an array type specification	149
Figure 23 – Example 1 of abbreviated encoding of an array type specification	149
Figure 24 – Example 2 of abbreviated encoding of an array type specification	150
Figure 25 – I/O Connection object state transition diagram	151
Figure 26 – Bridged Connection object state transition diagram	155
Figure 27 – Explicit Messaging Connection object state transition diagram	157
Figure 28 – State transition diagram of UCMM client	169
Figure 29 – State transition diagram of high-end UCMM server	170
Figure 30 – State transition diagram of low-end UCMM server	172
Figure 31 – Sequence diagram for a UCMM with one outstanding message	174
Figure 32 – Sequence diagram for a UCMM with multiple outstanding messages	175
Figure 33 – TPDU buffer	176
Figure 34 – Data flow diagram using a client transport class 0 and server transport class 0	179
Figure 35 – Sequence diagram of data transfer using transport class 0	179

Figure 36 – Class 0 client STD	180
Figure 37 – Class 0 server STD	181
Figure 38 – Data flow diagram using client transport class 1 and server transport class 1	182
Figure 39 – Sequence diagram of data transfer using client transport class 1 and server transport class 1	183
Figure 40 – Class 1 client STD	185
Figure 41 – Class 1 server STD	186
Figure 42 – Data flow diagram using client transport class 2 and server transport class 2	188
Figure 43 – Diagram of data transfer using client transport class 2 and server transport class 2 <i>without</i> returned data	189
Figure 44 – Sequence diagram of data transfer using client transport class 2 and server transport class 2 <i>with</i> returned data	190
Figure 45 – Class 2 client STD	191
Figure 46 – Class 2 server STD	193
Figure 47 – Data flow diagram using client transport class 3 and server transport class 3	196
Figure 48 – Sequence diagram of data transfer using client transport class 3 and server transport class 3 <i>without</i> returned data	197
Figure 49 – Sequence diagram of data transfer using client transport class 3 and server transport class 3 <i>with</i> returned data	198
Figure 50 – Class 3 client STD	200
Figure 51 – Class 3 server STD	203
Figure 52 – Data flow diagram using transport classes 4 and 5	205
Figure 53 – Sequence diagram of message exchange using transport classes 4 and 5	206
Figure 54 – Sequence diagram of messages overwriting each other	207
Figure 55 – Sequence diagram of queued message exchange using transport classes 4 and 5	208
Figure 56 – Sequence diagram of retries using transport classes 4 and 5	208
Figure 57 – Sequence diagram of idle traffic using transport classes 4 and 5	209
Figure 58 – Classes 4 and 5 basic structure	210
Figure 59 – Class 6 basic structure	211
Figure 60 – Classes 4 to 6 general STD	212
Figure 61 – Class 4 sender STD	214
Figure 62 – Class 4 receiver STD	217
Figure 63 – Sequence diagram of three fragments using transport class 5	220
Figure 64 – Sequence diagram of fragmentation with retries using transport class 5	221
Figure 65 – Sequence diagram of two fragments using transport class 5	221
Figure 66 – Sequence diagram of aborted message using transport class 5	222
Figure 67 – Class 5 sender STD	223
Figure 68 – Class 5 receiver STD	226
Figure 69 – Data flow diagram for transport class 6	231
Figure 70 – Sequence diagram of message exchange using transport class 6	233
Figure 71 – Sequence diagram of retries using transport class 6	233
Figure 72 – Sequence diagram of idle traffic using transport class 6	234

Figure 73 – Sequence diagram of request overwriting null	235
Figure 74 – Sequence diagram of response overwriting ACK of null.....	235
Figure 75 – Sequence diagram of three fragments using transport class 6.....	236
Figure 76 – Sequence diagram of fragmentation with retries using transport class 6.....	237
Figure 77 – Sequence diagram of two fragments using transport class 6	237
Figure 78 – Sequence diagram of aborted fragmented sequence using transport class 6	238
Figure 79 – Class 6 client STD	239
Figure 80 – Class 6 server STD	242
Figure 81 – Data flow diagram for a link producer and consumer	247
Figure 82 – State transition diagram for a link producer	250
Figure 83 – State transition diagram for a link consumer.....	251
Figure 84 – DS field in the IP header	261
Figure 85 – IEEE 802.1Q tagged frame.....	261
 Table 1 – Get_Attribute_All response service rules	 26
Table 2 – Example class level object/service specific response data of Get_Attribute_All	 26
Table 3 – Example Get_Attribute_All data array method	27
Table 4 – Set_Attribute_All request service rules	28
Table 5 – Example Set_Attribute_All attribute ordering method.....	28
Table 6 – Example Set_Attribute_All data array method.....	28
Table 7 – State event matrix format	30
Table 8 – Example state event matrix	30
Table 9 – UCMM_PDU header format	33
Table 10 – UCMM command codes.....	33
Table 11 – Transport class 0 header.....	34
Table 12 – Transport class 1 header.....	35
Table 13 – Transport class 2 header.....	35
Table 14 – Transport class 3 header.....	35
Table 15 – Classes 4 to 6 header format.....	35
Table 16 – Real-time data header – exclusive owner	36
Table 17 – Real-time data header– redundant owner	37
Table 18 – Forward_Open request format.....	39
Table 19 – Forward_Open_Good response format	40
Table 20 – Forward_Open_Bad response format	40
Table 21 – Large_Forward_Open request format	41
Table 22 – Large_Forward_Open_Good response format	42
Table 23 – Large_Forward_Open_Bad response format.....	42
Table 24 – Forward_Close request format	43
Table 25 – Forward_Close_Good response format.....	43
Table 26 – Forward_Close_Bad response format.....	44
Table 27 – Unconnected_Send request format.....	45
Table 28 – Unconnected_Send_Good response format.....	45

Table 29 – Unconnected_Send_Bad response format	46
Table 30 – Get_Connection_Data request format	46
Table 31 – Get_Connection_Data response format	47
Table 32 – Search_Connection_Data request format	47
Table 33 – Get_Object_Owner request format	48
Table 34 – Forward_Open_Good response format	48
Table 35 – Time-out multiplier	51
Table 36 – Time tick units	51
Table 37 – Selection of connection ID	55
Table 38 – Transport class, trigger and Is_Server format	55
Table 39 – MR_Request_Header format	56
Table 40 – MR_Response_Header format	56
Table 41 – Structure of Get_Attribute_All_ResponsePDU body	57
Table 42 – Structure of Set_Attribute_All_RequestPDU body	57
Table 43 – Structure of Get_Attribute_List_RequestPDU body	57
Table 44 – Structure of Get_Attribute_List_ResponsePDU body	57
Table 45 – Structure of Set_Attribute_List_RequestPDU body	57
Table 46 – Structure of Set_Attribute_List_ResponsePDU body	58
Table 47 – Structure of Reset_RequestPDU body	58
Table 48 – Structure of Reset_ResponsePDU body	58
Table 49 – Structure of Start_RequestPDU body	58
Table 50 – Structure of Start_ResponsePDU body	58
Table 51 – Structure of Stop_RequestPDU body	59
Table 52 – Structure of Stop_ResponsePDU body	59
Table 53 – Structure of Create_RequestPDU body	59
Table 54 – Structure of Create_ResponsePDU body	59
Table 55 – Structure of Delete_RequestPDU body	59
Table 56 – Structure of Delete_ResponsePDU body	59
Table 57 – Structure of Get_Attribute_Single_ResponsePDU body	60
Table 58 – Structure of Set_Attribute_Single_RequestPDU body	60
Table 59 – Structure of Set_Attribute_Single_ResponsePDU body	60
Table 60 – Structure of Find_Next_Object_Instance_RequestPDU body	60
Table 61 – Structure of Find_Next_Object_Instance_ResponsePDU body	60
Table 62 – Structure of Apply_Attributes_RequestPDU body	61
Table 63 – Structure of Apply_Attributes_ResponsePDU body	61
Table 64 – Structure of Save_RequestPDU body	61
Table 65 – Structure of Save_ResponsePDU body	61
Table 66 – Structure of Restore_RequestPDU body	61
Table 67 – Structure of Restore_ResponsePDU body	61
Table 68 – Structure of Group_Sync_RequestPDU body	62
Table 69 – Structure of Group_Sync_ResponsePDU body	62
Table 70 – Identity object class attributes	62
Table 71 – Identity object instance attributes	62

Table 72 – Identity object bit definitions for status instance attribute	63
Table 73 – Bits 4 – 7 of status instance attribute	64
Table 74 – Class level object/service specific response data of Get_Attribute_All	64
Table 75 – Instance level object/service specific response data of Get_Attribute_All	65
Table 76 – Modified instance level object/service specific response data of Get_Attribute_All	65
Table 77 – Object-specific parameter for Reset	66
Table 78 – Message Router object class attributes	66
Table 79 – Message Router object instance attributes	66
Table 80 – Class level object/service specific response data of Get_Attribute_All	67
Table 81 – Instance level object/service specific response data of Get_Attribute_All	67
Table 82 – Assembly object class attributes	67
Table 83 – Assembly object instance attributes	67
Table 84 – Acknowledge Handler object class attributes	68
Table 85 – Acknowledge Handler object instance attributes	69
Table 86 – Structure of Add_AckData_Path_RequestPDU body	69
Table 87 – Structure of Remove_AckData_Path_RequestPDU body	69
Table 88 – Time Sync object instance attributes	70
Table 89 – ClockIdentity encoding for different network implementations	73
Table 90 – ClockClass values	73
Table 91 – TimeAccuracy values	74
Table 92 – TimePropertyFlags bit values	74
Table 93 – TimeSource values	75
Table 94 – Types of Clock	75
Table 95 – Parameter object class attributes	75
Table 96 – Parameter Class Descriptor bit values	76
Table 97 – Parameter object instance attributes	77
Table 98 – Semantics of Descriptor Instance attribute	77
Table 99 – Minimum and Maximum Value semantics	79
Table 100 – Scaling Formula attributes	80
Table 101 – Scaling links	80
Table 102 – Structure of Get_Enum_String_RequestPDU body	81
Table 103 – Structure of Get_Enum_String_ResponsePDU body	81
Table 104 – Enumerated strings Type versus Parameter data type	81
Table 105 – Connection Manager object class attributes	82
Table 106 – Connection Manager object instance attributes	82
Table 107 – Connection object class attributes	83
Table 108 – Connection object instance attributes	84
Table 109 – Values assigned to the state attribute	85
Table 110 – Values assigned to the instance_type attribute	85
Table 111 – Possible values within Direction Bit	86
Table 112 – Possible values within Production Trigger Bits	86
Table 113 – Possible values within Transport Class Bits	87

Table 114 – Transport Class_Trigger attribute	88
Table 115 – Values defined for the CP2/3_produced_connection_id attribute	88
Table 116 – Values defined for the CP2/3_consumed_connection_id attribute	89
Table 117 – Values for the Initial Production Characteristics nibble	90
Table 118 – Values for the Initial Consumption Characteristics nibble.....	91
Table 119 – Values for the watchdog_timeout_action.....	94
Table 120 – Structure of Connection_Bind_RequestPDU body.....	95
Table 121 – Object specific status for Connection_Bind service.....	96
Table 122 – Structure of Producing_Application_Lookup_RequestPDU body	96
Table 123 – Structure of Producing_Application_Lookup_ResponsePDU body	96
Table 124 – Producing_Application_Lookup Service status codes	96
Table 125 – Possible port segment examples	98
Table 126 – TCP/IP link address examples.....	99
Table 127 – Electronic key segment format.....	101
Table 128 – Logical segments examples.....	102
Table 129 – Network segments.....	102
Table 130 – Extended subtype definitions	104
Table 131 – Data segment.....	104
Table 132 – ANSI_Extended_Symbol segment	105
Table 133 – Addressing categories	105
Table 134 – Class code ID ranges	106
Table 135 – Attribute ID ranges	106
Table 136 – Service code ranges.....	106
Table 137 – Class codes.....	107
Table 138 – Reserved class attributes for all object class definitions	107
Table 139 – Common services list	108
Table 140 – Acknowledge Handler object specific services list	109
Table 141 – Parameter object specific services list.....	109
Table 142 – Services specific to Connection Manager	109
Table 143 – Services specific to Connection object.....	109
Table 144 – Device type numbering	110
Table 145 – Connection Manager service request error codes	111
Table 146 – General status codes.....	116
Table 147 – Identity object status codes	118
Table 148 – Encapsulation header.....	125
Table 149 – Encapsulation command codes	125
Table 150 – Encapsulation status codes	126
Table 151 – Options flags	127
Table 152 – Nop request encapsulation header	127
Table 153 – RegisterSession request encapsulation header	127
Table 154 – RegisterSession request data portion	128
Table 155 – Options flags	128
Table 156 – RegisterSession reply encapsulation header	128

Table 157 – RegisterSession reply data portion	128
Table 158 – UnRegisterSession request encapsulation header	129
Table 159 – ListServices request encapsulation header	129
Table 160 – ListServices reply encapsulation header	130
Table 161 – ListServices reply data portion	130
Table 162 – Service type codes	130
Table 163 – Communications capability flags	130
Table 164 – ListIdentity request encapsulation header	131
Table 165 – ListIdentity reply encapsulation header	131
Table 166 – ListIdentity reply data portion	132
Table 167 – ListInterfaces request encapsulation header	132
Table 168 – ListInterfaces reply encapsulation header	133
Table 169 – SendRRData request encapsulation header	133
Table 170 – SendRRData request data portion	133
Table 171 – SendRRData reply encapsulation header	134
Table 172 – SendUnitData request encapsulation header	134
Table 173 – SendUnitData request data portion	135
Table 174 – Common packet format	135
Table 175 – Address and data item structure	135
Table 176 – Address type ID's	135
Table 177 – Data type ID's	136
Table 178 – Null address type	136
Table 179 – Connected address type	136
Table 180 – Sequenced address type	137
Table 181 – UCMM data type	137
Table 182 – Connected data type	137
Table 183 – Sockaddr info items	137
Table 184 – BOOLEAN encoding	139
Table 185 – Example compact encoding of a BOOL value	139
Table 186 – Encoding of SignedInteger values	139
Table 187 – Example compact encoding of a SignedInteger value	139
Table 188 – UnsignedInteger values	139
Table 189 – Example compact encoding of an UnsignedInteger	140
Table 190 – FixedLengthReal values	140
Table 191 – Example compact encoding of a REAL value	140
Table 192 – Example compact encoding of a LREAL value	140
Table 193 – FixedLengthReal values	140
Table 194 – STRING value	141
Table 195 – STRING2 value	141
Table 196 – STRINGN value	141
Table 197 – SHORT_STRING value	141
Table 198 – Example compact encoding of a STRING value	141
Table 199 – Example compact encoding of STRING2 value	142

Table 200 – SHORT_STRING type	142
Table 201 – Example compact encoding of a single dimensional ARRAY	143
Table 202 – Example compact encoding of a multi-dimensional ARRAY	144
Table 203 – Example compact encoding of a STRUCTURE	144
Table 204 – Identification codes and descriptions of elementary data types	146
Table 205 – Example 1 of formal encoding of a structure type specification	147
Table 206 – I/O Connection state event matrix.....	151
Table 207 – Bridged Connection state event matrix	156
Table 208 – Explicit Messaging Connection state event matrix	158
Table 209 – Primitives issued by FAL user to FSPM	161
Table 210 – Primitives issued by FAL user to FSPM	162
Table 211 – Primitives issued by FSPM to FAL user	164
Table 212 – Parameters used with primitives exchanged between FAL user and FSPM	165
Table 213 – Primitives issued by FSPM to ARPM	167
Table 214 – Primitives issued by ARPM to FSPM	167
Table 215 – Parameters used with primitives exchanged between FSPM and ARPM	168
Table 216 – UCMM client states	168
Table 217 – State event matrix of UCMM client.....	169
Table 218 – High-end UCMM server states.....	170
Table 219 – State event matrix of high-end UCMM server.....	171
Table 220 – Low-end UCMM server states.....	172
Table 221 – State event matrix of low-end UCMM server	173
Table 222 – Notification	176
Table 223 – Transport classes	177
Table 224 – Primitives issued by FSPM to ARPM	177
Table 225 – Primitives issued by ARPM to FSPM	178
Table 226 – Parameters used with primitives exchanged between FSPM and ARPM	178
Table 227 – Class 0 transport client states	180
Table 228 – Class 0 client SEM	180
Table 229 – Class 0 transport server states	181
Table 230 – Class 0 server SEM.....	181
Table 231 – Class 1 transport client states	184
Table 232 – Class 1 client SEM	185
Table 233 – Class 1 transport server states	186
Table 234 – Class 1 server SEM.....	187
Table 235 – Class 2 transport client states	191
Table 236 – Class 2 client SEM	192
Table 237 – Class 2 transport server states	193
Table 238 – Class 2 server SEM.....	194
Table 239 – Class 3 transport client states	199
Table 240 – Class 3 client SEM	200
Table 241 – Class 3 transport server states	202
Table 242 – Class 3 server SEM.....	204

Table 243 – Write and trigger events in class 4 and 5 transport	206
Table 244 – Common states for transport classes 4 to 6	211
Table 245 – Classes 4 to 6 general SEM	212
Table 246 – Class 4 transport sender states	214
Table 247 – Class 4 sender SEM	215
Table 248 – Class 4 transport receiver states	216
Table 249 – Class 4 receiver SEM	218
Table 250 – Class 5 transport sender states	223
Table 251 – Class 5 sender SEM	224
Table 252 – Class 5 transport receiver states	226
Table 253 – Class 5 receiver SEM	228
Table 254 – Class 6 transport client states	239
Table 255 – Class 6 client state event matrix	240
Table 256 – Class 6 transport server states	241
Table 257 – Class 6 server SEM	244
Table 258 – Primitives issued by ARPM to DMPM	248
Table 259 – Primitives issued by DMPM to ARPM	248
Table 260 – Parameters used with primitives exchanged between ARPM and DMPM	248
Table 261 – Primitives exchanged between data-link layer and DMPM	249
Table 262 – Parameters used with primitives exchanged between DMPM and Data-link	249
Table 263 – Link producer states	250
Table 264 – State event matrix of link producer	250
Table 265 – Link consumer states	251
Table 266 – State event matrix of link consumer	251
Table 267 – Network Connection ID selection	253
Table 268 – Example multicast assignments	256
Table 269 – UDP data format for class 0 and class 1	257
Table 270 – Default DSCP and IEEE 802.1D mapping	261

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIELDBUS SPECIFICATIONS –****Part 6-2: Application layer protocol specification –
Type 2 elements**

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NOTE 1 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 profile parts. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

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 second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- Clause 2 and Bibliography: update of normative and bibliographic references;
- subclause 3.4: update of abbreviations;

- subclause 4.1.2.1: update list of service request/response PDUs (Time Sync and Parameter ASEs/objects);
- subclause 4.1.8.6: update of Time Sync ASE/object;
- new subclause 4.1.8.7: new Parameter ASE/object;
- subclause 4.1.9.4: minor update of a common parameter;
- subclause 4.1.10.2: update/add object and services codes for Time Sync and Parameter ASEs;
- subclause 4.1.11: minor updates of error codes;
- new subclause 11.7: new QoS specification.

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

FDIS	Report on voting
65C/607/FDIS	65C/621/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.

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.

NOTE 2 The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

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/TR 61158-1:2010.

The application protocol provides the application service by making use of the services available from the data-link or other immediately lower layer. The primary aim of this standard is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer application entities (AEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- as a guide for implementers and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-2: Application layer protocol specification – Type 2 elements

1 Scope

1.1 General

The Fieldbus Application Layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be viewed as a “window between corresponding application programs.”

This standard provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment and material specific to Type 2 fieldbus. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard specifies interactions between remote applications and defines the externally visible behavior provided by the Type 2 fieldbus application layer in terms of

- a) the formal abstract syntax defining the application layer protocol data units conveyed between communicating application entities;
- b) the transfer syntax defining encoding rules that are applied to the application layer protocol data units;
- c) the application context state machine defining the application service behavior visible between communicating application entities;
- d) the application relationship state machines defining the communication behavior visible between communicating application entities.

The purpose of this standard is to define the protocol provided to

- a) define the wire-representation of the service primitives defined in IEC 61158-5-2:2010, and
- b) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 2 fieldbus application layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498-1) and the OSI application layer structure (ISO/IEC 9545).

1.2 Specifications

The principal objective of this standard is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-2:2010.

A secondary objective is to provide migration paths from previously-existing industrial communications protocols. It is this latter objective which gives rise to the diversity of protocols standardized in the various IEC 61158-6-x parts.

1.3 Conformance

This standard does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems. Conformance is achieved through implementation of this application layer protocol specification.

2 Normative references

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

IEC 61158-3-2:2007, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-4-2:2010¹, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-5-2:2010¹, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61588:2009, *Precision clock synchronization protocol for networked measurement and control systems*

IEC 61784-3-2, *Industrial communication networks – Profiles – Part 3-2: Functional safety fieldbuses – Additional specifications for CPF 2*

IEC 62026-3:2008, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3: DeviceNet*

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 8824 (all parts), *Information technology – Abstract Syntax Notation One (ASN.1)*

ISO/IEC 8825-1, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 9545, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 10646, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

¹ To be published.

ISO 11898:1993², *Road vehicles – Interchange of digital information – Controller area network (CAN) for high-speed communication*

IEEE 802.1D, *IEEE standard for local and metropolitan area networks – Media Access Control (MAC) bridges*, available at <http://www.ieee.org>

IEEE 802.1Q, *IEEE standard for local and metropolitan area networks – Virtual bridged local area networks*, available at <http://www.ieee.org>

IETF RFC 791, *Internet Protocol*, available at <http://www.ietf.org>

IETF RFC 1035, *Domain Names – Implementation and Specification*, available at <http://www.ietf.org>

IETF RFC 1122, *Requirements for Internet Hosts – Communication Layers*, available at <http://www.ietf.org>

IETF RFC 1759, *Printer MIB*, available at <http://www.ietf.org>

IETF RFC 2475, *An Architecture for Differentiated Services*, available at <http://www.ietf.org>

3 Terms, definitions, symbols, abbreviations and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviations and conventions apply.

3.1 Terms and definitions from other ISO/IEC standards

3.1.1 Terms and definitions from ISO/IEC 7498-1

- a) abstract syntax
- b) application entity
- c) application process
- d) application protocol data unit
- e) application service element
- f) application entity invocation
- g) application process invocation
- h) application transaction
- i) presentation context
- j) real open system
- k) transfer syntax

3.1.2 Terms and definitions from ISO/IEC 9545

- a) application-association
- b) application-context
- c) application context name
- d) application-entity-invocation
- e) application-entity-type
- f) application-process-invocation
- g) application-process-type
- h) application-service-element
- i) application control service element

3.1.3 Terms and definitions from ISO/IEC 8824

- a) object identifier
- b) type

² A newer edition of this standard has been published, but only the cited edition applies.