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Part 3:
Data Link Service definition

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CONTENTS

FOREWORD ....................................................................................................................... 16
INTRODUCTION .................................................................................................................. 18

Clause

1 Scope and object ........................................................................................................... 19
   1.1 Specifications ....................................................................................................... 20
   1.2 Conformance ........................................................................................................ 20

2 Normative references ..................................................................................................... 21
   2.1 Common normative references.............................................................................. 21
   2.2 Type 1: additional normative references ............................................................... 21
   2.3 Type 2: additional normative references ............................................................... 21
   2.4 Type 3: additional normative references ............................................................... 21
   2.5 Type 4: additional normative references ............................................................... 21
   2.6 Type 6: additional normative references ............................................................... 21
   2.7 Type 7: additional normative references ............................................................... 22
   2.8 Type 8: additional normative references ............................................................... 22

3 Definitions................................................................................................................... ... 23
   3.1 Reference model definitions .................................................................................. 23
   3.2 Service convention definitions ............................................................................... 25
   3.3 Common Data Link Service definitions .................................................................. 26
   3.4 Type 1: additional Data Link Service definitions .................................................... 28
   3.5 Type 2: additional Data Link Service definitions .................................................... 30
   3.6 Type 3: additional Data Link Service definitions .................................................... 32
   3.7 Type 4: additional Data Link Service definitions .................................................... 33
   3.8 Type 6: additional Data Link Service definitions .................................................... 34
   3.9 Type 7: additional Data Link Service definitions .................................................... 43
   3.10 Type 8: additional Data Link Service definitions .................................................... 46

4 Symbols and abbreviations ............................................................................................. 47
   4.1 Common symbols and abbreviations ..................................................................... 47
   4.2 Type 1: additional symbols and abbreviations ....................................................... 47
   4.3 Type 2: additional symbols and abbreviations ....................................................... 47
   4.4 Type 3: additional symbols and abbreviations ....................................................... 48
   4.5 Type 4: additional symbols and abbreviations ....................................................... 51
   4.6 Type 6: additional symbols and abbreviations ....................................................... 51
   4.7 Type 7: additional symbols and abbreviations ....................................................... 51
   4.8 Type 8: additional symbols and abbreviations ....................................................... 52

5 Conventions ................................................................................................................... 53
   5.1 General conventions ............................................................................................. 53
   5.2 Type 1: additional conventions ............................................................................. 54
   5.3 Type 2: additional conventions ............................................................................. 55
   5.4 Type 3: additional conventions ............................................................................. 55
   5.5 Type 4: additional conventions ............................................................................. 55
   5.6 Type 6: additional conventions ............................................................................. 55
   5.7 Type 7: additional conventions ............................................................................. 56
   5.8 Type 8: additional conventions ............................................................................. 56

6 Type 1: Overview of the Data Link Service .................................................................... 57
   6.2 Types and classes of Data Link Service. ................................................................. 60
   6.3 Quality of Service (QoS) attributes common to multiple types of Data Link Service. 60
7 Type 1: DL(SAP)-address, queue and buffer management Data Link Service ................. 66
   7.1 Facilities of the DL(SAP)-address, queue and buffer management Data Link Service ... 66
   7.2 Model of the DL(SAP)-address, queue and buffer management Data Link Service . 66
   7.3 Sequence of primitives at one DLSAP ................................................................. 66
   7.4 DL(SAP)-address, queue and buffer management facilities .................................. 68
   7.5 Type 1: facilities of the connection-mode Data Link Service ................................ 83
8 Type 1: Connection-mode Data Link Service .............................................................. 85
   8.1 Model of the connection-mode Data Link Service .................................................. 85
   8.2 Quality of connection-mode service ..................................................................... 92
   8.3 Sequence of primitives .......................................................................................... 98
   8.4 Connection establishment phase ......................................................................... 109
   8.5 Connection release phase ................................................................................... 116
   8.6 Data transfer phase ............................................................................................. 123
9 Type 1: Connectionless-mode Data Link Service ......................................................... 136
   9.1 Facilities of the connectionless-mode Data Link Service ....................................... 136
   9.2 Model of the connectionless-mode Data Link Service ........................................... 136
   9.3 Quality of connectionless-mode service ............................................................. 138
   9.4 Sequence of primitives ........................................................................................ 139
   9.5 Connectionless-mode functions ......................................................................... 141
10 Type 1: Time and scheduling guidance Data Link Service ........................................ 153
   10.1 Facilities and classes of the time and scheduling guidance Data Link Service ....... 153
   10.2 Model of the time and scheduling guidance Data Link Service ............................. 154
   10.3 Quality of scheduling guidance service .............................................................. 154
   10.4 Sequence of primitives at one DLE .................................................................... 154
   10.5 Scheduling guidance functions ........................................................................... 156
11 Types 1 and 4: DL-management Service ................................................................. 167
   11.1 Scope and inheritance ......................................................................................... 167
   11.2 Facilities of the DL-management service .......................................................... 167
   11.3 Model of the DL-management service ............................................................... 167
   11.4 Constraints on sequence of primitives .............................................................. 167
   11.5 Set ....................................................................................................................... 168
   11.6 Get ...................................................................................................................... 169
   11.7 Action ................................................................................................................ 169
   11.8 Event .................................................................................................................. 171
12 Type 2: Connection-mode and connectionless-mode Data Link Service ................. 172
   12.1 Overview ............................................................................................................ 172
   12.2 Facilities of the Data Link Service ....................................................................... 175
   12.3 Model of the Data Link Service ......................................................................... 176
   12.4 Sequence of primitives ...................................................................................... 178
   12.5 Connection-mode data transfer ......................................................................... 180
   12.6 Connectionless-mode data transfer .................................................................... 182
   12.7 Queue maintenance ............................................................................................ 185
   12.8 Tag filter ............................................................................................................. 187
13 Type 2: DL-management Services ............................................................................ 189
   13.1 Sequence of primitives ....................................................................................... 189
   13.2 Link synchronization ......................................................................................... 190
   13.3 Synchronized parameter change ....................................................................... 190
   13.4 Event reports ..................................................................................................... 193
   13.5 Bad FCS ............................................................................................................. 195
   13.6 Current Moderator ............................................................................................. 195
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.7</td>
<td>Enable moderator</td>
<td>196</td>
</tr>
<tr>
<td>13.8</td>
<td>Power-up and online</td>
<td>197</td>
</tr>
<tr>
<td>13.9</td>
<td>Listen only</td>
<td>198</td>
</tr>
<tr>
<td>13.10</td>
<td>Time distribution</td>
<td>198</td>
</tr>
<tr>
<td>14</td>
<td>Type 3: Connectionless-mode Data Link Service</td>
<td>201</td>
</tr>
<tr>
<td>14.1</td>
<td>General</td>
<td>201</td>
</tr>
<tr>
<td>14.2</td>
<td>Model of the connectionless-mode Data Link Service</td>
<td>201</td>
</tr>
<tr>
<td>14.3</td>
<td>Sequence of primitives</td>
<td>203</td>
</tr>
<tr>
<td>14.4</td>
<td>Connectionless-mode functions</td>
<td>207</td>
</tr>
<tr>
<td>15</td>
<td>Type 3: DL-management service</td>
<td>223</td>
</tr>
<tr>
<td>15.1</td>
<td>General</td>
<td>223</td>
</tr>
<tr>
<td>15.2</td>
<td>Facilities of the DLMS</td>
<td>223</td>
</tr>
<tr>
<td>15.3</td>
<td>Overview of services</td>
<td>223</td>
</tr>
<tr>
<td>15.4</td>
<td>Overview of interactions</td>
<td>224</td>
</tr>
<tr>
<td>15.5</td>
<td>Detailed specification of services and interactions</td>
<td>226</td>
</tr>
<tr>
<td>16</td>
<td>Type 4: Data Link Service and concepts</td>
<td>246</td>
</tr>
<tr>
<td>16.1</td>
<td>Overview</td>
<td>246</td>
</tr>
<tr>
<td>16.2</td>
<td>Types and classes of Data Link Service</td>
<td>247</td>
</tr>
<tr>
<td>16.3</td>
<td>Functional classes</td>
<td>247</td>
</tr>
<tr>
<td>16.4</td>
<td>Facilities of the connectionless-mode Data Link Service</td>
<td>247</td>
</tr>
<tr>
<td>16.5</td>
<td>Model of the connectionless-mode Data Link Service</td>
<td>247</td>
</tr>
<tr>
<td>16.6</td>
<td>Sequence of primitives</td>
<td>248</td>
</tr>
<tr>
<td>16.7</td>
<td>Connectionless-mode data transfer functions</td>
<td>250</td>
</tr>
<tr>
<td>17</td>
<td>Type 6: Data Link Service — concepts and models</td>
<td>253</td>
</tr>
<tr>
<td>17.2</td>
<td>QoS - Quality of Service</td>
<td>266</td>
</tr>
<tr>
<td>18</td>
<td>Type 7: Data Link services and concepts</td>
<td>276</td>
</tr>
<tr>
<td>18.1</td>
<td>Overview</td>
<td>276</td>
</tr>
<tr>
<td>18.2</td>
<td>Field of application, object</td>
<td>276</td>
</tr>
<tr>
<td>18.3</td>
<td>General description of services</td>
<td>276</td>
</tr>
<tr>
<td>18.4</td>
<td>Sequence of primitives</td>
<td>281</td>
</tr>
<tr>
<td>18.5</td>
<td>Buffer writing</td>
<td>282</td>
</tr>
<tr>
<td>18.6</td>
<td>Buffer reading</td>
<td>284</td>
</tr>
<tr>
<td>18.7</td>
<td>Buffer transfer</td>
<td>285</td>
</tr>
<tr>
<td>18.8</td>
<td>Explicit request for buffer transfer</td>
<td>287</td>
</tr>
<tr>
<td>18.9</td>
<td>Unacknowledged message transfer</td>
<td>291</td>
</tr>
<tr>
<td>18.10</td>
<td>Acknowledged Message transfer</td>
<td>293</td>
</tr>
<tr>
<td>19</td>
<td>Type 8: Data Link Service and concepts</td>
<td>296</td>
</tr>
<tr>
<td>19.1</td>
<td>Overview</td>
<td>296</td>
</tr>
<tr>
<td>19.2</td>
<td>Sequence of primitives</td>
<td>298</td>
</tr>
<tr>
<td>19.3</td>
<td>Connection-mode Data Link services</td>
<td>300</td>
</tr>
<tr>
<td>20</td>
<td>Type 8: DL-management Service</td>
<td>304</td>
</tr>
<tr>
<td>20.1</td>
<td>Scope</td>
<td>304</td>
</tr>
<tr>
<td>20.2</td>
<td>Facilities of the DL-management service</td>
<td>304</td>
</tr>
<tr>
<td>20.3</td>
<td>Overview of services</td>
<td>304</td>
</tr>
<tr>
<td>20.4</td>
<td>Overview of interactions</td>
<td>305</td>
</tr>
<tr>
<td>20.5</td>
<td>Detailed specification of services and interactions</td>
<td>307</td>
</tr>
</tbody>
</table>
Figures

Figure 1 – Relationship of IEC 61158-3 to other Fieldbus layers and to users of the Fieldbus Data Link Service 18
Figure 2 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses 27
Figure 3 – Relationships of DLCEPs and DLCEP-addresses to DLSAPs, DLSAP-addresses and group DL-addresses 29

Type 1

Figure 4 – Example of paths, links, bridges, and the extended link 58
Figure 5 – Types of DL-timeliness In terms of elapsed DL-time and events at the assessing DLCEP 64
Figure 6 – Sequence of primitives for the DL(SAP)-address, queue and buffer management DLS 68
Figure 7 – Supported methods of data management for transmission and delivery 69
Figure 8 – Peer-to-peer and multi-peer DLCs and their DLCEPs 84
Figure 9 – OSI abstract queue model of a peer DLC between a pair of DLS-users 86
Figure 10 – OSI abstract queue model of a multi-peer DLC between a publishing DLS-user and a set of subscribing DLS-users 89
Figure 11 – Summary of DL-connection-mode service primitive time-sequence diagrams for peer DLCs (portion 1) 103
Figure 12 – Summary of DL-connection-mode service primitive time-sequence diagrams for peer DLCs (portion 2) 104
Figure 13 – Summary of DL-connection-mode service primitive time-sequence diagrams for publishers of a multi-peer DLC (portion 1) 105
Figure 14 – Summary of DL-connection-mode service primitive time-sequence diagrams for publishers of a multi-peer DLC (portion 2) 106
Figure 15 – Summary of additional DL-connection-mode service primitive time-sequence diagrams for a multi-peer DLC subscriber where the diagrams differ from the corresponding ones for a publisher (portion 1) 107
Figure 16 – Summary of additional DL-connection-mode service primitive time-sequence diagrams for a multi-peer DLC subscriber where the diagrams differ from the corresponding ones for a publisher (portion 2) 108
Figure 17 – State transition diagram for sequences of DL-connection-mode service primitives at a DLCEP 109
Figure 18 – Peer DLC/DLCEP establishment initiated by a single DLS-user 115
Figure 19 – Multi-peer DLC/DLCEP establishment initiated by the Publishing DLS-user 115
Figure 20 – Multi-peer DLC/DLCEP establishment initiated by a Subscribing DLS-user 115
Figure 21 – Multi-peer DLC/DLCEP establishment using known DLCEP addresses initiated first by the Publishing DLS-user 115
Figure 22 – Multi-peer DLC/DLCEP establishment using known DLCEP addresses initiated first by one or more Subscribing DLS-users 116
Figure 23 – Peer DLC/DLCEP establishment initiated simultaneously by both Peer DLS-users, resulting in a merged DLC

Figure 24 – Multi-peer DLC/DLCEP establishment initiated simultaneously by both Publishing and Subscribing DLS-users, resulting in a merged DLC

Figure 25 – Peer DLS-user invocation

Figure 26 – Publishing DLS-user invocation

Figure 27 – Subscribing DLS-user invocation

Figure 28 – Simultaneous invocation by both DLS-users

Figure 29 – Peer DLS-provider invocation

Figure 30 – Publishing DLS-provider invocation

Figure 31 – Subscribing DLS-provider invocation

Figure 32 – Simultaneous Peer DLS-user and DLS-provider invocations

Figure 33 – Simultaneous Publishing DLS-user and DLS-provider invocations

Figure 34 – Simultaneous Subscribing DLS-user and DLS-provider invocations

Figure 35 – Sequence of primitives in a Peer DLS-user rejection of a DLC/DLCEP establishment attempt

Figure 36 – Sequence of primitives in a Publishing DLS-user rejection of a DLC/DLCEP establishment attempt

Figure 37 – Sequence of primitives in a Subscribing DLS-user rejection of a DLC/DLCEP establishment attempt

Figure 38 – Sequence of primitives in a DLS-provider rejection of a DLC/DLCEP establishment attempt

Figure 39 – Sequence of primitives in a DLS-user cancellation of a DLC/DLCEP establishment attempt: both primitives are destroyed in the queue

Figure 40 – Sequence of primitives in a DLS-user cancellation of a DLC/DLCEP establishment attempt: DL-DISCONNECT indication arrives before DL-CONNECT response is sent

Figure 41 – Sequence of primitives in a DLS-user cancellation of a DLC/DLCEP establishment attempt: Peer DL-DISCONNECT indication arrives after DL-CONNECT response is sent

Figure 42 – Sequence of primitives in a DLS-user cancellation of a DLC/DLCEP establishment attempt: Publisher’s DL-DISCONNECT indication arrives after DL-CONNECT response is sent

Figure 43 – Sequence of primitives in a DLS-user cancellation of a DLC/DLCEP establishment attempt: Subscriber’s DL-DISCONNECT request arrives after DL-CONNECT request has been communicated to the Publisher

Figure 44 – Sequence of primitives for a Classical or Disordered peer-to-peer queue to queue data transfer

Figure 45 – Sequence of primitives for an Ordered or Unordered peer-to-peer, or an Unordered subscriber-to-publisher queue-to-queue data transfer

Figure 46 – Sequence of primitives for a publisher-to-subscribers queue to queue data transfer
Figure 47 – Sequence of primitives for a failed queue-to-queue data transfer

Figure 48 – Sequence of primitives for an Ordered or Unordered Peer to Peer, or an Unordered Subscriber to Publisher, buffer to buffer data transfer

Figure 49 – Sequence of primitives for a Publisher to Subscribers buffer to buffer data transfer

Figure 50 – Sequence of primitives for an Ordered or Unordered Peer to Peer, or an Unordered Subscriber to Publisher, buffer to queue data transfer

Figure 51 – Sequence of primitives for a Publisher to Subscribers buffer to queue data transfer

Figure 52 – Sequence of primitives in a Peer DLS-user initiated Reset

Figure 53 – Sequence of primitives in a Publishing DLS-user initiated Reset

Figure 54 – Sequence of primitives in a Subscribing DLS-user initiated Reset

Figure 55 – Sequence of primitives in a simultaneous Peer DLS-users initiated Reset

Figure 56 – Sequence of primitives in a simultaneous Multi-peer DLS-users initiated Reset

Figure 57 – Sequence of primitives in a Peer DLS-provider initiated Reset

Figure 58 – Sequence of primitives in a Publishing DLS-provider initiated Reset

Figure 59 – Sequence of primitives in a Subscribing DLS-provider initiated Reset

Figure 60 – Sequence of primitives in a simultaneous Peer DLS-user and DLS-provider initiated Reset

Figure 61 – Sequence of primitives in a simultaneous Publishing DLS-user and DLS-provider initiated Reset

Figure 62 – Sequence of primitives in a simultaneous Subscribing DLS-user and DLS-provider initiated Reset

Figure 63 – Sequence of primitives for Subscriber Query

Figure 64 – Model for a data-link connectionless-mode unitdata transmission or unitdata exchange

Figure 65 – Summary of DL-connectionless-mode service primitive time-sequence diagrams

Figure 66 – State transition diagram for sequences of connectionless-mode primitives at one DLSAP

Figure 67 – Sequence of primitives for a successful locally-acknowledged connectionless-mode unitdata transfer

Figure 68 – Sequence of primitives for a successful remotely-acknowledged connectionless-mode unitdata transfer

Figure 69 – Sequence of primitives for an unsuccessful connectionless-mode unitdata transfer

Figure 70 – Sequence of primitives for connectionless-mode unitdata exchange

Figure 71 – Sequence of primitives for connectionless-mode listener query
Figure 72 – Summary of time and scheduling-guidance service primitive time sequence diagrams 155
Figure 73 – Sequence of primitives for DL-time 157
Figure 74 – Sequence of primitives for the Compel Service service 160
Figure 75 – Sequence of primitives for the sequence scheduling services 164
  Type 1 and Type 4
Figure 76 – Sequence of primitives for the DLM action service 167
  Type 2
Figure 77 – NUT structure 173
Figure 78 – Medium access during scheduled time 173
Figure 79 – Medium access during unscheduled time 174
Figure 80 – Queue model for the peer and multi-peer DLS, DLSAPs and their DLCEPs 176
Figure 81 – Queue model of a multi-peer DLS between a sending DLS-user and one or more receiving DLS-users 177
Figure 82 – DLS primitive time-sequence diagram 179
Figure 83 – State transition diagram for sequences of DLS primitives at one DLSAP 180
Figure 84 – Sequence of primitives for a successful connection-mode transfer 182
Figure 85 – Sequence of primitives for an unsuccessful connection-mode transfer 182
Figure 86 – Sequence of primitives for a successful connectionless-mode transfer 185
Figure 87 – Sequence of primitives for an unsuccessful connectionless-mode transfer 185
Figure 88 – Sequence of primitives for a queue maintenance request 187
Figure 89 – Sequence of primitives for a tag filter request 188
Figure 90 – Sequence of primitives for a local link synchronization 190
Figure 91 – Sequence of primitives for a get/set parameters request 192
Figure 92 – Sequence of primitives for a tMinus change request 192
Figure 93 – Sequence of primitives for an event indication 194
Figure 94 – Sequence of primitives for a bad-FCS 195
Figure 95 – Sequence of primitives for a current moderator 196
Figure 96 – Sequence of primitives for enable moderator 196
Figure 97 – Sequence of primitives for DLM-online 197
Figure 98 – Sequence of primitives for DLM-power-up 197
Figure 99 – Sequence of primitives for listen only 198
Figure 100 – SDA service
Figure 101 – SDN service
Figure 102 – SRD service
Figure 103 – CSRD service
Figure 104 – Reset, Set Value, Read Value, Ident (local), DLSAP Status (local), DLSAP Activate, DLSAP Activate Responder, DLSAP Deactivate service
Figure 105 – Event service
Figure 106 – Ident (remote), DLSAP Status (remote), Live-list service

Figure 107– Relationship of PhE, DLE and DLS-users
Figure 108 – Confirmed and unconfirmed UNITDATA request time-sequence diagram
Figure 109– Repeated Confirmed request time-sequence diagram
Figure 110 – State transition diagram for sequences of primitives at one DLSAP

Figure 111 shows TDMA bus operation using slots and channels and the derivation of DLC-IDs for the DLCs.
Figure 112 – Fundamental Concepts - Slots, Channels, Scan Classes, Bus-Cycles and Bus Synchronization
Figure 113 shows the operation of the GPC channel class including the Channel-Direction-semaphore and DLS-user interaction and retries of lost DLPDUs.
Figure 114 shows the operation of the GPA channel class including the Channel-Direction-semaphore and DLS-user interaction and retries of lost DLPDUs.
Figure 115 shows the operation of the GPU channel class, including the Channel-Direction-semaphore and DLS-user interaction with no retries of lost DLPDUs.
Figure 116 show the operation of the SCAN and EXSCAN channel classes including the Channel-Direction-semaphore and DLS-user interaction
Figure 117 shows peer and multi-peer DLCs, their DLC identifiers and related DLCEP types
Figure 118 Relationships of DLSAPs, DLCEPs, DLEs and DLS-users. Also shows allowed classes of traffic from DLSAPs and DLCEPs
Figure 119 Connectionless DL-addresses and node Visible Identification
Figure 120 Functional DLSAP illustrates the operation of Individual and group DLSAP - addresses for Connectionless transfers
Figure 121 shows the roles played by various DLSAPs in peer and multi-peer DLCs.
Figure 122 shows Real and Virtual Topologies of an Extended Link and the identification of (local) Links within that Extended Link.
Figure 123 shows the operation of the Connectionless Service, including DLS-user interaction with no retries of lost DLPDUs.
Figure 124 Device illustrates the address-recognition of connectionless data transfers 274

Type 7

Figure 125 – General description of medium allocation 280
Figure 126 – Primitives associated with the buffer writing service 283
Figure 127 – Primitives associated with the buffer reading service 284
Figure 128 – Primitives associated with the buffer transfer service 286
Figure 129 – Primitives associated with the specified explicit request for a buffer transfer 288
Figure 130 – Primitives associated with the free explicit request for a buffer transfer 290
Figure 131 – Primitives associated with the unacknowledged message transfer request service 291
Figure 132 – Primitives associated with the acknowledged message transfer request service 293

Type 8

Figure 133 – Relationships of DLCEPs and DLCEP-addresses to default DLSAP 297
Figure 134 – Sequence of primitives for the buffer data transfer 299
Figure 135 – Normal data transfer service between a master and a slave 300
Figure 136 – Sequence of primitives for a failed normal data transfer 300
Figure 137 – Sequence of primitives for the reset service 306
Figure 138 – Sequence of primitives for the set value service 306
Figure 139 – Sequence of primitives for the read value service 306
Figure 140 – Sequence of primitives for the DLM Event service 306
Figure 141 – Sequence of primitives for the get current configuration service 307
Figure 142 – Sequence of primitives for the get active configuration service 307
Figure 143 – Sequence of primitives for the set active configuration service 307
## Tables

### Type 1

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Summary of DL(SAP)-address, queue and buffer management primitives and parameters</td>
<td>67</td>
</tr>
<tr>
<td>2</td>
<td>DL-buffer-and-queue-management Create primitive and parameters</td>
<td>69</td>
</tr>
<tr>
<td>3</td>
<td>DL-buffer-and-queue-management Delete primitive and parameters</td>
<td>72</td>
</tr>
<tr>
<td>4</td>
<td>DL(SAP)-address-management Bind primitive and parameters</td>
<td>74</td>
</tr>
<tr>
<td>5</td>
<td>DL(SAP)-role Constraints on DLSAPs, DLCEPs and other DLS Primitives</td>
<td>74</td>
</tr>
<tr>
<td>6</td>
<td>DL(SAP)-address-management Unbind primitive and parameters</td>
<td>78</td>
</tr>
<tr>
<td>7</td>
<td>DL-buffer-management Put primitive and parameters</td>
<td>79</td>
</tr>
<tr>
<td>8</td>
<td>DL-buffer-and-queue-management Get primitive and parameters</td>
<td>81</td>
</tr>
<tr>
<td>9</td>
<td>Relationships between abstract queue model objects</td>
<td>87</td>
</tr>
<tr>
<td>10</td>
<td>Attributes and class requirements of DLCEP data delivery features</td>
<td>94</td>
</tr>
<tr>
<td>11</td>
<td>Summary of DL-connection-mode primitives and parameters (portion 1)</td>
<td>100</td>
</tr>
<tr>
<td>12</td>
<td>Summary of DL-connection-mode primitives and parameters (portion 2)</td>
<td>101</td>
</tr>
<tr>
<td>13</td>
<td>DLC / DLCEP establishment primitives and parameters (portion 1)</td>
<td>110</td>
</tr>
<tr>
<td>14</td>
<td>DLC / DLCEP establishment primitives and parameters (portion 2)</td>
<td>111</td>
</tr>
<tr>
<td>15</td>
<td>DLC / DLCEP release primitives and parameters</td>
<td>117</td>
</tr>
<tr>
<td>16</td>
<td>Queue data transfer primitive and parameters</td>
<td>123</td>
</tr>
<tr>
<td>17</td>
<td>Buffer sent primitive and parameter</td>
<td>126</td>
</tr>
<tr>
<td>18</td>
<td>Buffer received primitive and parameter</td>
<td>126</td>
</tr>
<tr>
<td>19</td>
<td>DLC/DLCEP reset primitives and parameters (portion 1)</td>
<td>129</td>
</tr>
<tr>
<td>20</td>
<td>DLC/DLCEP reset primitives and parameters (portion 2)</td>
<td>129</td>
</tr>
<tr>
<td>21</td>
<td>Subscriber query primitives and parameters</td>
<td>134</td>
</tr>
<tr>
<td>22</td>
<td>Summary of DL-connectionless-mode primitives and parameters</td>
<td>139</td>
</tr>
<tr>
<td>23</td>
<td>DL-connectionless-mode unitdata transfer primitives and parameters</td>
<td>142</td>
</tr>
<tr>
<td>24</td>
<td>DL-connectionless-mode unitdata exchange primitive and parameters</td>
<td>146</td>
</tr>
<tr>
<td>25</td>
<td>Listener query primitives and parameters</td>
<td>151</td>
</tr>
<tr>
<td>26</td>
<td>Summary of DL-scheduling-guidance primitives and parameters</td>
<td>155</td>
</tr>
<tr>
<td>27</td>
<td>DL-time primitive and parameters</td>
<td>156</td>
</tr>
<tr>
<td>28</td>
<td>DL-scheduling-guidance Compel Service primitive and parameters</td>
<td>158</td>
</tr>
<tr>
<td>29</td>
<td>DL-scheduling-guidance Schedule Sequence primitives and parameters</td>
<td>161</td>
</tr>
<tr>
<td>Table</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Table 30</td>
<td>DL-scheduling-guidance Cancel Schedule primitives and parameters</td>
<td>164</td>
</tr>
<tr>
<td>Table 31</td>
<td>DL-scheduling-guidance Subset Sequence primitives and parameters</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td><strong>Type 1 and Type 4</strong></td>
<td></td>
</tr>
<tr>
<td>Table 32</td>
<td>Summary of DL-management primitives and parameters</td>
<td>168</td>
</tr>
<tr>
<td>Table 33</td>
<td>DLM-Set primitive and parameters</td>
<td>168</td>
</tr>
<tr>
<td>Table 34</td>
<td>DLM-Get primitive and parameters</td>
<td>169</td>
</tr>
<tr>
<td>Table 35</td>
<td>DLM-Action primitive and parameters</td>
<td>170</td>
</tr>
<tr>
<td>Table 36</td>
<td>DLM-Event primitive and parameters</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td><strong>Type 2</strong></td>
<td></td>
</tr>
<tr>
<td>Table 37</td>
<td>Summary of connection-mode and connectionless-mode primitives and parameters</td>
<td>179</td>
</tr>
<tr>
<td>Table 38</td>
<td>DL-connection-mode transfer primitives and parameters</td>
<td>181</td>
</tr>
<tr>
<td>Table 39</td>
<td>DL-connectionless-mode transfer primitives and parameters</td>
<td>183</td>
</tr>
<tr>
<td>Table 40</td>
<td>Fixed tag services available to the DLS-user</td>
<td>184</td>
</tr>
<tr>
<td>Table 41</td>
<td>DL-queue maintenance primitives and parameters</td>
<td>186</td>
</tr>
<tr>
<td>Table 42</td>
<td>DL-connectionless-mode tag filter primitives and parameters</td>
<td>187</td>
</tr>
<tr>
<td>Table 43</td>
<td>Summary of DL-management primitives and parameters</td>
<td>189</td>
</tr>
<tr>
<td>Table 44</td>
<td>DLM-link maintenance primitives and parameters</td>
<td>190</td>
</tr>
<tr>
<td>Table 45</td>
<td>Synchronized parameter change primitives and parameters</td>
<td>191</td>
</tr>
<tr>
<td>Table 46</td>
<td>DLMS configuration data</td>
<td>192</td>
</tr>
<tr>
<td>Table 47</td>
<td>Local link maintenance primitives and parameters</td>
<td>193</td>
</tr>
<tr>
<td>Table 48</td>
<td>DLS events being reported</td>
<td>194</td>
</tr>
<tr>
<td>Table 49</td>
<td>Bad-FCS primitives and parameters</td>
<td>195</td>
</tr>
<tr>
<td>Table 50</td>
<td>Local moderator primitives and parameters</td>
<td>195</td>
</tr>
<tr>
<td>Table 51</td>
<td>Enable moderator primitives and parameters</td>
<td>196</td>
</tr>
<tr>
<td>Table 52</td>
<td>Power-up primitives and parameters</td>
<td>197</td>
</tr>
<tr>
<td>Table 53</td>
<td>Listen only primitives and parameters</td>
<td>198</td>
</tr>
<tr>
<td>Table 54</td>
<td>DLMS time and time quality parameters</td>
<td>199</td>
</tr>
<tr>
<td>Table 55</td>
<td>Time distribution source quality</td>
<td>199</td>
</tr>
<tr>
<td></td>
<td><strong>Type 3</strong></td>
<td></td>
</tr>
<tr>
<td>Table 56</td>
<td>Summary of DL services and primitives</td>
<td>203</td>
</tr>
<tr>
<td>Table 57</td>
<td>SDA data ack primitives and parameters</td>
<td>208</td>
</tr>
<tr>
<td>Table 58</td>
<td>Values of DL-status for the SDA data ack service</td>
<td>210</td>
</tr>
<tr>
<td>Table 59</td>
<td>SDN data primitives and parameters</td>
<td>210</td>
</tr>
</tbody>
</table>
Table 60 – Values of DL-status for the SDN data service
Table 61 – SRD data reply primitives and parameters
Table 62 – Values of Update_status for the SRD data reply service
Table 63 – Additional values of DL-status for the SRD data reply service
Table 64 – SRD reply-update primitives and parameters
Table 65 – Values of DL-status for the SRD reply-update service
Table 66 – CSRD send-update primitives and parameters
Table 67 – Values of DL-status for the CSRD send-update service
Table 68 – CSRD cyclic data reply primitives and parameters
Table 69 – Poll_list for the CSRD cyclic data reply service
Table 70 – Additional values of DL-status for the CSRD cyclic data reply service
Table 71 – Values of Update_status for the CSRD cyclic data reply service
Table 72 – CSRD cyclic entry primitives and parameters
Table 73 – Values of DL-status for the CSRD cyclic entry service
Table 74 – CSRD cycle deactivate primitives and parameters
Table 75 – Values of DL-status of the CSRD cycle deactivate service
Table 76 – Summary of DL-management services and primitives
Table 77 – Reset primitives and parameters
Table 78 – Values of DLM_status for the Reset service
Table 79 – Set value primitives and parameters
Table 80 – Mandatory DLE-variables
Table 81 – Optional DLE-variables
Table 82 – Permissible values of mandatory DLE-variables
Table 83 – Permissible values of optional DLE-variables
Table 84 – Default reaction times and operating parameters for a Master station for asynchronous transmission
Table 85 – Default reaction times and operating parameters for a Slave station with asynchronous transmission
Table 86 – Default reaction times and operating parameters for Master stations for coupling of synchronous and asynchronous transmission segments
Table 87 – Default reaction times and operating parameter for Slave stations for coupling of synchronous and asynchronous transmission segments
Table 88 – values of DLM_status for the set-value service
Table 89 – Read value primitives and parameters
Table 90 – Additional mandatory DLE-variables in Master stations
Table 91 – Additional optional DLE-variables in Master stations 232
Table 92 – Permissible values of the additional DLE-variables in Master stations 233
Table 93 – values of DLM_status for the read value service 233
Table 94 – Event primitive and parameters 234
Table 95 – DLL events and fault types 234
Table 96 – Ident primitives and parameters 235
Table 97 – values of DLM_status for the Ident service 235
Table 98 – DLSAP status primitives and parameters 236
Table 99 – values of DLM_status for the DLSAP status service 237
Table 100 – Live-list primitives and parameters 237
Table 101 – Live_list 238
Table 102 – values of M_status for the live-list service 238
Table 103 – DLSAP activate primitives and parameters 239
Table 104 – DLSAP activate service_list 239
Table 105 – DLSAP activate DLSDU_length_list 240
Table 106 – DLSDU lengths of SDA and SDN as used in the DLSAP activate service 240
Table 107 – DLSDU lengths of SRD as used in the DLSAP activate service 241
Table 108 – DLSDU_length_list for the DLSAP activate service 241
Table 109 – values of DLM_status for the DLSAP activate service 242
Table 110 – DLSAP activate responder primitives and parameters 242
Table 111 – DLSDU_length_list for the DLSAP activate responder service 243
Table 112 – DLSDU length of SRD and CSRD as used in the DLSAP activate responder service 243
Table 113 – values of DLM_status for the DLSAP activate responder service 244
Table 114 – DLSAP deactivate primitives and parameters 244
Table 115 – values of M_status for the DLSAP-deactivate service 245

Type 4
Table 116 – Summary of DL-connectionless-mode primitives and parameters 249
Table 117 – Unitdata transfer primitives and parameters 250
Table 118 – Control-status error codes 252

Type 6
Table 119 – DL-Time-Primitive and Parameters 270
Table 120 – DL-Time Classes 271
Table 121 – DL-Time Stamp Primitives and Parameters 272
Table 122 – Correspondence of maximum DLSDU size and max-PDU-length

Table 123 – Summary of DL-services and primitives for buffer transfers

Table 124 – Summary of DL-services and primitives for message exchanges

Table 125 – DL-Put primitives and parameters

Table 126 – DL-Get Primitives and parameters

Table 127 – DL-Buffer-Sent primitive and parameter

Table 128 – DL-Buffer-Received primitive and parameter

Table 129 – DL-Spec-Update primitives and parameters

Table 130 – DL-Free-Update primitives and parameters

Table 131 – DL-Message primitives and parameters

Table 132 – DL-Message-Ack Primitives and parameters

Table 133 – Summary of DL-connection-mode primitives and parameters

Table 134 – Put buffer primitive and parameters

Table 135 – Get buffer primitive and parameters

Table 136 – Buffer received primitive and parameters

Table 137 – Normal data transfer primitive and parameters

Table 138 – Summary of DL-management primitives and parameters

Table 139 – Reset service primitives and parameters

Table 140 – Set value service primitives and parameters

Table 141 – Read value service primitives and parameters

Table 142 – Event service primitive and parameters

Table 143 – Get current configuration service primitives and parameters

Table 144 – Get active configuration service primitives and parameters

Table 145 – The active configuration parameter

Table 146 – Set active configuration service primitives and parameters

Bibliography .......................................................... 314
Index ........................................................................... 315
1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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

This second edition cancels and replaces the first edition which was issued as a technical specification in 1999. It constitutes a technical revision and now has the status of an International Standard.

This second edition adds seven distinct sets of services and corresponding protocol elements to the set of services and protocol elements of the first edition.

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

<table>
<thead>
<tr>
<th>FDIS</th>
<th>Report on voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>65C/223/FDIS</td>
<td>65C/228/RVD</td>
</tr>
</tbody>
</table>

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 the ISO/IEC Directives, Part 3.

IEC 61158 consists of the following parts, under the general title Digital data communications for measurement and control — Fieldbus for use in industrial control systems:

Part 1: Introductory guide (under preparation)
Part 2: Physical layer specification and service definition
Part 3: Data Link Service definition
Part 4: Data Link Protocol specification
Part 5: Application layer service definition
Part 6: Application layer protocol specification
Part 7: System management (under consideration)
Part 8: Conformance testing (under consideration)

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

— reconfirmed;
— withdrawn;
— replaced by a revised edition; or
— amended.
INTRODUCTION

This standard 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 Fieldbus Reference Model, which is based in part on the Reference Model for Open Systems Interconnection. Both Reference Models subdivide the area of standardization for interconnection into a series of layers of specification, each of manageable size.

The Data Link Service is provided by the Data Link Protocol making use of the services available from the Physical Layer. This part of IEC 61158 also defines the Data Link Service characteristics that the immediately higher-level protocol may exploit. The relationship between the International Standards for Fieldbus Data Link Service, Fieldbus Data Link Protocol, Fieldbus Physical Service, Fieldbus Application Protocol, Systems Management and other users of the Fieldbus Data Link Service is illustrated in Figure 1.

![Diagram of Fieldbus layers and their services](image)

Figure 1 – Relationship of IEC 61158-3 to other Fieldbus layers and to users of the Fieldbus Data Link Service

Throughout the set of Fieldbus standards and technical specifications, the term “service” refers to the abstract capability provided by one layer of the OSI or Fieldbus Basic Reference Model to the layer immediately above. Thus, the Data Link Service defined in this standard is a conceptual architectural service, independent of administrative and implementation divisions.
1 Scope and object

This part of IEC 61158 is an International Standard that provides basic time-critical messaging communications between devices in an automation environment. 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 part of IEC 61158 defines in an abstract way the externally visible service provided by the Fieldbus Data Link Layer in terms of

a) the primitive actions and events of the service;

b) the parameters associated with each primitive action and event, and the form which they take; and

c) the interrelationship between these actions and events, and their valid sequences.

The purpose of this part of IEC 61158 is to define the services provided to

1) the various types of Fieldbus Application Layer at the boundary between the Application and Data Link Layers of the Fieldbus Reference Model, and

2) Systems Management at the boundary between the Data Link Layer and Systems Management of the Fieldbus Reference Model.

Seven distinct types of services are defined in this part of IEC 61158; each has a corresponding protocol in IEC 61158-4. The seven distinct types of DL-service are:

**Type 1** — A DL-service which provides a superset of those services expected of OSI Data Link Protocols as specified in ISO/IEC 8886. This type of service may be used by any OSI Network Layer Protocol or any Type 1 or Type 7 Fieldbus Application Layer Protocol. Where its scope of addressing is adequate, it may also be used in lieu of any OSI Transport Layer Protocol.

**Type 2** — A DL-service which provides both a connected and a connectionless subset of those services specified in ISO/IEC 8886. This type of service may be used by a Type 2 Fieldbus Application Layer Protocol.

**Type 3** — A DL-service which provides a connectionless subset of those services specified in ISO/IEC 8886. This type of service may be used by a Type 3 Fieldbus Application Layer Protocol.

**Type 4** — A DL-service which provides a connectionless subset of those services specified in ISO/IEC 8886. This type of service may be used by a Type 4 Fieldbus Application Layer Protocol.

**Type 5** — This part of this International Standard does not define a Type 5 Data Link service. Other parts of this International Standard define a Type 5 Application Layer service and protocol. The designation Type 5 is used in this part of this International Standard only to maintain numbering consistency with the other parts of this International Standard.
Type 6 — A DL-service which provides both a connected and a connectionless subset of those services provided by OSI Data Link Protocols as specified in ISO/IEC 8886. This type of service may be used by any Type 6 Fieldbus Application Layer Protocol.

Type 7 — A DL-service which provides both a connected and a connectionless subset of those services provided by OSI Data Link Protocols as specified in ISO/IEC 8886. This type of service may be used by any Type 7 Fieldbus Application Layer Protocol. It may also be usable by a Type 1 Fieldbus Application Layer Protocol, depending on the Type 1 Application Service Elements employed.

Type 8 — A DL-service which provides a connection-oriented subset of those services specified in ISO/IEC 8886. This type of service may be used by a Type 8 Fieldbus Application Protocol.

Many of these Types of service are suitable for use with other higher-layer protocols than those specified. In addition to the potential ability of these types of Data Link service to support unrelated Types of Fieldbus Application Layer protocol, some of these Types of Data Link service also may be able to support:

a) the OSI Network Layer at the boundary between the Network and Data Link Layers of the OSI Basic Reference Model

b) the IETF (IP) Network Layer

c) the Smart Transducer Interface for Sensors and Actuators as defined in IEEE 1451.2.

1.1 Specifications

The principal objective of this part of IEC 61158 is to specify the characteristics of conceptual Data Link Services suitable for time-critical communications, and thus supplement the OSI Basic Reference Model in guiding the development of Data Link protocols for time-critical communications.

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 services standardized in this part of IEC 61158, and the corresponding protocols standard in IEC 61158-4.

This specification may be used as the basis for formal DL-Programming-Interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this specification, including

a) the sizes and octet ordering of various multi-octet service parameters, and

b) the correlation of paired request and confirm, or indication and response, primitives.

1.2 Conformance

This part of IEC 61158 does not specify individual implementations or products, nor does it constrain the implementations of Data Link entities within industrial automation systems.

There is no conformance of equipment to this Data Link Service definition standard. Instead, conformance is achieved through implementation of conforming Data Link protocols that fulfill any given Type of Data Link Services as defined in this part of IEC 61158.
2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards

2.1 Common normative references


IEC 61158-4:2000, Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 4 : Data link protocol specification

2.2 Type 1: additional normative references

IEC 61158-3:2000, Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 4 : Data link service definition

2.3 Type 2: additional normative references

none

2.4 Type 3: additional normative references


ISO/IEC JTC 1/SC 6N 4960:1988, Standards for Local Area Networks: Logical Link Control - Type 3 Operation, Acknowledged Connectionless Service

2.5 Type 4: additional normative references

none

2.6 Type 6: additional normative references

2.7 Type 7: additional normative references
none

2.8 Type 8: additional normative references
none