

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Industrial communication networks – Profiles –
Part 2: Additional fieldbus profiles for real-time networks based on
ISO/IEC 8802-3

Réseaux de communication industriels – Profils –
Partie 2: Profils de bus de terrain supplémentaires pour les réseaux en temps
réel basés sur l'ISO/CEI 8802-3





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CONTENTS

FOREWORD	14
INTRODUCTION	17
1 Scope	18
2 Normative references	18
3 Terms, definitions, abbreviated terms, acronyms, and conventions	23
3.1 Terms and definitions	23
3.2 Abbreviated terms and acronyms	27
3.3 Symbols	29
3.3.1 CPF 2 symbols	29
3.3.2 CPF 3 symbols	30
3.3.3 CPF 4 symbols	31
3.3.4 CPF 6 symbols	31
3.3.5 CPF 10 symbols	32
3.3.6 CPF 11 symbols	32
3.3.7 CPF 12 symbols	33
3.3.8 CPF 13 symbols	33
3.3.9 CPF 14 symbols	34
3.3.10 CPF 15 symbols	34
3.3.11 CPF 16 symbols	35
3.3.12 CPF 17 symbols	35
3.3.13 CPF 18 symbols	36
3.4 Conventions	37
3.4.1 Conventions common to all layers	37
3.4.2 Physical layer	38
3.4.3 Data-link layer	38
3.4.4 Application layer	39
4 Conformance to communication profiles	39
5 RTE performance indicators	40
5.1 Basic principles of performance indicators	40
5.2 Application requirements	41
5.3 Performance indicators	41
5.3.1 Delivery time	41
5.3.2 Number of RTE end-stations	42
5.3.3 Basic network topology	42
5.3.4 Number of switches between RTE end-stations	42
5.3.5 Throughput RTE	42
5.3.6 Non-RTE bandwidth	42
5.3.7 Time synchronization accuracy	43
5.3.8 Non-time-based synchronization accuracy	43
5.3.9 Redundancy recovery time	43
6 Conformance tests	43
6.1 Concept	43
6.2 Methodology	44
6.3 Test conditions and test cases	44
6.4 Test procedure and measuring	44
6.5 Test report	45

7	Communication Profile Family 2 (CIP™) – RTE communication profiles.....	45
7.1	General overview	45
7.2	Profile 2/2	46
7.2.1	Physical layer	46
7.2.2	Data-link layer	46
7.2.3	Application layer	46
7.2.4	Performance indicator selection	46
7.3	Profile 2/2.1	50
7.3.1	Physical layer	50
7.3.2	Data-link layer	50
7.3.3	Application layer	52
7.3.4	Performance indicator selection	54
8	Communication Profile Family 3 (PROFIBUS & PROFINET) – RTE communication profiles	55
8.1	General overview	55
8.1.1	CPF 3 overview	55
8.1.2	Administrative numbers	55
8.1.3	Node Classes	56
8.1.4	Timing parameters	57
8.1.5	Communication classes	60
8.1.6	Media redundancy classes	63
8.1.7	Media classes	63
8.1.8	Application classes	64
8.1.9	Records	67
8.1.10	Communication feature list	73
8.1.11	Conformance class behaviors	74
8.2	Profile 3/4	78
8.2.1	Physical layer	78
8.2.2	Data link layer	78
8.2.3	Application layer	79
8.2.4	Performance indicator selection	86
8.3	Profile 3/5	93
8.3.1	Physical layer	93
8.3.2	Data link layer	93
8.3.3	Application layer	93
8.3.4	Performance indicator selection	100
8.4	Profile 3/6	102
8.4.1	Physical layer	102
8.4.2	Data link layer	102
8.4.3	Application layer	102
8.4.4	Performance indicator selection	109
9	Communication Profile Family 4 (P-NET) – RTE communication profiles	114
9.1	General overview	114
9.2	Profile 4/3, P-NET on IP	115
9.2.1	Physical layer	115
9.2.2	Data-link layer	115
9.2.3	Application layer	116
9.2.4	Performance indicator selection	117
10	Communication Profile Family 6 (INTERBUS®) – RTE communication profiles	120

10.1	General overview	120
10.2	Profile 6/4	122
10.2.1	Mapping	122
10.2.2	Type 10 service and protocol selection	123
10.2.3	Type 8 service and protocol selection	123
10.2.4	Performance indicator selection	124
10.3	Profile 6/5	125
10.3.1	Mapping	125
10.3.2	Type 10 service and protocol selection	125
10.3.3	Type 8 service and protocol selection	125
10.3.4	Performance indicator selection	125
10.4	Profile 6/6	126
10.4.1	Mapping	126
10.4.2	Type 10 service and protocol selection	126
10.4.3	Type 8 service and protocol selection	126
10.4.4	Performance indicator selection	126
11	Communication Profile Family 10 (Vnet/IP) – RTE communication profiles	127
11.1	General overview	127
11.2	Profile 10/1	128
11.2.1	Physical layer	128
11.2.2	Data link layer	128
11.2.3	Application layer	130
11.2.4	Performance indicator selection	131
12	Communication Profile Family 11 (TCnet) – RTE communication profiles	136
12.1	General overview	136
12.2	Profile 11/1	137
12.2.1	Physical layer	137
12.2.2	Data-link layer	137
12.2.3	Application layer	141
12.2.4	Performance indicator selection	141
12.3	Profile 11/2	147
12.3.1	Physical layer	147
12.3.2	Data-link layer	147
12.3.3	Application layer	151
12.3.4	Performance indicator selection	151
12.4	Profile 11/3	156
12.4.1	Physical layer	156
12.4.2	Data-link layer	156
12.4.3	Application layer	159
12.4.4	Performance indicator selection	160
13	Communication Profile Family 12 (EtherCAT®) – RTE communication profiles	166
13.1	General overview	166
13.2	Profile CP 12/1	166
13.2.1	Physical layer	166
13.2.2	Data-link layer	167
13.2.3	Application layer	171
13.2.4	Performance indicator selection	173
13.3	Profile CP 12/2	176
13.3.1	Physical layer	176

13.3.2	Data-link layer	176
13.3.3	Application layer	179
13.3.4	Performance indicator selection	181
14	Communication Profile Family 13 (Ethernet POWERLINK) – RTE communication profiles	183
14.1	General overview	183
14.2	Profile 13/1	183
14.2.1	Physical layer	183
14.2.2	Data-link layer	184
14.2.3	Application layer	184
14.2.4	Performance indicator selection	184
15	Communication Profile Family 14 (EPA)- RTE communication profiles	189
15.1	General overview	189
15.2	CPF 14 (EPA) communication concept	190
15.2.1	General	190
15.2.2	Network Topology	190
15.2.3	EPA devices	191
15.3	Profile 14/1	192
15.3.1	Physical layer	192
15.3.2	Data-link layer	192
15.3.3	Network Layer	192
15.3.4	Transport Layer	192
15.3.5	Application layer	192
15.3.6	Performance indicator selection	193
15.4	Profile 14/2	196
15.4.1	Physical layer	196
15.4.2	Data-link layer	196
15.4.3	Network Layer	197
15.4.4	Transport Layer	197
15.4.5	Application layer	197
15.4.6	Performance indicator selection	198
15.5	Profile 14/3	201
15.5.1	Physical layer	201
15.5.2	Data-link layer	201
15.5.3	Network Layer	202
15.5.4	Transport Layer	202
15.5.5	Application layer	202
15.5.6	Performance indicator selection	203
15.6	Profile 14/4	206
15.6.1	Physical layer	206
15.6.2	Data-link layer	206
15.6.3	Network layer	207
15.6.4	Transport layer	208
15.6.5	Application layer	208
15.6.6	Performance indicatior selection	209
16	Communication Profile Family 15 (MODBUS-RTPS) – RTE communication profiles	211
16.1	General overview	211
16.2	Profile 15/1	212
16.2.1	Physical layer	212

16.2.2	Data-link layer	212
16.2.3	Application layer	212
16.2.4	Performance indicator selection	212
16.3	Profile 15/2	217
16.3.1	Physical layer	217
16.3.2	Data-link layer	217
16.3.3	Application layer	217
16.3.4	Performance indicator selection	218
17	Communication Profile Family 16 (SERCOS)- RTE communication profiles	222
17.1	General overview	222
17.2	Profile 16/3 (SERCOS III)	222
17.2.1	Physical layer	222
17.2.2	Data-link layer	223
17.2.3	Application layer	223
17.2.4	Performance indicator selection	224
18	Communication Profile Family 17(RAPIEnet) – RTE communication profiles	230
18.1	General overview	230
18.2	Profile 17/1	230
18.2.1	Physical layer	230
18.2.2	Datalink layer	230
18.2.3	Application layer	231
18.2.4	Performance indicator selection	232
19	Communication Profile Family 18 (SafetyNET p) – RTE communication profiles	236
19.1	General overview	236
19.2	Profile 18/1	236
19.2.1	Physical layer	236
19.2.2	Data link layer	236
19.2.3	Application layer	239
19.2.4	Performance indicator selection	240
19.3	Profile 18/2	243
19.3.1	Physical layer	243
19.3.2	Data link layer	243
19.3.3	Application layer	245
19.3.4	Performance indicator selection	247
20	Communication Profile Family 8 (CC-Link) – RTE communication profiles	249
20.1	General overview	249
20.2	Profile 8/4	249
20.2.1	Physical layer	249
20.2.2	Data link layer	249
20.2.3	Application layer	250
20.2.4	Performance indicator selection	251
20.3	Profile 8/5	256
20.3.1	Physical layer	256
20.3.2	Data link layer	256
20.3.3	Application layer	256
20.3.4	Performance indicator selection	257
Annex A (informative)	Performance Indicator calculation	263
Bibliography.....	283	

Figure 1 – Example of graphical representation of consistent indicators.....	41
Figure 2 – Conformance test overview	43
Figure 3 – Example of network topology using CP 3/4, CP 3/5, and CP 3/6 components	78
Figure 4 – Example of network topology with wireless segment	81
Figure 5 – Calculation basis for delivery time and throughput RTE.....	89
Figure 6 – Linking-device communication profiles RTE-network context.....	121
Figure 7 – Linking-device mapping principle	122
Figure 8 – Data Mapping.....	122
Figure 9 – CP 11/1: Throughput RTE and non-RTE bandwidth.....	144
Figure 10 – CP 11/2: Throughput RTE and non-RTE bandwidth.....	154
Figure 11 – CP 11/3: Throughput RTE and non-RTE bandwidth.....	163
Figure 12 – EPA system network topology example	191
Figure A.1 – CP 3/4: Example of line structure.....	265
Figure A.2 – CP 3/4: Example of ring structure	266
Figure A.3 – CP 3/4: Example of a wireless segment	266
Figure A.4 – CP 3/4: Example of an integrated wireless client.....	267
Figure A.5 – CP 3/5: Example of line structure.....	267
Figure A.6 – CP 3/5: Example of ring structure	268
Figure A.7 – CP 3/6: Example of line structure.....	269
Figure A.8 – CP 3/6: Example of line structure	270
Figure A.9 – CP 3/6: Example of ring structure	271
Figure A.10 – CP 3/6: Example of tree structure	272
Figure A.11 – CP 3/6: Example of comb structure	273
Figure A.12 – CP 3/6: Example of comb structure (optional)	274
Figure A.13 – Definition of bridge delay	275
Figure A.14 – Example of a switch structure	276
Figure A.15 – Application configuration.....	277
Figure A.16 – Non-RTE throughput calculation	279
Figure A.17 – Non time-base synchronization accuracy	279
Table 1 – Layout of profile (sub)clause selection tables	37
Table 2 – Contents of (sub)clause selection tables	37
Table 3 – Layout of service selection tables.....	37
Table 4 – Contents of service selection tables	38
Table 5 – Layout of parameter selection tables	38
Table 6 – Contents of parameter selection tables	38
Table 7 – Layout of class attribute selection tables	39
Table 8 – Contents of class attribute selection tables.....	39
Table 9 – Basic network topology types	42
Table 10 – CP 2/2: PI overview.....	46
Table 11 – CP 2/2: PI dependency matrix	47
Table 12 – CP 2/2: Consistent set of PIs for factory automation	50

Table 13 – CP 2/2.1: DLL protocol selection	51
Table 14 – CP 2/2.1: DLL protocol selection of management objects	51
Table 15 – CP 2/2.1: AL service selection	52
Table 16 – CP 2/2.1: AL protocol selection	53
Table 17 – CP 2/2.1: PI overview	54
Table 18 – CP 2/2.1: PI dependency matrix	54
Table 19 – CP 2/2.1: Consistent set of PIs for motion control	55
Table 20 – Administrative numbers assignment	56
Table 21 – IP layer parameters for IO controller	57
Table 22 – IP layer parameters for IO device	57
Table 23 – Timeout values for name resolution	58
Table 24 – Reaction time for an IO device	58
Table 25 – Maximum time values for MRP	59
Table 26 – Maximum time values for PTCP	59
Table 27 – Maximum time values for LLDP	60
Table 28 – Communication classes applicable in conformance classes	60
Table 29 – Communication performance parameters	61
Table 30 – Parameters for RT_CLASS_3 bridges	61
Table 31 – FrameSendOffset deviation	61
Table 32 – FrameSendOffset deviation for RT_CLASS_1 / RT_CLASS_UDP	62
Table 33 – Minimum FrameSendOffset	62
Table 34 – PTCP control loop	62
Table 35 – Maximum frame size	63
Table 36 – Media redundancy class applicable in conformance classes	63
Table 37 – Application classes applicable in conformance classes for IO device and IO controller	64
Table 38 – Application classes applicable in conformance classes for network components	64
Table 39 – Application class “isochronous application” AL service selection	65
Table 40 – Application class “isochronous application” AL protocol selection component	65
Table 41 – Application class “process automation” AL service selection	65
Table 42 – Application class “process automation” AL protocol selection component	65
Table 43 – Application class “High performance” features supported	66
Table 44 – Application class “High performance” parameter values	66
Table 45 – Application class “Controller to controller” features supported	66
Table 46 – Index (user specific)	67
Table 47 – Index (subslot specific)	67
Table 48 – Index (slot specific)	69
Table 49 – Index (AR specific)	69
Table 50 – Index (API specific)	71
Table 51 – Index (device specific)	72
Table 52 – PDPortDataAdjust (sub blocks)	73
Table 53 – PDPortDataCheck (sub blocks)	73

Table 54 – Communication feature list	74
Table 55 – Conformance class behaviors.....	74
Table 56 – MIB-II objects	76
Table 57 – Conformance class behaviors for network components.....	77
Table 58 – CP 3/4: AL service selection for an IO device	79
Table 59 – CP 3/4: AL protocol selection for an IO device and Network component	82
Table 60 – CP 3/4: AL protocol selection for an IO controller	84
Table 61 – CP 3/4, CP 3/5 and CP 3/6: Performance indicator overview	87
Table 62 – CP 3/4, CP 3/5 and CP 3/6: PI dependency matrix	87
Table 63 – Manager parameters	90
Table 64 – Client parameters	91
Table 65 – CP 3/4: Consistent set of PIs for MinDeviceInterval=128 ms.....	92
Table 66 – CP 3/4: Assumed values for consistent set of PI calculation	92
Table 67 – CP 3/5: AL service selection for an IO device	94
Table 68 – CP 3/5: AL protocol selection for an IO device and Network component	96
Table 69 – Buffering capacity for less than eight ports	98
Table 70 – Buffering capacity for eight and more ports	98
Table 71 – CP 3/5: AL protocol selection for an IO controller	98
Table 72 – CP 3/5: Consistent set of PIs for MinDeviceInterval=128 ms.....	101
Table 73 – CP 3/5: Assumed values for consistent set of PI calculation	101
Table 74 – CP 3/6: AL service selection for an IO device	103
Table 75 – Buffering capacity.....	105
Table 76 – CP 3/6: AL protocol selection for an IO device and network component.....	105
Table 77 – CP 3/6: AL protocol selection for an IO controller	107
Table 78 – CP 3/6: Consistent set of PIs for MinDeviceInterval=1 ms and NumberOfSwitches=20	110
Table 79 – CP 3/6: Consistent set of PI for MinDeviceInterval=1 ms and NumberOfSwitches=63	111
Table 80 – CP 3/6: Assumed values for consistent set of PI calculation	112
Table 81 – CP 3/6: Consistent set of PIs for MinDeviceInterval=31,25 µs and NumberOfSwitches=10	113
Table 82 – CP 3/6: Assumed values for consistent set of PI calculation	114
Table 83 – CP 4/3: DLL service selection.....	115
Table 84 – CP 4/3: DLL protocol selection	116
Table 85 – CP 4/3: AL service selection.....	116
Table 86 – CP 4/3: AL protocol selection	116
Table 87 – CP 4/3: PI overview.....	117
Table 88 – CP 4/3: PI dependency matrix	117
Table 89 – CP 4/3: Consistent set of PIs.....	120
Table 90 – Parameters for calculation of consistent set of PIs	120
Table 91 – CPF 6: device CP identifier assignment.....	121
Table 92 – Linking-device Type 10 network PI overview	124
Table 93 – OSI layers and CPF 10 layers	127
Table 94 – Overview of CPF 10 profile	127

Table 95 – CP 10/1: DLL service selection	129
Table 96 – CP 10/1: DLL protocol selection	129
Table 97 – Transport Layer Parameter selection	130
Table 98 – CP 10/1: AL service selection	131
Table 99 – CP 10/1: AL protocol selection	131
Table 100 – CP 10/1: PI overview	132
Table 101 – CP 10/1: PI dependency matrix	132
Table 102 – CP 10/1: Consistent set of PIs for the communication between two end-stations belonging to the same domain	135
Table 103 – CP 10/1: Consistent set of PIs for the communication between two end-stations belonging to different domains	135
Table 104 – CP 10/1: Consistent set of PIs for the communication between two end-stations belonging to the same domain with one lost frame	136
Table 105 – CP 10/1: Consistent set of PIs for the communication between two end-stations belonging to different domains with one lost frame	136
Table 106 – CPF 11: Overview of profile sets	137
Table 107 – CP 11/1: DLL service selection	137
Table 108 – CP 11/1: DLL protocol selection	138
Table 109 – CP 11/1: DLL protocol selection of Clause 5	139
Table 110 – CP 11/1: DLL protocol selection of Clause 6	139
Table 111 – CP 11/1: AL service selection	141
Table 112 – CP 11/1: AL protocol selection	141
Table 113 – CP 11/1: PI overview	142
Table 114 – CP 11/1: PI dependency matrix	142
Table 115 – CP 11/1: TCC data service selection	143
Table 116 – CP 11/1: Consistent set of PIs preferential for RTE communications	146
Table 117 – CP 11/1: Consistent set of PIs both for RTE and non-RTE communications	147
Table 118 – CP 11/2: DLL protocol selection	147
Table 119 – CP 11/2: DLL protocol selection of Clause 5	149
Table 120 – CP 11/2: DLL protocol selection of Clause 6	149
Table 121 – CP 11/2: PI overview	151
Table 122 – CP 11/2: PI dependency matrix	152
Table 123 – CP 11/2: TCC data service selection	152
Table 124 – CP 11/2: Consistent set of PIs preferential for RTE communications	155
Table 125 – CP 11/2: Consistent set of PIs both for RTE and non-RTE communications	156
Table 126 – CP 11/3: DLL protocol selection	156
Table 127 – CP 11/3: DLL protocol selection of Clause 5	157
Table 128 – CP 11/3: DLL protocol selection of Clause 6	158
Table 129 – CP 11/3: PI overview	160
Table 130 – CP 11/3: PI dependency matrix	161
Table 131 – CP 11/3: TCC data service selection	161
Table 132 – CP 11/3: Consistent set of PIs preferential for RTE communications	165
Table 133 – CP 11/3: Consistent set of PIs both for RTE and non-RTE communications	165
Table 134 – CP 12/1: PhL selection of preferred physical layer from IEEE 802.3-2008	166

Table 135 – CP 12/1: PhL selection of an optimized physical layer from IEC 61158-2	167
Table 136 – CP 12/1: DLL service selection	168
Table 137 – CP 12/1: DLL protocol selection	168
Table 138 – CP 12/1: DLL service selection	170
Table 139 – CP 12/1: DLL protocol selection	170
Table 140 – CP 12/1: AL service selection	171
Table 141 – CP 12/1: AL protocol selection	172
Table 142 – CP 12/1: AL service selection	172
Table 143 – CP 12/1: AL protocol selection	173
Table 144 – CP 12/1: PI overview	173
Table 145 – CP 12/1: PI dependency matrix	174
Table 146 – CP 12/1: PI ranges	174
Table 147 – CP 12/1: Consistent set of PIs for mid size automation systems	176
Table 148 – CP 12/2: DLL service selection	176
Table 149 – CP 12/2: DLL protocol selection	177
Table 150 – CP 12/2: DLL service selection	178
Table 151 – CP 12/2: DLL protocol selection	178
Table 152 – CP 12/2: AL service selection	179
Table 153 – CP 12/2: AL protocol selection	180
Table 154 – CP 12/2: AL service selection	180
Table 155 – CP 12/2: AL protocol selection	181
Table 156 – CP 12/2: PI overview	182
Table 157 – CP 12/2: PI dependency matrix	182
Table 158 – CP 12/2: Consistent set of PIs	183
Table 159 – CPF 13: Overview of profile sets	183
Table 160 – CP 13/1: DLL service selection	184
Table 161 – CP 13/1: DLL protocol selection	184
Table 162 – CP 13/1: AL service selection	184
Table 163 – CP 13/1: AL protocol selection	184
Table 164 – CP 13/1: PI overview	185
Table 165 – CP 13/1: PI dependency matrix	185
Table 166 – CP 13/1: Consistent set of PIs small size automation system	188
Table 167 – CP 13/1: Consistent set of PIs medium size automation system	188
Table 168 – CP 13/1: Consistent set of PIs large size automation system	189
Table 169 – CP 14/1: AL service selection	192
Table 170 – CP 14/1: AL protocol selection	193
Table 171 – CP 14/1: PI overview	193
Table 172 – CP 14/1: PI dependency matrix	194
Table 173 – CP 14/1: Consistent set of PIs	196
Table 174 – CP 14/2: DLL service selection	196
Table 175 – CP 14/2: DLL protocol selection	197
Table 176 – CP 14/2: AL service selection	197
Table 177 – CP 14/2: AL protocol selection	198

Table 178 – CP 14/2: PI overview	198
Table 179 – CP 14/2: PI dependency matrix	199
Table 180 – CP 14/2: Consistent set of PIs	200
Table 181 – CP 14/3: DLL service selection	201
Table 182 – CP 14/3: DLL protocol selection	201
Table 183 – CP 14/3: AL service selection	202
Table 184 – CP 14/3: AL protocol selection	202
Table 185 – CP 14/3: PI overview	203
Table 186 – CP 14/3: PI dependency matrix	203
Table 187 – CP 14/3: Consistent set of PIs	205
Table 188 – CP 14/3: Consistent set of PIs	206
Table 189 – CP 14/3: Consistent set of PIs	206
Table 190 – CP 14/4: DLL service selection	207
Table 191 – CP 14/4: DLL protocol selection	207
Table 192 – CP 14/4: AL service selection	208
Table 193 – CP 14/4: AL protocol selection	208
Table 194 – CP 14/4: PI overview	209
Table 195 – CP 14/4: PI dependency matrix	209
Table 196 – CP 14/4: Consistent set of PIs	211
Table 197 – CP 15/1: AL service selection	212
Table 198 – CP 15/1: AL protocol selection	212
Table 199 – CP 15/1: PI overview	213
Table 200 – CP 15/1: PI dependency matrix	214
Table 201 – CP 15/2: AL service selection	218
Table 202 – CP 15/2: AL protocol selection	218
Table 203 – CP 15/2: PI overview	218
Table 204 – CP 15/2: PI dependency matrix	219
Table 205 – CP 16/3: DLL service selection	223
Table 206 – CP 16/3: DLL protocol selection	223
Table 207 – CP 16/3: AL service selection	223
Table 208 – CP 16/3: AL protocol selection	223
Table 209 – CP 16/3: PI overview	224
Table 210 – CP 16/3: PI dependency matrix	224
Table 211 – CP 16/3: Consistent set of PIs with a minimum cycle time of 31,25 µs	228
Table 212 – CP 16/3: Consistent set of PIs with a cycle time of 500 µs (real-time only)	228
Table 213 – CP 16/3: Consistent set of PIs with a cycle time of 500 µs (real-time and non-real-time)	229
Table 214 – CP 16/3: Consistent set of PIs with non symmetrical data throughput and a cycle time of 500 µs (real-time and non-real-time)	229
Table 215 – CPF 17: Overview of profile sets	230
Table 216 – CP 17/1: DLL service selection	230
Table 217 – CP 17/1: DLL protocol selection	231
Table 218 – CP 17/1: AL service selection	231
Table 219 – CP 17/1: AL protocol selection	231

Table 220 – CP 17/1: PI overview	232
Table 221 – CP 17/1: PI dependency matrix	232
Table 222 – Consistent set of PIs small size automation system	235
Table 223 – Parameters for Calculation of Consistent set of PIs	235
Table 224 – CP 18/1: DLL service selection	236
Table 225 – CP 18/1: DLL protocol selection	238
Table 226 – CP 18/1: AL service selection	239
Table 227 – CP 18/1: AL protocol selection	240
Table 228 – CP 18/1: PI overview	240
Table 229 – CP 18/1: PI dependency matrix	241
Table 230 – CP 18/2: DLL service selection	243
Table 231 – CP 18/2: DLL protocol selection	244
Table 232 – CP 18/2: AL service selection	246
Table 233 – CP 18/2: AL protocol selection	247
Table 234 – CP 18/2: PI overview	247
Table 235 – CP 18/2: PI dependency matrix	248
Table 236 – CP 8/4: AL service selection	250
Table 237 – CP 8/4: AL protocol selection	251
Table 238 – CP 8/4: PI overview	251
Table 239 – CP 8/4: PI dependency matrix	252
Table 240 – CP 8/4: Consistent set of PIs (real-time only)	255
Table 241 – CP 8/4: Consistent set of PIs (real-time and non-real-time)	256
Table 242 – CP 8/5: AL service selection	256
Table 243 – CP 8/5: AL protocol selection	257
Table 244 – CP 8/5: PI overview	257
Table 245 – CP 8/5: PI dependency matrix	258
Table 246 – CP 8/5: Consistent set of PIs (real-time only)	262
Table 247 – CP 8/5: Consistent set of PIs (real-time and non-real-time)	262

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
PROFILES –****Part 2: Additional fieldbus profiles for real-time
networks based on ISO/IEC 8802-3****FOREWORD**

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

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

International Standard IEC 61784-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

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

- update of the dated references to the IEC 61158 series, to IEC 61784-1, to the IEC 61784-3 series, to the IEC 61784-5 series and to IEC 61918 throughout the document;
- update of selection tables for CPF 3
 - update of the requirements for all conformance classes;
 - added precise timing requirements for IP;
 - updated timing requirements for IO devices;
 - added precise timing requirements for PTCP;
 - increasing the amount of synchronized devices in line;
 - added consistent set of parameters;
 - added application classes;
 - integrating the fast startup as additional feature.
- update of selection tables for CPF 11 and CPF 14;
- addition of a new profile CP 11/3 in 12.4;
- addition of a new profile CP 14/4 in 15.6;
- addition of a new Communication Profile Family – CPF 8 in Clause 20.

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

FDIS	Report on voting
65C/761FDIS	65C/771/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 the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61784 series, published under the general title *Industrial communication networks – Profiles*, 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 61784 provides additional Communication Profiles (CP) to the existing Communication Profile Families (CPF) of IEC 61784-1 and additional CPFs with one or more CPs. These profiles meet the industrial automation market objective of identifying Real-Time Ethernet (RTE) communication networks coexisting with ISO/IEC 8802-3 or IEEE 802.3 – commonly known as Ethernet. These RTE communication networks use provision from ISO/IEC 8802-3 for the lower communication stack layers and additionally provide more predictable and reliable real-time data transfer and means for support of precise synchronization of automation equipment.

More specifically, these profiles help to correctly state the compliance of RTE communication networks with ISO/IEC 8802-3 or IEEE 802.3, and to avoid the spreading of divergent implementations.

Adoption of Ethernet technology for industrial communication between controllers and even for communication with field devices promotes use of Internet technologies in the field area. This availability would be unacceptable if it causes the loss of features required in the field area for industrial communication automation networks, such as:

- real-time,
- synchronized actions between field devices like drives,
- efficient, frequent exchange of very small data records.

These new RTE profiles may take advantage of the improvements of Ethernet networks in terms of transmission bandwidth and network span.

Another implicit but essential requirement is that the typical Ethernet communication capabilities, as used in the office world, are fully retained, so that the software involved remains applicable.

The market is in need of several network solutions, each with different performance characteristics and functional capabilities, matching the diverse application requirements. RTE performance indicators (see Clause 5), which values will be provided with RTE devices based on communication profiles specified in this part of IEC 61784, enable the user to match network devices with application dependant performance requirements of an RTE network.

Subclause 5.1 specifies basic principles of performance indicators required to express RTE performance of a CP. Subclause 5.2 describes the view of application requirements. An application-dependant class could be used to find out a suitable CP. Clause 4 specifies how conformance of a device to the CPF or CP should be stated.

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

1 Scope

This part of IEC 61784 specifies

- performance indicators supporting classification schemes for Real-Time Ethernet (RTE) requirements;
- profiles and related network components based on ISO/IEC 8802-3 or IEEE 802.3, IEC 61158 series, and IEC 61784-1;
- RTE solutions that are able to run in parallel with ISO/IEC 8802-3 or IEEE 802.3 based applications.

These communication profiles are called Real-Time Ethernet communication profiles.

NOTE The RTE communication profiles use ISO/IEC 8802-3 or IEEE 802.3 communication networks and its related network components or IEC 61588 and may in some cases amend those standards to obtain RTE features.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 IEC 61784-1 and IEC 61784-2 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 61010 (all parts), *Safety requirements for electrical equipment for measurement, control, and laboratory use*

IEC 61131-2, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61158-1:2014, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-2:2014, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-2:2014, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-3-4:2014, *Industrial communication networks – Fieldbus specifications – Part 3-4: Data-link layer service definition – Type 4 elements*

IEC 61158-3-11:2007, *Industrial communication networks – Fieldbus specifications – Part 3-11: Data-link layer service definition – Type 11 elements*

IEC 61158-3-12:2014, *Industrial communication networks – Fieldbus specifications – Part 3-12: Data-link layer service definition – Type 12 elements*

IEC 61158-3-13:2014, *Industrial communication networks – Fieldbus specifications – Part 3-13: Data-link layer service definition – Type 13 elements*

IEC 61158-3-14:2014, *Industrial communication networks – Fieldbus specifications – Part 3-14: Data-link layer service definition – Type 14 elements*

IEC 61158-3-17:2007, *Industrial communication networks – Fieldbus specifications – Part 3-17: Data-link layer service definition – Type 17 elements*

IEC 61158-3-19:2014, *Industrial communication networks – Fieldbus specifications – Part 3-19: Data-link layer service definition – Type 19 elements*

IEC 61158-3-21:2010, *Industrial communication networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements*

IEC 61158-3-22:2014, *Industrial communication networks – Fieldbus specifications – Part 3-22: Data-link layer service definition – Type 22 elements*

IEC 61158-4-2:2014, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-4-4:2014, *Industrial communication networks – Fieldbus specifications – Part 4-4: Data-link layer protocol specification – Type 4 elements*

IEC 61158-4-11:2014, *Industrial communication networks – Fieldbus specifications – Part 4-11: Data-link layer protocol specification – Type 11 elements*

IEC 61158-4-12:2014, *Industrial communication networks – Fieldbus specifications – Part 4-12: Data-link layer protocol specification – Type 12 elements*

IEC 61158-4-13:2014, *Industrial communication networks – Fieldbus specifications – Part 4-13: Data-link layer protocol specification – Type 13 elements*

IEC 61158-4-14:2014, *Industrial communication networks – Fieldbus specifications – Part 4-14: Data-link layer protocol specification – Type 14 elements*

IEC 61158-4-17:2007, *Industrial communication networks – Fieldbus specifications – Part 4-17: Data-link layer protocol specification – Type 17 elements*

IEC 61158-4-19:2014, *Industrial communication networks – Fieldbus specifications – Part 4-19: Data-link layer protocol specification – Type 19 elements*

IEC 61158-4-21:2010, *Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 elements*

IEC 61158-4-22:2014, *Industrial communication networks – Fieldbus specifications – Part 4-22: Data-link layer protocol specification – Type 22 elements*

IEC 61158-5-2:2014, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-5-4:2014, *Industrial communication networks – Fieldbus specifications – Part 5-4: Application layer service definition – Type 4 elements*

IEC 61158-5-10:2014, *Industrial communication networks – Fieldbus specifications – Part 5-10: Application layer service definition – Type 10 elements*

IEC 61158-5-11:2007, *Industrial communication networks – Fieldbus specifications – Part 5-11: Application layer service definition – Type 11 elements*

IEC 61158-5-12:2014, *Industrial communication networks – Fieldbus specifications – Part 5-12: Application layer service definition – Type 12 elements*

IEC 61158-5-13:2014, *Industrial communication networks – Fieldbus specifications – Part 5-13: Application layer service definition – Type 13 elements*

IEC 61158-5-14:2014, *Industrial communication networks – Fieldbus specifications – Part 5-14: Application layer service definition – Type 14 elements*

IEC 61158-5-15:2010, *Industrial communication networks – Fieldbus specifications – Part 5-15: Application layer service definition – Type 15 elements*

IEC 61158-5-17:2007, *Industrial communication networks – Fieldbus specifications – Part 5-17: Application layer service definition – Type 17 elements*

IEC 61158-5-19:2014, *Industrial communication networks – Fieldbus specifications – Part 5-19: Application layer service definition – Type 19 elements*

IEC 61158-5-21:2010, *Industrial communication networks – Fieldbus specifications – Part 5-21: Application layer service definition – Type 21 elements*

IEC 61158-5-22:2014, *Industrial communication networks – Fieldbus specifications – Part 5-22: Application layer service definition – Type 22 elements*

IEC 61158-5-23:2014, *Industrial communication networks – Fieldbus specifications – Part 5-23: Application layer service definition – Type 23 elements*

IEC 61158-6-2:2014, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61158-6-4:2014, *Industrial communication networks – Fieldbus specifications – Part 6-4: Application layer protocol specification – Type 4 elements*

IEC 61158-6-10:2014, *Industrial communication networks – Fieldbus specifications – Part 6-10: Application layer protocol specification – Type 10 elements*

IEC 61158-6-11:2007, *Industrial communication networks – Fieldbus specifications – Part 6-11: Application layer protocol specification – Type 11 elements*

IEC 61158-6-12:2014, *Industrial communication networks – Fieldbus specifications – Part 6-12: Application layer protocol specification – Type 12 elements*

IEC 61158-6-13:2014, *Industrial communication networks – Fieldbus specifications – Part 6-13: Application layer protocol specification – Type 13 elements*

IEC 61158-6-14:2014, *Industrial communication networks – Fieldbus specifications – Part 6-14: Application layer protocol specification – Type 14 elements*

IEC 61158-6-15:2010, *Industrial communication networks – Fieldbus specifications – Part 6-15: Application layer protocol specification – Type 15 elements*

IEC 61158-6-17:2007, *Industrial communication networks – Fieldbus specifications – Part 6-17: Application layer protocol specification – Type 17 elements*

IEC 61158-6-19:2014, *Industrial communication networks – Fieldbus specifications – Part 6-19: Application layer protocol specification – Type 19 elements*

IEC 61158-6-21:2010, *Industrial communication networks – Fieldbus specifications – Part 6-21: Application layer protocol specification – Type 21 elements*

IEC 61158-6-22:2014, *Industrial communication networks – Fieldbus specifications – Part 6-22: Application layer protocol specification – Type 22 elements*

IEC 61158-6-23:2014, *Industrial communication networks – Fieldbus specifications – Part 6-23: Application layer protocol specification – Type 23 elements*

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

IEC 61784-1:2014, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61784-5-2:2013, *Industrial communication networks – Profiles – Part 5-2: Installation of fieldbuses – Installation profiles for CPF 2*

IEC 61784-5-3:2013, *Industrial communication networks – Profiles – Part 5-3: Installation of fieldbuses – Installation profiles for CPF 3*

IEC 61784-5-6:2013, *Industrial communication networks – Profiles – Part 5-6: Installation of fieldbuses – Installation profiles for CPF 6*

IEC 61784-5-8:2013, *Industrial communication networks – Profiles – Part 5-8: Installation of fieldbuses – Installation profiles for CPF 8*

IEC 61784-5-11:2013, *Industrial communication networks – Profiles – Part 5-11: Installation of fieldbuses – Installation profiles for CPF 11*

IEC 61918:2013, *Industrial communication networks – Installation of communication networks in industrial premises*

IEC 61800 (all parts), *Adjustable speed electrical power drive systems*

ISO/IEC 2382-16:1996, *Information technology – Vocabulary – Part 16: Information theory*

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

ISO/IEC 8802-2, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

Corrigendum 1

ISO/IEC 8802-3:2000, *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 8802-11, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN medium access control (MAC) and physical layer (PHY) specifications*

ISO/IEC 11801:2002, *Information technology – Generic cabling for customer premises*¹

Amendment 1: 2008

Amendment 2:2010

ISO 15745-3, *Industrial automation systems and integration – Open systems application integration framework – Part 3: Reference description for IEC 61158-based control systems*

ISO 15745-4:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 4: Reference description for Ethernet-based control systems*

Amendment 1:2006, *PROFINET profiles*

IEEE 802-2001, *IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture*

IEEE 802.1AB, *IEEE Standard for Local and metropolitan area networks Station and Media Access Control Connectivity Discovery*

IEEE 802.1AS-2011, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – IEEE standard for Local and metropolitan area networks – Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks*

IEEE 802.1D-2004, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – IEEE standard for local and metropolitan area networks – Common specifications – Media access control (MAC) Bridges*

IEEE 802.1Q-2011 *IEEE Standard for Information technology – Telecommunications and information exchange between systems – IEEE standard for Local and metropolitan area networks – Virtual bridged local area networks*

IEEE 802.3-2008, *IEEE Standard for 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*

NOTE Compliance with future editions of this standard will need checking.

IEEE Std 802.11-2007, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*

IEEE Std 802.15.1, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 15: Wireless medium access control (MAC) and physical layer (PHY) specifications for wireless personal area networks (WPANs)*

IETF RFC 768, *User Datagram Protocol*, available at <<http://www.ietf.org>>

¹ There exists a consolidated edition 2.2:2011 that comprises ISO/IEC 11801:2002, its Amendment 1:2008 and its Amendment 2:2010.

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

IETF RFC 792, *Internet Control Message Protocol*, available at <<http://www.ietf.org>>

IETF RFC 793, *Transmission Control Protocol*, available at <<http://www.ietf.org>>

IETF RFC 826, *Ethernet Address Resolution Protocol*, available at <<http://www.ietf.org>>

IETF RFC 894, *A standard for the Transmission of IP Datagrams over Ethernet Networks*, available at <<http://www.ietf.org>>

IETF RFC 1034, *Domain names – concepts and facilities*; available at <<http://www.ietf.org>>

IETF RFC 1112, *Host Extensions for IP Multicasting*, available at <<http://www.ietf.org>>

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

IETF RFC 1123, *Requirements for Internet Hosts – Application and Support*, available at <<http://www.ietf.org>>

IETF RFC 1127, *A Perspective on the Host Requirements RFCs*, available at <<http://www.ietf.org>>

IETF RFC 1157, *Simple Network Management Protocol (SNMP)*, available at <<http://www.ietf.org>>

IETF RFC 1213, *Management Information Base for Network Management of TCP/IP-based internets: MIB-II*, available at <<http://www.ietf.org>>

IETF RFC 1305, *Network Time Protocol (Version 3)*, available at <<http://www.ietf.org>>

IETF RFC 2131, *Dynamic Host Configuration Protocol*, available at <<http://www.ietf.org>>

IETF RFC 2236, *Internet Group Management Protocol, Version 2*, available at <<http://www.ietf.org>>

IETF RFC 2544, *Benchmarking Methodology for Network Interconnect Devices*, available at <<http://www.ietf.org>>

IETF RFC 2988, *Computing TCP's Retransmission Timer*, available at <<http://www.ietf.org>>

IETF RFC 4836, *Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)*, available at <<http://www.ietf.org>>

Open Software Foundation (OSF): C706, *CAE Specification DCE1.1: Remote Procedure Call*, available at <<http://www.opengroup.org/onlinepubs/9629399/toc.htm>>

3 Terms, definitions, abbreviated terms, acronyms, and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 8802-3, IEEE 802, IEEE 802.1AB, IEEE 802.1AS, IEEE 802.1D, IEEE 802.1Q and IEEE 802.3, as well as the following, apply.