IEC 61158-6-26

Edition 2.0 2023-03

INTERNATIONAL STANDARD

Industrial communication networks – Fieldbus specifications – Part 6-26: Application layer protocol specification – Type 26 elements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-6630-4

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 11
INTRODUCTION 13
1 Scope 14
1.1 General 14
1.2 Specifications 15
1.3 Conformance 15
2 Normative references 15
3 Terms, definitions, symbols, abbreviated terms and conventions 16
3.1 Terms and definitions from other ISO/IEC standards 17
3.1.1 Terms and definitions from ISO/IEC 7498-1 17
3.1.2 Terms and definitions from ISO/IEC 8822 17
3.1.3 Terms and definitions from ISO/IEC 9545 17
3.1.4 Terms and definitions from ISO/IEC 8824-1 17
3.1.5 Terms and definitions from ISO/IEC 8825-1 18
3.2 Type 26 specific terms and definitions 18
3.3 Abbreviated terms and symbols 22
3.4 Conventions 24
3.4.1 Conventions used in state machines 24
3.4.2 Convention for abstract syntax description 26
3.4.3 Convention for reserved bits and octets 26
3.4.4 Conventions for bit description in octets 26
4 FAL syntax description 27
4.1 General 27
4.2 Overview of Type 26 fieldbus 27
4.2.1 Application field and Common-memory 27
4.2.2 Structure of Type 26 protocol 28
4.2.3 Structure of Type 26 FAL 29
4.2.4 Data link layer 30
4.3 Operating principle 31
4.3.1 Overview 31
4.3.2 Logical ring maintenance 31
4.3.3 Node addition 34
4.3.4 Node in a logical ring 38
4.3.5 Node drop-out 39
4.3.6 Data transmission 39
4.3.7 Data transmission frames 49
4.4 FAL PDU abstract syntax 52
4.4.1 Basic abstract syntax 52
4.4.2 Transparent-msg- PDU 55
4.4.3 Token-PDU 55
4.4.4 Participation-req-PDU 56
4.4.5 Byte-block-read PDUs 56
4.4.6 Byte-block-write PDUs 56
4.4.7 Word-block-read PDUs 56
4.4.8 Word-block-write PDUs 57
4.4.9 Network-parameter-read PDUs 57
4.4.10 Network-parameter-write PDUs 57

4.4.11 Stop-command PDUs 57
4.4.12 Operation-command PDUs 58
4.4.13 Profile-read PDUs 58
4.4.14 Trigger-PDU 58
4.4.15 Log-data-read PDUs 58
4.4.16 Log-data-clear PDUs 59
4.4.17 Message-return PDUs 59
4.4.18 Vendor-specific-msg PDUs 59
4.4.19 Start-TK-hld-time-mrmt PDUs 60
4.4.20 Terminate-TK-hld-time-mrmt PDUs 60
4.4.21 Start-GP_Comm-sndr-log PDUs 60
4.4.22 Terminate-GP_Comm-sndr-log PDUs 60
4.4.23 Set-remote-node-config-para PDUs 61
4.4.24 Read-rmt-partici-node-mgt-info-para PDUs 61
4.4.25 Read-rmt- node-mgt-info-para PDUs 61
4.4.26 Read-rmt-node-set-info-para PDUs 61
4.4.27 Reset-node PDUs 62
4.4.28 Cyclic-data PDUs 62
4.4.29 Extended-prticiption-req-PDU 62
4.4.30 Extended-network-parameter-read PDUs 63
4.4.31 Extended-network-parameter-write PDUs 63
4.5 Data type assignments 63
5 Transfer syntax 65
5.1 Encoding rules 65
5.1.1 Basic encoding 65
5.1.2 Fixed length Unsigned encoding 65
5.1.3 Fixed length BitString encoding 65
5.1.4 OctetString encoding 65
5.1.5 SEQUENCE encoding 65
5.2 PDU elements encoding 65
5.2.1 FALARHeader 65
5.2.2 Transparent-msg PDU 69
5.2.3 Token-PDU 70
5.2.4 Participation-req-PDU 71
5.2.5 Byte-block-read PDUs 72
5.2.6 Byte-block-write PDUs 74
5.2.7 Word-block-read PDUs 75
5.2.8 Word-block-write PDUs 77
5.2.9 Network-parameter-read PDUs 79
5.2.10 Network-parameter-write PDUs 83
5.2.11 Stop-command PDUs 85
5.2.12 Operation-command PDUs 87
5.2.13 Profile-read PDUs 89
5.2.14 Trigger-PDU 92
5.2.15 Log-data-read PDUs 92
5.2.16 Log-data-clear PDUs 98
5.2.17 Message-return PDUs 100
5.2.18 Vendor-specific-msg PDUs 102
5.2.19 Start-TK-hld-time-mrmt PDUs 105

5.2.20 Terminate-TK-hld-time-mrmt PDUs 106
5.2.21 Start-GP_Comm-sndr-log PDUs 110
5.2.22 Terminate-GP_Comm-sndr-log PDUs 111
5.2.23 Set-remote-node-config-para PDUs 114
5.2.24 Read-rmt-partici-node-mgt-info-para PDUs 117
5.2.25 Read-rmt- node-mgt-info-para PDUs 120
5.2.26 Read-rmt-node-set-info-para PDUs 123
5.2.27 Reset-node PDUs 125
5.2.28 Cyclic-data PDUs 126
5.2.29 Extended-participation-request PDU 129
5.2.30 Extended-network-parameter-read PDUs 129
5.2.31 Extended-network-parameter-write PDUs 132
6 FAL protocol state machines structure 135
6.1 Overview 135
6.2 Common variables, parameters, timers, counters, lists and queues 136
6.2.1 V(3CWT), P(3CWT), T(3CWT): Three-lap-time-period-of-the-token-circulation 136
6.2.2 V(ACK): ACK received 136
6.2.3 V(ACK_TN): ACK to this node 137
6.2.4 V(AWT), P(AWT), T(AWT): Waiting-time-period-for-receiving-message-acknowledge 137
6.2.5 V(CBN): Current fragment number for fragmented cyclic-data transmission 137
6.2.6 V(CTFG): Cyclic-data fragment transfer 137
6.2.7 V(CTRen), P (CTRen): Cyclic-data on CM1 and CM2 receive enable 137
6.2.8 V(CTRQ): Cyclic-data transfer request 137
6.2.9 V(ExCTRQ): Cyclic-data of CM3 transfer request 138
6.2.10 C(ExCT): Cumulative count of extended-cyclic-data transmission 138
6.2.11 V(ExCTRen), P(ExCTRen): Cyclic-data on CM3 receive enable 138
6.2.12 V(ExTBN), P(ExTBN): Total fragment number of Cyclic-data on CM3 138
6.2.13 V(ExTSZ), P(ExTSZ): Total cyclic-data size on CM3 138
6.2.14 C(MCNT): Cumulative count of message transmission carried over 138
6.2.15 V(MCV): Message transmission carried over 138
6.2.16 V(MFT), P(MFT), T(MFT): Allowable-minimum-frame-interval-time 138
6.2.17 V(MmtCntType): Measurement control type 139
6.2.18 V(MRVRQ): Message receive request 139
6.2.19 V(MSRQ): Message transfer request 139
6.2.20 Q(MSRXQ): Message-RX-Queue 139
6.2.21 Q(MTXQ): Message-TX-Queue 139
6.2.22 V(NMTP): No message transmission in previous cycle 139
6.2.23 V(PAT), P(PAT), T(PAT): Participation-request-frame-acceptance-time 140
6.2.24 V(PnMgtIF): Participation-node-management-information List 140
6.2.25 V(PWT), T(PWT): Participation-request-frame-transmission-waiting-time 140
6.2.26 V(RCT): Allowable-refresh-cycle-time 140
6.2.27 V(RMT), T(RMT): Refresh-cycle-measurement-time 140
6.2.28 C(RTX): Retransmission count 141
6.2.29 V(SEQ): Sequence number value List 141
6.2.30 V(SN): Successor node 141
6.2.31 V(SrtMmt): Measurement started 141

6.2.32 Q(SVRXQ): Server-RX Queue 141
6.2.33 Q(SVTXQ): Server-TX Queue 141
6.2.34 V(TBN), P(TBN): Total fragment number of Cyclic-data on CM1 and CM2 141
6.2.35 V(TDT), P(TDT), T(TDT): Joining-token-detection-time 141
6.2.36 V(THT), P(THT), T(THT): Token-holding-time 142
6.2.37 V(TK): Token holding 142
6.2.38 V(TKH): Token holding node 142
6.2.39 V(TN): Node identifier number 142
6.2.40 V(TrWT), T(TrWT): Trigger-frame-transmission-waiting-time 142
6.2.41 V(TSZ), P(TSZ): Total cyclic-data size on CM1 and CM2 142
6.2.42 V(TW), P(TW), T(TW)( ): Token-watchdog-time 142
6.2.43 V(VSEQ): Version of sequence number value List 142
6.3 Functions used in state tables 143
7 FAL service protocol machine (FSPM) 146
7.1 Overview 146
7.2 Cyclic-data protocol machine 146
7.2.1 Overview 146
7.2.2 Cyclic-data primitives between FAL user and FSPM 146
7.2.3 State table 147
7.3 Message data protocol machine 149
7.3.1 Overview 149
7.3.2 Message-data primitive between FAL user and FSPM 149
7.3.3 State table 153
7.4 Load measurement protocol machine 163
7.4.1 Overview 163
7.4.2 Load measurement primitives between FAL user and FSPM 163
7.4.3 State table 164
7.5 General purpose communication server protocol machine 168
7.5.1 Overview 168
7.5.2 GP command server primitives between FAL user and FSPM 168
7.5.3 State table 168
7.6 Network management protocol machine 170
7.6.1 Overview 170
7.6.2 Network management primitives 170
7.6.3 State table 171
8 Application relationship protocol machine (ARPM) 174
8.1 Overview 174
8.2 Cyclic-TX/RX control 175
8.2.1 Overview 175
8.2.2 Cyclic-TX/RX control primitives between FSPM and ARPM 175
8.2.3 State table 176
8.3 Message-TX/RX control 176
8.3.1 Overview 176
8.3.2 Message-TX/RX control primitives between FSPM and ARPM 176
8.3.3 State table 177
8.4 Command server TX/RX control 177
8.4.1 Overview 177
8.4.2 Command server TX/RX primitives between FSPM and ARPM 178

8.4.3 State table 178
8.5 AR control 178
8.5.1 Overview 178
8.5.2 AR control primitives between FSPM and ARPM 179
8.5.3 State table 179
9 DLL mapping protocol machine (DMPM) 202
9.1 Overview 202
9.2 Mapping of DMPM service primitives and DLL service primitives 202
9.3 Mapping DMPM service port to DLSAP 204
9.4 Mapping of Network address to each node 204
Bibliography 206

Figure 1 – Bit identification in an octet 26
Figure 2 – Bit identification in multiple octets (four-octet case) 27
Figure 3 – Data sharing with the CM 28
Figure 4 – Protocol stack for Type 26 fieldbus 29
Figure 5 – The structure of ASEs for Type 26 FAL 30
Figure 6 – A token circulation on a logical ring 32
Figure 7 – Logical ring recovery 34
Figure 8 – An example in case of start simultaneously with another node 36
Figure 9 – Start alone case 37
Figure 10 – Node addition: in-ring start-up state 38
Figure 11 – Data sharing with the CM 40
Figure 12 – Configuration of the Common-memory 41
Figure 13 – Example of train of multiple extended-cyclic-data frames 42
Figure 14 – APDUs of cyclic-data frames containing fragmented data 43
Figure 15 – Example of sequential diagram of ACK over UDP channel 46
Figure 16 – Delivery confirmation checked by TCP protocol 47
Figure 17 – Train of data frames and a token frame 49
Figure 18 – Frame structure 50
Figure 19 – Structure of Trans-msgData 70
Figure 20 – Structure of B_Blk_Rd_rspData with M_RLT = 0 73
Figure 21 – Structure of B_Blk_Rd_rspData in case of M_RLT = 1 73
Figure 22 – Structure of B_Blk_Wt_reqDat 75
Figure 23 – Structure of B_Blk_Wt_rspData in case of M_RLT = 1 75
Figure 24 – Structure of W_Blk_Rd_rspData with M_RLT = 0 77
Figure 25 – Structure of W_Blk_Rd_rspData in case of M_RLT = 1 77
Figure 26 – Structure of W_Blk_Wt_reqDat 79
Figure 27 – Structure of W_Blk_Wt_rspData in case of M_RLT = 1 79
Figure 28 – Structure of Net-para-Rd-rspData with M_RLT = 0 81
Figure 29 – Structure of Net-para-Rd-rspData with M_RLT = 1 82
Figure 30 – Structure of Net-para-Wrt-reqData 84
Figure 31 – Structure of Net-para-Wrt-rspData with M_RLT = 1 85
Figure 32 – Structure of Stop-cmdData with M_RLT = 1 87

Figure 33 – Structure of Op-cmdData with M_RLT = 1 88
Figure 34 – Structure of Profile-readData with M_RLT = 0 90
Figure 35 – Structure of Profile-readData with M_RLT = 1 92
Figure 36 – Structure of Log-readData with M_RLT = 0 94
Figure 37 – Structure of Log-readData with M_RLT = 1 98
Figure 38 – Structure of Log-clearData 99
Figure 39 – Structure of Msg-return-reqData 101
Figure 40 – Structure of Msg-return-rspData 102
Figure 41 – Structure of V_msg_reqData 104
Figure 42 – Structure of V_msg_rspData in case of M_RLT = 0 104
Figure 43 – Structure of V_msg_rspData in case of M_RLT = 1 105
Figure 44 – Token-holding-time measurement result 109
Figure 45 – Structure of Sndr-logData 114
Figure 46 – Structure of Set-remote-node-config-para-ReqData 116
Figure 47 – Structure of Set-remote-node-config-para-RspData 117
Figure 48 – Structure of Read-rmt-partici-node-mgt-info-ReqData 119
Figure 49 – Structure of Read-rmt-partici-node-mgt-info-RspData 119
Figure 50 – Structure of Rmt-node-mgt-info-paraData 122
Figure 51 – Structure of Set-info-para-read-data 124
Figure 52 – Structure of ACKdata 128
Figure 53 – Structure of Ex-Net-para-Rd-rspData with M_RLT = 0 131
Figure 54 – Structure of Ex-Net-para-Rd-rspData with M_RLT = 1 132
Figure 55 – Structure of Ex-Net-para-Wrt-reqData 134
Figure 56 – Structure of Ex-Net-para-Wrt-rspData with M_RLT = 1 135
Figure 57 – Relationship between FAL protocol machines 136
Figure 58 – Overall structure of FSPM 146
Figure 59 – State transition diagram of Cyclic-data protocol machine 147
Figure 60 – State transition diagram of Message-data protocol machine 154
Figure 61 – State transition diagram of Load measurement protocol machine 164
Figure 62 – State transition diagram of GP-command-server protocol machine 169
Figure 63 – State transition diagram of Network management protocol machine 172
Figure 64 – Overall structure of ARPM 175
Figure 65 – State transition diagram of Cyclic-TX/RX control 176
Figure 66 – State transition diagram of Message-TX/RX control 177
Figure 67 – State transition diagram of Command server TX/RX protocol machine 178
Figure 68 – Overall state transition diagram of AR control protocol machine 180
Figure 69 – State transition diagram for message-data transmission 196
Figure 70 – State transition diagram for ACK creation and message-data reception 199
Figure 71 – Overall structure of DMPM 202
Figure 72 – DLSAP mapping 204
Figure 73 – Structure of IP address 205

Table 1 – Conventions used for state machines 25

Table 2 – Conventions used in state machine 25
Table 3 – Available functions to message-data transfer on UDP channel 44
Table 4 – Data transmission frame and the TCD value 50
Table 5 – Upper layer operating condition matrix 67
Table 6 – Transparent-msg-PDU specific values 70
Table 7 – Token-PDU specific values 71
Table 8 – Participation-req -PDU specific values 71
Table 9 – Byte-block-read-req-PDU specific values 72
Table 10 – Byte-block-read-rsp-PDU specific values 72
Table 11 – Byte-block-write-req-PDU specific values 74
Table 12 – Byte-block-write-rsp-PDU specific values 74
Table 13 – Word-block-read-req-PDU specific values 76
Table 14 – Word-block-read-rsp-PDU specific values 76
Table 15 – Word-block-write-req-PDU specific values 78
Table 16 – Word-block-write-rsp-PDU specific values 78
Table 17 – Network-parameter-read-req-PDU specific values 80
Table 18 – Network-parameter-read-rsp-PDU specific values 80
Table 19 – Values of data elements of Net-para-Rd-rspData 82
Table 20 – Network-parameter-write-req-PDU specific values 83
Table 21 – Network-parameter-write-rsp-PDU specific values 83
Table 22 – Values of the data elements of Net-para-Wrt-reqData 84
Table 23 – Stop-command-req-PDU specific values 85
Table 24 – Stop-command-rsp-PDU specific values 86
Table 25 – Operation-command-req-PDU specific values 87
Table 26 – Operation-command-rsp-PDU specific values 88
Table 27 – Profile-read-req-PDU specific values 89
Table 28 – Profile-read-rsp-PDU specific values 90
Table 29 – Trigger-PDU specific values 92
Table 30 – Log-data-read-req-PDU U specific values 93
Table 31 – Log-data-read-rsp-PDU specific values 93
Table 32 – Contents of Log-readData 94
Table 33 – Log-data-clear-req-PDU specific values 98
Table 34 – Log-data-clear-rsp-PDU specific values 99
Table 35 – Message-return-req-PDU specific values 100
Table 36 – Message-return-rsp-PDU specific values 100
Table 37 – Vendor-specific-msg-req-PDU specific values 102
Table 38 – Vendor-specific-msg-rsp-PDU specific values 103
Table 39 – Start-TK-hld-time-mrmt-req-PDU specific values 105
Table 40 – Start-TK-hld-time-mrmt-rsp-PDU specific values 106
Table 41 – Terminate-TK-hld-time-mrmt-req-PDU specific values 107
Table 42 – Terminate-TK-hld-time-mrmt-rsp-PDU specific values 108
Table 43 – Value of the data element of TK-hld-timeData 109
Table 44 – Start-GP_Comm-sndr-log-req-PDU specific values 110

Table 45 – Start-GP_Comm-sndr-log-rsp-PDU specific values 111
Table 46 – Terminate-GP_Comm-sndr-log-req-PDU specific values 112
Table 47 – Terminate-GP_Comm-sndr-log-req-PDU specific values 113
Table 48 – Value of the data element of Sndr-logData 114
Table 49 – Set-remote-node-config-para-req-PDU specific values 115
Table 50 – Set-remote-node-config-para-rsp-PDU specific values 115
Table 51 – Value of the data element of Set-remote-node-config-para-ReqData 116
Table 52 – Bit definition of Update flag 117
Table 53 – Value of the data element of Set-remote-node-config-para-RspData 117
Table 54 – Read-rmt-partici-node-mgt-info-para-req-PDU specific values 118
Table 55 – Read-rmt-partici-node-mgt-info-para-rsp-PDU specific values 118
Table 56 – Value of the data element of Read-rmt-partici-node-mgt-info-RspData 120
Table 57 – Read-rmt- node-mgt-info-para-req-PDU specific values 120
Table 58 – Read-rmt- node-mgt-info-para-rsp-PDU specific values 121
Table 59 – Value of the data element of Rmt-node-mgt-info-paraData 122
Table 60 – Bit definition of Node status 123
Table 61 – Read-rmt-node-set-info-para-req-PDU specific values 123
Table 62 – Read-rmt-node-set-info-para-rsp-PDU specific values 124
Table 63 – Value of the data element of Set-info-para-read-data 125
Table 64 – Rest-node-req-PDU specific values 125
Table 65 – Rest-node-rsp-PDU specific values 126
Table 66 – Cyclic-data-w/wo-ACK-PDU specific values 126
Table 67 – Extended-cyclic-data-PDU specific values 127
Table 68 – Value of the element of ACKdata 128
Table 69 – Value of R_STSx field 128
Table 70 – Extended-participation-req-PDU specific values 129
Table 71 – Extended-network-parameter-read-req-PDU specific values 130
Table 72 – Extended-network-parameter-read-rsp-PDU specific values 131
Table 73 – Values of data elements of Ex-Net-para-Rd-rspData 131
Table 74 – Ex-network-parameter-write-req-PDU specific values 133
Table 75 – Ex-network-parameter-write-rsp-PDU specific values 134
Table 76 – Values of data elements of Ex-Net-para-Wrt-reqData 135
Table 77 – Value of R_STSx field 137
Table 78 – Functions used in state tables 143
Table 79 – Cyclic-data primitives between FAL user and FSPM 147
Table 80 – State table of Cyclic-data protocol machine 148
Table 81 – Message-data primitives between FAL user and FSPM 150
Table 82 – State table of Message-data protocol machine 154
Table 83 – Load measurement primitives between FAL user and FSPM 163
Table 84 – State table of Load measurement protocol machine 164
Table 85 – GP command server primitives between FAL user and FSPM 168
Table 86 – State table of General purpose command server protocol machine 169
Table 87 – Primitives used in network management protocol machine 170

Table 88 – State table of Network management protocol machine 172
Table 89 – Cyclic-TX/RX control primitives between FSPM and ARPM 175
Table 90 – State table of Cyclic-TX/RX control 176
Table 91 – Message-TX/RX control primitives between FSPM and ARPM 177
Table 92 – State table of Message-TX/RX control 177
Table 93 – Command server TX/RX primitives between FSPM and ARPM 178
Table 94 – State table of Command server TX/RX protocol machine 178
Table 95 – AR control primitives between FSPM and ARPM 179
Table 96 – Overall AR control state table 181
Table 97 – State table for message-data transmission 196
Table 98 – State table for ACK creation and message-data reception 200
Table 99 – Mapping of DMPM primitives and DLL service primitives 203
Table 100 – Supposed Transport service primitives 203
Table 101 – Mapping of output and input ports to DL-SAP 204

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-26: Application layer protocol specification – Type 26 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 the IEC 61784-1 series and the IEC 61784-2 series.

IEC 61158-6-26 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This second edition cancels and replaces the first edition published in 2019. This edition constitutes a technical revision.

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

a) expand Common-memory-area as a new Common-memory-area-3 (CM3);
b) add new protocol elements with expansion of Common-memory-area:
   – Extended-cyclic-data transfer element;
   – Extended-participation-request element;
   – Extended-network-parameter-read element;
   – Extended-network-parameter-write element.

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

Draft	Report on voting
65C/1204/FDIS	65C/1245/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 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.

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

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-26: Application layer protocol specification – Type 26 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 part of IEC 61158 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 26 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 document defines in an abstract way the externally visible behavior provided by the Type 26 of the fieldbus Application Layer in terms of:

- the abstract syntax defining the application layer protocol data units conveyed between communicating application entities;
- the transfer syntax defining the application layer protocol data units conveyed between communicating application entities;
- the application context state machine defining the application service behavior visible between communicating application entities; and
- the application relationship state machines defining the communication behavior visible between communicating application entities.

The purpose of this document is to define the protocol provided to:

- define the wire-representation of the service primitives defined in IEC 61158-5-26, and
- define the externally visible behavior associated with their transfer.

This document specifies the protocol of the Type 26 fieldbus Application Layer, in conformance to the OSI Basic Reference Model (see ISO/IEC 7498-1) and the OSI Application Layer Structure (see ISO/IEC 9545).

FAL services and protocols are provided by FAL application-entities (AE) contained within the application processes. The FAL AE is composed of a set of object-oriented Application Service Elements (ASEs) and a Layer Management Entity (LME) that manages the AE. The ASEs provide communication services that operate on a set of related application process object (APO) classes. One of the FAL ASEs is a management ASE that provides a common set of services for the management of the instances of FAL classes.

Although these services specify, from the perspective of applications, how request and responses are issued and delivered, they do not include a specification of what the requesting and responding applications are to do with them. That is, the behavioral aspects of the applications are not specified; only a definition of what requests and responses they can send/receive is specified. This permits greater flexibility to the FAL users in standardizing such object behavior. In addition to these services, some supporting services are also defined in this document to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this document is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-26.

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 subparts of the IEC 61158-6 series.

1.3 Conformance

This document does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems.

There is no conformance of equipment to the application layer service definition standard. Instead, conformance is achieved through implementation of this application layer protocol specification.

2 Normative references

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

NOTE All parts of the IEC 61158 series, as well as the IEC 61784-1 series and the IEC 61784-2 series are maintained simultaneously. Cross-references to these documents within the text therefore refer to the editions as dated in this list of normative references.

IEC 61158-5-26:2023, *Industrial communication networks – Fieldbus specification – Part 5-26: Application layer service definition – Type 26 elements*

IEC 61784-2-21:2023, *Industrial networks – Profiles – Part 2-21: Additional real-time fieldbus profiles based on ISO/IEC/IEEE 8802-3 – CPF 21*

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

ISO/IEC/IEEE 8802-3, *Telecommunications and exchange between information technology systems − Requirements for local and metropolitan area networks − Part 3: Standard for Ethernet*

ISO/IEC 8822, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824-1, *Information technology – Abstract Syntax Notation One (ASN.1) – Part 1: Specification of basic notation*

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 9899, *Information technology – Programming languages – C*

IETF RFC 768, J. Postel, *User Datagram Protocol*, August 1980, available at https://www.rfc-editor.org/info/rfc768 [viewed 2022-02-18]

IETF RFC 791, J. Postel, *Internet Protocol*, September 1981, available at https://www.rfc-editor.org/info/rfc791 [viewed 2022-02-18]

IETF RFC 792, J. Postel, *Internet Control Message Protocol*, September 1981, available at https://www.rfc-editor.org/info/rfc792 [viewed 2022-02-18]

IETF RFC 793, J. Postel, *Transmission Control Protocol*, September 1981, available at https://www.rfc-editor.org/info/rfc793 [viewed 2022-02-18]

IETF RFC 796, J. Postel, *Address mappings,* September 1981, available at https://www.rfc-editor.org/info/rfc796 [viewed 2022-02-18]

IETF RFC 826, D. Plummer, *An Ethernet Address Resolution Protocol: Or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware*, November 1982, available at https://www.rfc-editor.org/info/rfc826 [viewed 2022-02-18]

IETF RFC 894, C. Hornig, *A Standard for the Transmission of IP Datagrams over Ethernet*, April 1984, available at https://www.rfc-editor.org/info/rfc894 [viewed 2022-02-18]

IETF RFC 919, J.C. Mogul, *Broadcasting Internet Datagrams*, October 1984, available at https://www.rfc-editor.org/info/rfc919 [viewed 2022-02-18]

IETF RFC 922, J.C. Mogul, *Broadcasting Internet datagrams in the presence of subnets*, October 1984, available at https://www.rfc-editor.org/info/rfc922 [viewed 2022-02-18]

IETF RFC 950, J.C. Mogul and J. Postel, *Internet Standard Subnetting Procedure*, August 1985, available at https://www.rfc-editor.org/info/rfc950 [viewed 2022-02-18]