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Interested committees:

Title: BS EN 63380-2 Local Charging station management systems and Local Energy Management Systems network connectivity and information exchange

Part 2: Specific Data Model Mapping

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

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SUPERSEDES DOCUMENTS:

69/741A/NP, 69/751/RVN**IEC TC 69 : ELECTRICAL POWER/ENERGY TRANSFER SYSTEMS FOR ELECTRICALLY PROPELLED ROAD VEHICLES AND INDUSTRIAL TRUCKS**

SECRETARIAT:

Belgium

SECRETARY:

Mr Peter Van den Bossche

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC☐ ENVIRONMENT☐ QUALITY ASSURANCE☐ SAFETY

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- any relevant patent rights of which they are aware and to provide supporting documentation,
- any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "in some countries" clauses. See AC/22/2007.

TITLE:

<p>Local Charging station management systems and Local Energy Management Systems network connectivity and information exchange - Part 2 Specific Data Model Mapping</p>

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CONTENTS

FOREWORD.....	12
INTRODUCTION.....	14
1 Scope.....	15
2 Normative references	15
3 Terms and definitions	16
4 Reader's Guide	18
4.1 General.....	18
4.2 Reading the graphics	19
4.2.1 General	19
4.2.2 Hierarchy diagram	19
4.2.3 Sequence diagram.....	19
4.3 Finding the right information	20
5 Use Case Function (UCF) details.....	20
5.1 General.....	20
5.2 Mapping to SPINE	20
5.2.1 Concepts	20
5.2.2 UCF_AC_Measurement	38
5.2.3 UCF_Characteristics.....	80
5.2.4 UCF_Charging_Power_Limits	99
5.2.5 UCF_Consumption_Curve	103
5.2.6 UCF_Device_Configuration.....	115
5.2.7 UCF_Device_State	127
5.2.8 UCF_EV_Connected.....	131
5.2.9 UCF_Heartbeat	133
5.2.10 UCF_Identification	138
5.2.11 UCF_Incentive_Table	142
5.2.12 UCF_Load_Control	157
5.2.13 UCF_Manufacturer_Information	167
5.2.14 UCF_Maximum_Power_Limitation_Curve	172
5.2.15 UCF_Measurement.....	180
5.2.16 UCF_Power_Limit.....	187
5.2.17 UCF_Session_Summary	196
5.2.18 UCF_Setpoint.....	207
5.3 Mapping to ECHONET Lite	215
5.3.1 Concepts	215
5.3.2 UCF_Device_State	216
5.3.3 UCF_EV_Connected	220
5.3.4 UCF_Load_Control	221
5.3.5 UCF_Measurement.....	224
5.3.6 UCF_Operation_Mode	226
5.3.7 UCF_Power_Limit	230
Bibliography.....	234

Figure 1 – Overview of resources within IEC 63380-2

47	Figure 2 – Actor overview example	19
48	Figure 3 – Example communication sequence diagram	20
49	Figure 4 - Actor overview example	33
50	Figure 5 - Pre-Scenario communication - Detailed discovery sequence diagram	36
51	Figure 6 - Pre-Scenario communication - Binding sequence diagram	37
52	Figure 7 - Pre-Scenario communication - Subscription sequence diagram	38
53	Figure 8: Messaging sequence for UCF_AC_Measurement.....	39
54	Figure 9: UCF_AC_Measurement: Request Measurement/Measurement	
55	communication sequence diagram	40
56	Figure 10 - UCF_AC_Measurement: Request Electrical Connection Data/Electrical	
57	Connection Data communication sequence diagram	68
58	Figure 11 - Actor "Device " overview	79
59	Figure 12 - Actor "EMS" overview	80
60	Figure 13: Messaging sequence for UCF_Characteristics	81
61	Figure 14 - UCF_Characteristics: Request Characteristics/Characteristics	
62	communication sequence diagram	81
63	Figure 15 - Actor "Device" overview	97
64	Figure 16 - Actor "EMS" overview	98
65	Figure 17: Messaging sequence for UCF_Charging_Power_Limits.....	99
66	Figure 18: UCF_Charging_Power_Limits: Request Power Limits / Power Limits	
67	communication sequence diagram	100
68	Figure 19: Actor "Device" overview	102
69	Figure 20: Actor "EMS" overview	103
70	Figure 21: Messaging sequence for UCF_Consumption_Curve	104
71	Figure 22 - SPINE Sequence Diagram for Request Consumption Curve and	
72	Consumption Curve	105
73	Figure 23 - Actor "Device" overview	114
74	Figure 24 - Actor "EMS" overview	115
75	Figure 25: Messaging sequence for UCF_Device_Configuration	116
76	Figure 26 - UCF_Device Configuration: Request Device Configuration/Device	
77	Configuration Data communication sequence diagram	116
78	Figure 27 - UCF_Device Configuration: Notify Device Configuration Data	
79	communication sequence diagram	122
80	Figure 28 - UCF_Device Configuration: Write Device Configuration communication	
81	sequence diagram	124
82	Figure 29 - Actor "Device" overview	125
83	Figure 30 - Actor "EMS" overview	126
84	Figure 31: Messaging sequence for UCF_Device_State	127
85	Figure 32: SPINE Sequence Diagram for Device State	127
86	Figure 33: Actor "Device" overview	130
87	Figure 34: Actor "EMS" overview	131
88	Figure 35: Actor "Device" overview	132
89	Figure 36: Actor "EMS" overview	133
90	Figure 37: Messaging sequence for UCF_Heartbeat	133
91	Figure 38 - UCF_Heartbeat communication sequence diagram	134
92	Figure 39 - Actor "Device" overview	137

93	Figure 40 - Actor "EMS" overview	138
94	Figure 41: Messaging sequence for UCF_Identification.....	139
95	Figure 42 - UCF_Identification communication sequence diagram	139
96	Figure 43: Actor "Device" overview	141
97	Figure 44: Actor "EMS" overview	142
98	Figure 45: Messaging sequence for UCF_Incentive_Table.....	143
99	Figure 46 - SPINE Sequence Diagram for Read Incentive Table and Incentive Table.....	144
100	Figure 47 - SPINE Sequence Diagram for Write Incentive Table	151
101	Figure 48 - Actor "Device" overview	156
102	Figure 49 - Actor "EMS" overview	157
103	Figure 50: Messaging sequence for UCF_Load_Control.....	158
104	Figure 51: SPINE Sequence Diagram for Request Load Constraints and Load	
105	Constraints	159
106	Figure 52: SPINE Sequence Diagram for Load Constraints	164
107	Figure 53: SPINE Sequence Diagram for Load Control	165
108	Figure 54: UCF_Load_Control Actor "Device" overview	166
109	Figure 55: UCF_Load_Control Actor "EMS" overview.....	166
110	Figure 56: Messaging sequence for UCF_Manufacturer_Information.....	167
111	Figure 57: SPINE Sequence Diagram for Request Manufacturer Data and Manufacturer	
112	Data.....	168
113	Figure 58: Actor "Device" overview	171
114	Figure 59: Actor "EMS" overview	171
115	Figure 60: Messaging sequence for UCF_Maximum_Power_Limitation_Curve	172
116	Figure 61: SPINE Sequence Diagram for Request Max Power Limitation Curve and	
117	Max Power Limitation Curve	173
118	Figure 62: SPINE Sequence Diagram for Update Max Power Limitation Curve.....	177
119	Figure 63: Actor "Device" overview	179
120	Figure 64: Actor "EMS" overview	180
121	Figure 65: Messaging sequence for UCF_Measurement	180
122	Figure 66: SPINE Sequence Diagram for Request Measurement and Measurement	181
123	Figure 67: Actor "Device" overview	186
124	Figure 68: Actor "EMS" overview	187
125	Figure 69: Messaging sequence for UCF_Power_Limit	188
126	Figure 70 - UCF_Power_Limit: Read Active Power Limit/Current Active Power Limit	
127	communication sequence diagram	188
128	Figure 71 - UCF_Power_Limit: Notify Current Active Power Limit communication	
129	sequence diagram	193
130	Figure 72 - Actor "Device" overview	194
131	Figure 73 - Actor "EMS" overview	195
132	Figure 74: Messaging sequence for UCF_Session_Summary.....	197
133	Figure 75: SPINE Sequence Diagram for Request Session Summary and Session	
134	Summary	198
135	Figure 76: SPINE Sequence Diagram for Write Session Summary	203
136	Figure 77: Actor "Device" overview	206
137	Figure 78: Actor "EMS" overview	

138	Figure 79: Messaging sequence for UCF_Setpoint.....	207
139	Figure 80: SPINE Sequence Diagram for Request Setpoint and Setpoint.....	208
140	Figure 81: SPINE Sequence Diagram for Change Setpoint	213
141	Figure 82: Actor "Device" overview	214
142	Figure 83: Actor "EMS" overview	215
143	Figure 84:– ECHONET Lite frame format	216
144	Figure 85: ECHONET Lite Sequence Diagram for Request Device State and Device	
145	State.....	217
146	Figure 86: ECHONET Lite Sequence Diagram for EV Connected	220
147	Figure 87: ECHONET Lite Sequence Diagram for Load Control	222
148	Figure 88: ECHONET Lite Sequence Diagram for Request Measurement and	
149	Measurement.....	225
150	Figure 89: Messaging sequence for UCF_Operation_Mode.....	227
151	Figure 90: ECHONET Lite Sequence Diagram for Request Device State and Device	
152	State.....	227
153	Figure 91: ECHONET Lite Sequence Diagram for Power Limit	231
154		
155	Table 1 - Presence indication description.....	26
156	Table 2 - Example table for cardinality indications on Elements and list items.....	28
157	Table 3 - Content of an example table	32
158	Table 4 - Content of measurementDescriptionListData read at Actor EMS – Use Case	
159	"Monitoring of Power Consumption", "EV Charging Electricity Measurement".....	40
160	Table 5 - Content of measurementConstraintListData read at Actor EMS.....	41
161	Table 6 - Content of measurementListData read at Actor EMS.....	41
162	Table 7 - Content of measurementDescriptionListData reply or notify at Actor Device –	
163	Power, non-phase specific – Use Case "Monitoring of Power Consumption"	43
164	Table 8 - Content of measurementDescriptionListData reply or notify at Actor Device –	
165	Power, non-phase specific – Use Case "EV Charging Electricity Measurement".....	43
166	Table 9 - Content of measurementDescriptionListData reply or notify at Actor Device –	
167	Power, phase-specific – Use Case "Monitoring of Power Consumption"	44
168	Table 10 - Content of measurementConstraintsListData reply or notify at Actor Device	
169	– Power, non-phase specific – Use Case "Monitoring of Power Consumption"	45
170	Table 11 - Content of measurementConstraintsListData reply or notify at Actor Device	
171	– Power, non-phase specific – Use Case "EV Charging Electricity Measurement".....	45
172	Table 12 - Content of measurementConstraintsListData reply or notify at Actor Device	
173	– Power, phase-specific – Use Case "Monitoring of Power Consumption"	47
174	Table 13 - Content of measurementListData reply or notify at Actor Device – Power,	
175	non-phase specific – Use Case "Monitoring of Power Consumption"	48
176	Table 14 - Content of measurementListData reply or notify at Actor Device – Power,	
177	phase-specific – Use Case "Monitoring of Power Consumption".....	49
178	Table 15 - Content of measurementListData reply or notify at Actor Device – Power,	
179	phase-specific – Use Case "EV Charging Electricity Measurement"	49
180	Table 16 - Content of measurementDescriptionListData reply or notify at Actor Device	
181	– Energy consumed – Use Case "Monitoring of Power Consumption"	50
182	Table 17 - Content of measurementDescriptionListData reply or notify at Actor Device	
183	– Energy produced – Use Case "Monitoring of Power Consumption".....	51
184	Table 18 - Content of measurementDescriptionListData reply or notify at Actor Device	
185	– Use Case "EV Charging Electricity Measurement"	

186	Table 19 - Content of measurementConstraintsListData reply or notify at Actor Device	
187	– Energy consumed – Use Case "Monitoring of Power Consumption"	52
188	Table 20 - Content of measurementConstraintsListData reply or notify at Actor Device	
189	– Energy produced – Use Case "Monitoring of Power Consumption"	53
190	Table 21 - Content of measurementConstraintsListData reply or notify at Actor Device	
191	– Use Case "EV Charging Electricity Measurement"	54
192	Table 22 - Content of measurementListData reply or notify at Actor Device – Energy	
193	consumed – Use Case "Monitoring of Power Consumption"	55
194	Table 23 - Content of measurementListData reply or notify at Actor Device – Energy	
195	produced – Use Case "Monitoring of Power Consumption"	56
196	Table 24 - Content of measurementListData reply or notify at Actor Device – Use Case	
197	"EV Charging Electricity Measurement"	56
198	Table 25 - Content of measurementDescriptionListData reply or notify at Actor Device	
199	– Current – Use Case "Monitoring of Power Consumption"	57
200	Table 26 - Content of measurementDescriptionListData reply or notify at Actor Device	
201	– Current – Use Case "EV Charging Electricity Measurement"	58
202	Table 27 - Content of measurementConstraintsListData reply or notify at Actor Device	
203	– Current – Use Case "Monitoring of Power Consumption"	59
204	Table 28 - Content of measurementConstraintsListData reply or notify at Actor Device	
205	– Current – Use Case "EV Charging Electricity Measurement"	59
206	Table 29 - Content of measurementListData reply or notify at Actor Device – Current –	
207	Use Case "Monitoring of Power Consumption"	61
208	Table 30 - Content of measurementListData reply or notify at Actor Device – Current –	
209	Use Case "EV Charging Electricity Measurement"	61
210	Table 31 - Content of measurementDescriptionListData reply or notify at Actor Device	
211	– Voltage – Use Case "Monitoring of Power Consumption"	62
212	Table 32 - Content of measurementConstraintsListData reply or notify at Actor Device	
213	– Voltage – Use Case "Monitoring of Power Consumption"	63
214	Table 33 - Content of measurementListData reply or notify at Actor Device – Voltage –	
215	Use Case "Monitoring of Power Consumption"	64
216	Table 34 - Content of measurementDescriptionListData reply or notify at Actor Device	
217	– Frequency – Use Case "Monitoring of Power Consumption"	65
218	Table 35 - Content of measurementConstraintsListData reply or notify at Actor Device	
219	– Frequency – Use Case "Monitoring of Power Consumption"	66
220	Table 36 - Content of measurementListData reply or notify at Actor Device –	
221	Frequency – Use Case "Monitoring of Power Consumption"	67
222	Table 37 - Content of electricalConnectionParameterListData read at Actor EMS	68
223	Table 38 - Content of electricalConnectionDescriptionListData read at Actor EMS	69
224	Table 39 - Content of electricalConnectionDescriptionListData reply or notify at Actor	
225	Device – Use Case "Monitoring of Power Consumption"	69
226	Table 40 - Content of electricalConnectionDescriptionListData reply or notify at Actor	
227	Device – Use Case "EV Charging Electricity Measurement"	70
228	Table 41 - Content of electricalConnectionParameterDescriptionListData reply or notify	
229	at Actor Device – Power, non-phase specific	71
230	Table 42 - Content of electricalConnectionParameterDescriptionListData reply or notify	
231	at Actor Device – Power, non-phase specific – Use Case "EV Charging Electricity	
232	Measurement"	71
233	Table 43 - Content of electricalConnectionParameterDescriptionListData reply or notify	
234	at Actor Device – Power, phase-specific	72
235	Table 44 - Content of electricalConnectionParameterDescriptionListData reply or notify	
236	at Actor Device – Energy consumed – Use Case "Monitoring of Power Consumption"	73

237	Table 45: Content of electricalConnectionParameterDescriptionListData reply or notify	
238	at Actor Device – Energy produced – Use Case "Monitoring of Power Consumption"	73
239	Table 46: Content of electricalConnectionParameterDescriptionListData reply or notify	
240	at Actor Device – Use Case "EV Charging Electricity Measurement"	74
241	Table 47 - Content of electricalConnectionParameterDescriptionListData reply or notify	
242	at Actor Device – Current – Use Case "Monitoring of Power Consumption"	75
243	Table 48 - Content of electricalConnectionParameterDescriptionListData reply or notify	
244	at Actor Device – Current – Use Case "EV Charging Electricity Measurement"	75
245	Table 49 - Content of electricalConnectionParameterDescriptionListData reply or notify	
246	at Actor Device – Voltage – Use Case "Monitoring of Power Consumption"	77
247	Table 50 - Content of electricalConnectionParameterDescriptionListData reply or notify	
248	at Actor Device – Frequency – Use Case "Monitoring of Power Consumption"	78
249	Table 51 - Actor naming for "Device"	79
250	Table 52 - Actor naming for "EMS"	80
251	Table 53: Content of electricalConnectionCharacteristicListData read at Actor EMS –	
252	Use Cases "Limitation of Active Power Consumption", "EV State of Charge", "Dynamic	
253	Bidirectional EV Charging, Scenario 3"	81
254	Table 54: Content of electricalConnectionCharacteristicListData reply or notify at Actor	
255	Device – Use Case "Limitation of Power Consumption"	83
256	Table 55: Content of electricalConnectionCharacteristicListData reply or notify at Actor	
257	Device – Use Case "EV State of Charge"	89
258	Table 56: Content of electricalConnectionCharacteristicListData reply or notify at Actor	
259	Device – Use Case "Dynamic Bidirectional EV Charging"	91
260	Table 57 - Actor naming for "Device"	97
261	Table 58 - Actor naming for "EMS"	98
262	Table 59: Information content for electricalConnectionParameterDescriptionListData	
263	read at Actor EMS	100
264	Table 60: Information content for electricalConnectionPermittedValueSetListData read	
265	at Actor EMS	100
266	Table 61: Information content for electricalConnectionParameterDescriptionListData	
267	reply at Actor Device – Use Case "EV Commissioning and Configuration"	101
268	Table 62: Information content for electricalConnectionPermittedValueSetListData reply	
269	at Actor Device – Use Case "EV Commissioning and Configuration"	101
270	Table 63 - Information content for timeSeriesDescriptionListData read at Actor EMS –	
271	Use Case "Coordinated EV Charging", Scenario 1	105
272	Table 64 - Information content for timeSeriesDescriptionListData read at Actor EMS –	
273	Use Case "Coordinated EV Charging", Scenario 4	106
274	Table 65 - Information content for timeSeriesDescriptionListData read at Actor EMS –	
275	Use Case "Dynamic Bidirectional EV Charging", Scenario 2	106
276	Table 66 - Information content for timeSeriesListData read at Actor EMS (all cases)	106
277	Table 67 - Information content for timeSeriesDescriptionListData reply at Actor Device	
278	– Use Case "Coordinated EV Charging"	107
279	Table 68 - Information content for timeSeriesDescriptionListData reply at Actor Device	
280	– Use Case "Dynamic Bidirectional EV Charging"	107
281	Table 69 - Information content for timeSeriesListData reply at Actor Device – Use Case	
282	"Coordinated EV Charging"	108
283	Table 70 - Information content for timeSeriesListData reply at Actor Device – Use Case	
284	"Dynamic Bidirectional EV Charging"	111
285	Table 71 - Actor naming for "Device"	113
286	Table 72 - Actor naming for "EMS"	114

287	Table 73 - Content of deviceConfigurationKeyValueDescriptionListData read at Actor	
288	EMS	117
289	Table 74 - Content of deviceConfigurationKeyValueListData read at Actor EMS	117
290	Table 75 - Content of deviceConfigurationKeyValueDescriptionListData reply or notify	
291	at Actor Device – failsafeConsumptionActivePowerLimit – Use Case "Limitation of	
292	Power Consumption"	118
293	Table 76 - Content of deviceConfigurationKeyValueDescriptionListData reply or notify	
294	at Actor Device – failsafeDurationMinimum – Use Case "Limitation of Power	
295	Consumption"	119
296	Table 77 - Content of deviceConfigurationKeyValueDescriptionListData reply or notify	
297	at Actor Device – Use Case "EV Commissioning and Configuration"	119
298	Table 78 - Content of deviceConfigurationKeyValueDescriptionListData reply or notify	
299	at Actor Device – Use Case "Dynamic Bidirectional EV Charging"	120
300	Table 79 - Content of deviceConfigurationKeyValueListData reply or notify at Actor	
301	Device – Use Case "Limitation of Power Consumption"	120
302	Table 80 - Content of deviceConfigurationKeyValueListData reply or notify at Actor	
303	Device – Use Case "EV Commissioning and Configuration"	121
304	Table 81 - Content of deviceConfigurationKeyValueListData reply or notify at Actor	
305	Device – Use Case "Dynamic Bidirectional EV Charging"	122
306	Table 82 - Content of deviceConfigurationKeyValueListData write at Actor EMS – Use	
307	Case "Limitation of Power Consumption" for Failsafe Duration Minimum	123
308	Table 83 - Content of deviceConfigurationKeyValueListData write at Actor EMS – Use	
309	Case "Limitation of Power Consumption" for Failsafe Duration Minimum	123
310	Table 84 - Actor naming for "Device"	125
311	Table 85 - Actor naming for "EMS"	126
312	Table 86: Information content for deviceDiagnosisStateData reply at Actor EMS – Use	
313	Cases "Overload Protection by EV Charging Current Curtailment", "Optimization of	
314	Self-Consumption during EV Charging"	128
315	Table 87: Information content for deviceDiagnosisStateData reply at Actor EMS – Use	
316	Case "EV Commissioning and Configuration"	128
317	Table 88: Information content for deviceDiagnosisStateData reply at Actor EMS – Use	
318	Case "Coordinated EV Charging"	128
319	Table 89: Information content for deviceDiagnosisStateData reply at Actor EMS – Use	
320	Case "Charging Station Commissioning and Configuration"	129
321	Table 90: Resource Names for UCF_Device_State, Actor "Device"	129
322	Table 91: Resource Names for UCF_Device_State, Actor "EMS"	130
323	Table 92 - Content of deviceDiagnosisHeartbeatData read at Actor Device or EMS	134
324	Table 93 - Content of deviceDiagnosisHeartbeatData reply or notify at Actor Device or	
325	EMS	135
326	Table 94 - Actor naming for "Device"	136
327	Table 95 - Actor naming for "EMS"	137
328	Table 96 - Information content for identificationListData read at Actor EMS	140
329	Table 97 - Information content for identificationListData reply or notify at Actor Device	
330	– Use Case "EV Commissioning and Configuration"	140
331	Table 98 - Information content for incentiveTableDescriptionData read at Actor EMS	144
332	Table 99 - Information content for incentiveTableConstraintsData read at Actor EMS	145
333	Table 100 - Information content for incentiveTableData read at Actor EMS	145
334	Table 101 - Information content for incentiveTableDescriptionData reply at Actor	
335	Device – Use Case "Coordinated EV Charging"	145

336	Table 102 - Information content for incentiveTableConstraintsData reply at Actor	
337	Device – Use Case "Coordinated EV Charging"	148
338	Table 103 - Information content for incentiveTableData reply at Actor Device Use Case	
339	– "Coordinated EV Charging"	148
340	Table 104 - Information content for incentiveTableDescriptionData write at Actor EMS	
341	–Use Case "Coordinated EV Charging"	151
342	Table 105 - Information content for incentiveTableData write at Actor EMS Use Case –	
343	"Coordinated EV Charging"	153
344	Table 106 - Resource Names for UCF_Incentive_Table Actor "Device"	156
345	Table 107 - Resource Names for UCF_Incentive_Table Actor "EMS"	157
346	Table 108: Information content for loadControlLimitDescriptionListData read at Actor	
347	EMS	159
348	Table 109: Information content for loadControlLimitListData read at Actor EMS	160
349	Table 110: Information content for electricalConnectionParameterDescriptionListData	
350	read at Actor EMS	160
351	Table 111: Information content for electricalConnectionPermittedValueSetListData	
352	read at Actor EMS	160
353	Table 112: Information content for loadControlLimitDescriptionListData reply at Actor	
354	Device – Use Case "Overload Protection by EV Charging Current Curtailment", and	
355	"Optimization of Self-Consumption during EV Charging"	161
356	Table 113: Information content for loadControlLimitDescriptionListData reply at Actor	
357	Device – Use Case "Overload Protection by EV Charging Current Curtailment", and	
358	"Optimization of Self-Consumption during EV Charging"	161
359	Table 114: Information content for electricalConnectionParameterDescriptionListData	
360	reply at Actor Device – Use Case "Overload Protection by EV Charging Current	
361	Curtailment", and "Optimization of Self-Consumption during EV Charging"	162
362	Table 115: Information content for electricalConnectionPermittedValueSetListData	
363	reply at Actor Device – Use Case "Overload Protection by EV Charging Current	
364	Curtailment", and "Optimization of Self-Consumption during EV Charging"	163
365	Table 116: Information content for loadControlLimitListData write at Actor – Use Case	
366	"Overload Protection by EV Charging Current Curtailment", and "Optimization of Self-	
367	Consumption during EV Charging"	164
368	Table 117: Resource Names for UCF_Load_Control Actor "Device"	165
369	Table 118: Information content for deviceClassificationManufacturerData read at Actor	
370	EMS	168
371	Table 119: Information content for deviceClassificationManufacturerData reply at Actor	
372	Device – Use Case "EV Commissioning and Configuration"	168
373	Table 120: Information content for deviceClassificationManufacturerData reply at Actor	
374	Device – Use Case "Charging Station Commissioning and Configuration"	169
375	Table 121: Resource Names for UCF_Manufacturer_Information Actor "Device"	170
376	Table 122: Information content for timeSeriesDescriptionListData read at Actor EMS	173
377	Table 123: Information content for timeSeriesConstraintsListData read at Actor EMS	173
378	Table 124: Information content for timeSeriesListData read at Actor EMS	174
379	Table 125: Information content for timeSeriesDescriptionListData reply at Actor Device	
380	– Use Case "Coordinated EV Charging"	174
381	Table 126: Information content for timeSeriesConstraintsListData reply at Actor	
382	Device– Use Case "Coordinated EV Charging"	175
383	Table 127: Information content for timeSeriesListData reply at Actor Device – Use	
384	Case "Coordinated EV Charging"	176

385	Table 128: Information content for timeSeriesListData write at Actor EMS – Use Case	
386	"Coordinated EV Charging"	177
387	Table 129: Resource Names for UCF_Maximum_Power_Limitation_Curve Actor	
388	"Device"	179
389	Table 130: Information content for measurementDescriptionListData read at Actor EMS.....	181
390	Table 131: Information content for measurementConstraintListData read at Actor EMS	182
391	Table 132: Information content for measurementListData read at Actor EMS	182
392	Table 133: Information content for measurementDescriptionListData reply at Actor	
393	Device – Use Case "EV State of Charge"	183
394	Table 134: Information content for measurementConstraintsListData reply at Actor	
395	Device – Use Case "EV State of Charge"	183
396	Table 135: Information content for measurementListData reply at Actor Device – Use	
397	Case "EV State of Charge"	184
398	Table 136: Resource Names for UCF_AC_Measurement Actor "Device"	186
399	Table 137: Resource Names for UCF_Measurement Actor "EMS"	186
400	Table 138 - Content of loadControlLimitDescriptionListData read at Actor EMS Use	
401	Cases – "Limitation of Active Power Consumption"	189
402	Table 139 - Content of loadControlLimitListData read at Actor EMS – Use Cases	
403	"Limitation of Active Power Consumption"	189
404	Table 140 - Content of loadControlLimitDescriptionListData reply or notify at Actor	
405	Device – Use Case "Limitation of Power Consumption"	190
406	Table 141 - Content of loadControlLimitListData reply or notify at Actor Device – Use	
407	Cases "Limitation of Power Consumption"	191
408	Table 142 - Content of loadControlLimitListData write at Actor EMS– Use Case	
409	"Limitation of Power Consumption"	193
410	Table 143 - Resource Names for UCF_Measurement Actor "Device"	194
411	Table 144: Information content for billDescriptionListData read at Actor Device	198
412	Table 145: Information content for billConstraintsListData read at Actor Device	199
413	Table 146: Information content for billListData read at Actor Device	199
414	Table 147: Information content for billDescriptionListData reply at Actor EMS – Use	
415	Cases "EV Charging Summary"	199
416	Table 148: Information content for billConstraintsListData reply at Actor EMS – Use	
417	Cases "EV Charging Summary"	200
418	Table 149: Information content for billListData reply at Actor EMS– Use Cases "EV	
419	Charging Summary"	201
420	Table 150: Information content for billListData write at Actor EMS– Use Cases "EV	
421	Charging Summary"	203
422	Table 151: Information content for setpointDescriptionListData read	208
423	Table 152: Information content for setpointConstraintsListData read at Actor EMS	208
424	Table 153: Information content for setpointListData read at Actor EMS	209
425	Table 154: Information content for setpointDescriptionListData reply at Actor Device –	
426	Use Cases "Dynamic Bidirectional EV Charging"	209
427	Table 155: Information content for setpointConstraintsListData reply at Actor Device –	
428	Use Cases "Dynamic Bidirectional EV Charging"	210
429	Table 156: Information content for setpointListData reply at Actor Device – Use Cases	
430	"Dynamic Bidirectional EV Charging"	211
431	Table 157: Information content for setpointListData write at Actor EMS – Use Cases	
432	"Dynamic Bidirectional EV Charging"	212
433	Table 158 - Resource Names for UCF_Setpoint Actor "Device"	214

434	Table 159 - Resource Names for UCF_Setpoint Actor "EMS".....	214
435	Table 160: Information content for "read" message – Use Case "Basic EV	
436	Charging/Discharging"	217
437	Table 161: Information content for "write" message – Use Case "Basic EV	
438	Charging/Discharging"	218
439	Table 162: Information content for "response" message – Use Case "Basic EV	
440	Charging/Discharging"	218
441	Table 163: Information content for "notification" message – Use Case "Basic EV	
442	Charging/Discharging"	219
443	Table 164: Information content for "response" message – Use Case "Basic EV	
444	Charging/Discharging"	219
445	Table 165: Information content for "notification" message – Use Case " EV	
446	Commissioning and Configuration"	220
447	Table 166: Information content for "write" message – Use Case "Basic EV	
448	Charging/Discharging"	222
449	Table 167: Information content for "response" message – Use Case "Basic EV	
450	Charging/Discharging"	223
451	Table 168: Information content for "read" message – Use Case "Basic EV	
452	Charging/Discharging"	223
453	Table 169: Information content for "response" message – Use Case "Basic EV	
454	Charging/Discharging"	224
455	Table 170: Information content for "notification" message – Use Case "Basic EV	
456	Charging/Discharging"	224
457	Table 171: Information content for "read" message – Use Case " EV State of Charge"	225
458	Table 172: Information content for "response" message – Use Case " EV State of	
459	Charge"	226
460	Table 173: Information content for "read" message – Use Case "Basic EV	
461	Charging/Discharging"	228
462	Table 174: Information content for "response" message – Use Case "Basic EV	
463	Charging/Discharging"	228
464	Table 175: Information content for "notification" message – Use Case "Basic EV	
465	Charging/Discharging"	229
466	Table 176: Information content for "write" message – Use Case "Basic EV	
467	Charging/Discharging"	229
468	Table 177: Information content for "response" message – Use Case "Basic EV	
469	Charging/Discharging"	230
470	Table 178: Information content for "read" message – Use Case "Basic EV	
471	Charging/Discharging"	231
472	Table 179: Information content for "response" message – Use Case "Basic EV	
473	Charging/Discharging"	232
474	Table 180: Information content for "write" message – Use Case "Basic EV	
475	Charging/Discharging"	232
476	Table 181: Information content for "response" message – Use Case "Basic EV	
477	Charging/Discharging"	233

478

479

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

STANDARD INTERFACE FOR CONNECTING CHARGING POINTS AND/OR CHARGING STATIONS TO LOCAL ENERGY MANAGEMENT SYSTEMS

Part 2: Specific Data Model Mapping

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IEC 63380 has been prepared by subcommittee PT63380: Local Charging station management systems, of IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is an International Standard.

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

Draft	Report on voting
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533
534 Full information on the voting for its approval can be found in the report on voting indicated in
535 the above table.

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

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

541 The committee has decided that the contents of this document will remain unchanged until the
542 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
543 specific document. At this date, the document will be

- 544 • reconfirmed,
545 • withdrawn,
546 • replaced by a revised edition, or
547 • amended.

548

549

INTRODUCTION

550 The expansion of renewable energy and the simultaneous reduction in conventional generation
551 result in new power flows and loads on the equipment in the grid and at the house connection
552 point. At the same time, electrical consumers with high power consumption are increasingly
553 being installed in low-voltage systems in private customer systems. These include charging
554 systems for electric vehicles and heat pumps. These two developments can temporarily lead to
555 peak loads and bottlenecks in the network. An expansion of the distribution grids for the
556 comparatively few hours of high simultaneous power consumption is not considered
557 economically sensible. The legislator has therefore introduced the concept of "network-friendly
558 control of controllable consumer devices".

559 It is crucial to define a standardized interface for the connected consumers and generating
560 facilities, which also includes the charging infrastructure for electric vehicles. When developing
561 a local, standardized interface, a fundamental distinction must be made between the terms
562 power and energy management.

563 In order to avoid an overload and the associated emergency shutdown due to specified power
564 limits in the property while all consumers are drawing electricity at the same time - especially
565 heating and air conditioning technology as well as charging infrastructure - power management
566 is of great urgency. This allows the maximum load at the grid connection point to be reduced.
567 Accordingly, priority must be given to local power management over, for example, optimization
568 of operations and tariffs or desired charging plans.

569 In addition to the above-described goal of power management, the further goal of procurement-
570 or tariff-optimized operation can be pursued within the performance limits specified by the
571 infrastructure – controlled by the energy management system. Accordingly, a charging
572 infrastructure should be able to transmit information about procurement and tariff-optimized
573 operation from the local energy management of the property to the electric vehicle so that it
574 can coordinate its charging plan according to local requirements. Such coordination is
575 particularly necessary if generating systems (e.g. solar system, combined heat and power plant)
576 are used within the property in order to achieve the highest possible self-consumption of
577 electricity.

578 The long-term goal is to buffer power and energy bottlenecks within a property using the energy
579 stored in the vehicle, which also brings the topic of energy recovery into focus and should be
580 taken into account when developing a standardized interface for local power and energy
581 management.

582 The aim of this document is to define a standard interface for connecting charging points and/or
583 charging stations to local energy management system.

STANDARD INTERFACE FOR CONNECTING CHARGING POINTS AND/OR CHARGING STATIONS TO LOCAL ENERGY MANAGEMENT SYSTEMS

Part 2: Specific Data Model Mapping

1 Scope

This document defines the secure information exchange between Local Charging Station Management Systems (LCSMS), which may be part of charging stations or implemented as separate local (or cloud-based) systems, and local Energy Management Systems/Customer Energy Managers (EMS/CEM) in homes and buildings.

It will specify use cases, the sequences of information exchange, the data models and the communication protocols to use and shall cover all aspects of local energy management of charging stations. It will be based on the needs of energy transfer aspects, information exchange and data models defined in the IEC 63110 series, ensuring interoperability of in-building appliances as well as charging stations on the one hand, and local EMS/CEM on the other.

This document does not cover the secure information exchange between the charging station and the IT backend system(s), such as the management of energy transfer of the charge session, contractual and billing data, provided by the IT backend. Neither does it cover the information exchange over any other interfaces defined in IEC 63110-1.

While IEC 63110-1 covers scenarios where there is a charging infrastructure backend, this document (IEC 63380) will cover cases where such a backend is not involved.

The series will consist of the following structure, describing the interface between LCSMS and local energy management systems from the LCSMS perspective.

- Part -1 General Requirements, Use Cases and abstract Messages
- Part -2 Specific Data Model Mapping
- Part -3 Communication Protocol and Cybersecurity Specific Aspects
- Part -4 Test Specifications

This part of IEC 63380 maps the generic use case functions defined in IEC 63380-1 to specific data model.

2 Normative references

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

IEC 61851-1:2017: Electric vehicle conductive charging system - Part 1: General requirements

ISO 15118-2:2014: Road vehicles -- Vehicle-to-Grid Communication Interface -- Part 2: Network and application protocol requirements

ISO 15118-20 Road vehicles — Vehicle to grid communication interface — Part 20: 2nd generation network layer and application layer requirements

626 E DIN EN 63110-1:2019-02 VDE 0122-110-1. Protocol for Management of Electric Vehicles
627 charging and discharging infrastructures - Part 1: Basic Definitions, Use Cases and
628 architectures.

629 **3 Terms and definitions**

630 IEC maintain terminological databases for use in standardization at the following addresses:

- 631 • IEC Electropedia: available at <http://www.electropedia.org/>

632 For the purposes of this document, the following terms and definitions apply.

633 **3.1**

634 **actor**

635 entity that communicates and interacts [1].

636 **3.2**

637 **binding**

638 concept for connecting functionally matching features

639

640 **3.3**

641 **client**

642 role that specifies that a node uses data from a "server" or can request for change

643

644 **3.4**

645 **data model**

646 definition of possible data (data structures, values) for the exchange of information (especially for
647 communications systems)

648

649 **3.5**

650 **device**

651 <specific node> SPINE node that can include a set of entities

652 Note 1 to entry: It has a "deviceType". With regard to the hierarchy of SPINE nodes a device is a root
653 node for all functionalities offered by a device.

654 **3.6**

655 **device**

656 <address information> SPINE address part for the (physical) device

657 Note 1 to entry: The address part shall be written between quotation marks, e.g., "device"

658

659 **3.7**

660 **discovery**

661 process of finding appropriate partners for communication. Dependent on the context this can
662 be either finding other devices or examination of a device's potential functionalities

663 **3.8**

664 **Energy Management System (EMS)**

665 system used to monitor and control the energy consuming devices in a building. Within this
666 document, "energy management system" always refers to a customer/facility energy
667 management system and not a utility energy management system [2]. EMS may also be based
668 on EN 50941-12-2 concept [3].

669 Note 1 to entry: For the purposes of this document, either a device located in a user's home or property,
670 or a cloud application. The energy manager enables energy-optimized operation of the devices connected
671 to it by harmonizing energy demand and availability.

3.9**entity**

<specific node> SPINE node that can include a set of (sub-)entities or features

Note 1 to entry: It has an “entityType”. With regard to the hierarchy of SPINE nodes an entity is a sub-element of a device.

3.10**entity**

<address information> SPINE address part for the (logical) entity

Note 1 to entry: The address part shall be written between quotation marks, e.g., “entity”

3.11**feature**

<specific node> SPINE node that can include a set of functions (of a class)

Note 1 to entry: It has a “featureType”. With regard to the hierarchy of SPINE nodes a feature is a sub-element (i.e. “child”) of an entity.

3.12**feature**

<address information> SPINE address part for one feature

Note 1 to entry: The address part shall be written between quotation marks, e.g., “feature”.

3.13**function**

smallest structure to model “actual data” (“functional data”), i.e. functions usually consist of child elements that each hold an information (e.g. “timestamp”, “value”, etc.)

Note 1 to entry: Information between communication partners is exchanged via the exchange of a function (as part of a so-called “payload”).

3.14**local EMS**

see EMS.

Note 1 to entry: “Local” refers to the area of operation of the EMS, but not its location; the EMS can reside in an on-site device as well as in the cloud.

3.15**role**

each Feature has a functional role, usually either “server” (data owner) or “client”. For some special features (e.g. NodeManagement) the role “special” is defined

3.16**scenario**

sequence of steps that are taken to change the state from that before the scenario to that immediately after the scenario [4]

Note 1 to entry: For the purposes of this document, part of a use case. Dividing a use case into scenarios helps the reader to understand the use case more quickly. Some scenarios are mandatory for a use case, while others may be recommended or optional.

3.17**scope type**

feature type that defines scope types for identifying specific functionalities unambiguously (e.g., overloadProtection)

3.18

server

role that specifies that a node offers own data to be read or written by a node with role client. A server can notify its data to other nodes (with role client)

3.19

subscription

concept that enables the receiving of messages of interest from another device without polling it

3.20

use case

specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system

3.21

use case function

Functions which group basic functionalities that had been derived from use cases.

Note 1 to entry: These functions provide the entire information exchange required to implement the considered use cases and user stories.

3.22

user story

complete (but specific) business case described from the perspective of a user; can be separated into several use cases; e.g. "The user wants to simply charge her/his EV at home"

4 Reader's Guide

4.1 General

This document defines the mapping of neutral messages to examples of typical data models like SPINE, and ECHONET Lite. Specifically, it describes SPINE Resources and ECHONET Lite Resources mapped from the high-level Use Case Functions described in IEC 63380-1 as shown in Figure 1.

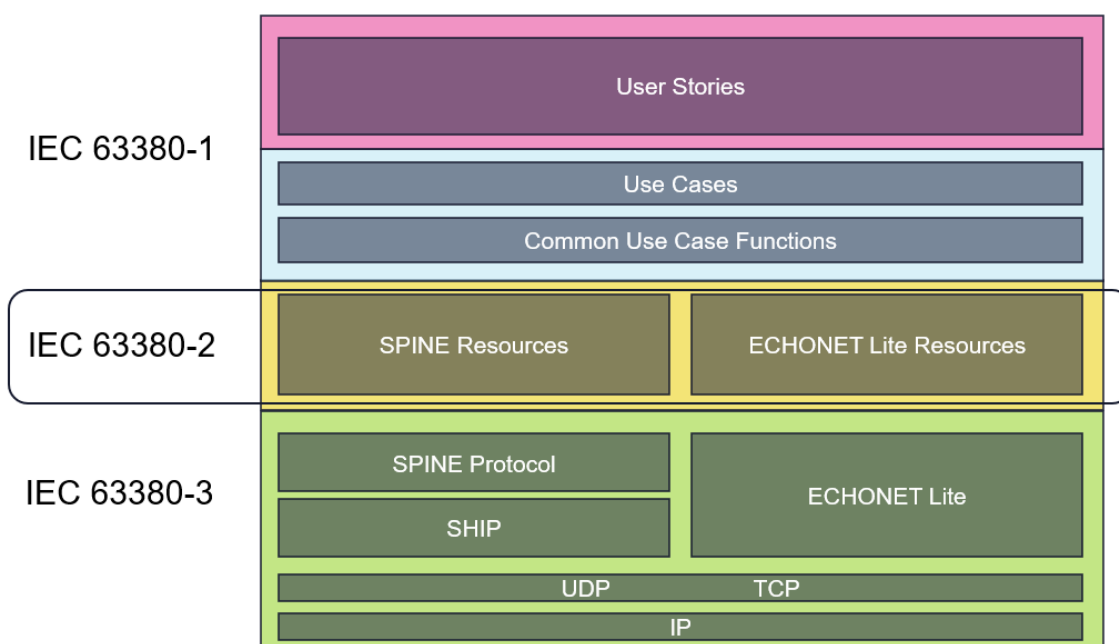


Figure 1 – Overview of resources within IEC 63380-2

4.2 Reading the graphics

4.2.1 General

This document contains several graphical representations based on PlantUML [5]. In order to facilitate their interpretation by readers unfamiliar with UML, the following provides an introduction.

4.2.2 Hierarchy diagram

Within the "Actor [...]" overview diagrams in the "Actors" sub-sections the complete functionality of this Use Case is provided. The Actor MAY have more functionality implemented than needed for this Use Case. For the following Actor overview example in Figure 2, a brief description of the graphical symbols will be described.

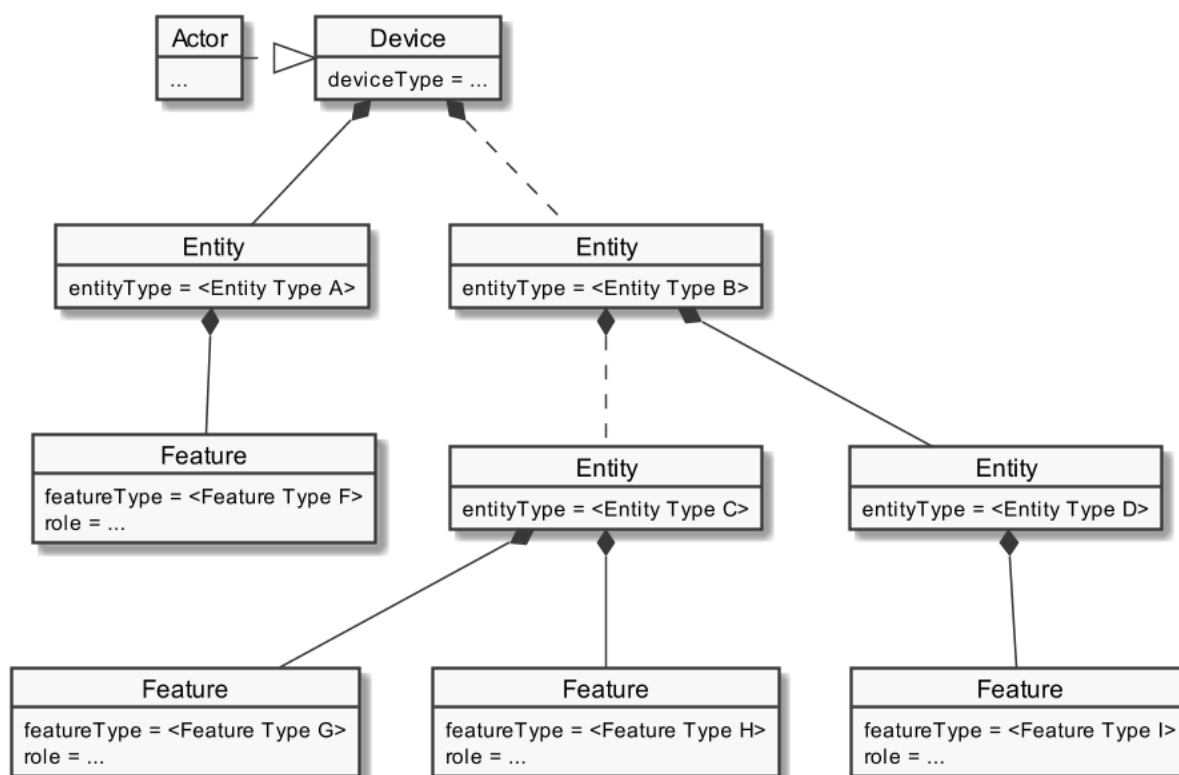


Figure 2 – Actor overview example

The solid lines in the figure represent an immediate parent-childhood relation: The Entity with "<Entity Type A>" is a direct child of "Device". The Entity with "<Entity Type D>" is a direct child of the Entity with "<Entity Type B>". All Features are immediate child of the respective Entity.

The dashed lines in the figure express that there MAY be additional Entities between the shown Entities: A vendor's implementation MAY have one or more Entities between "Device" and the Entity with "<Entity Type B>". Likewise, a vendor's implementation MAY have one or more Entities between the Entity with "<Entity Type B>" and the Entity with "<Entity Type D>".

4.2.3 Sequence diagram

Communication sequence diagrams visualize the messages sent between actors as part of a use case function or scenario, as shown in Figure 3.

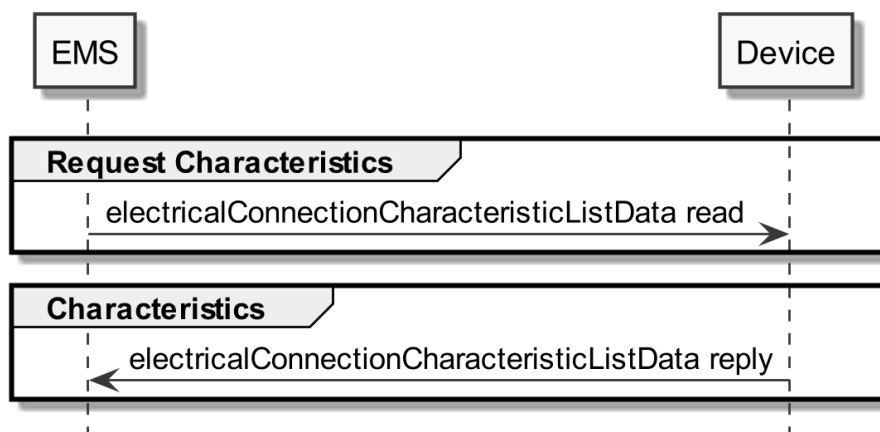


Figure 3 – Example communication sequence diagram

The participating actors are represented by rectangles with their names at the top of the diagram (and optionally at the bottom), as well as by a connecting vertical line.

Horizontal arrows indicate the types of messages sent as well as their direction. In the above example, the first message is a read command of the data structure called "electricalConnectionCharacteristicListData" initiated by the EMS and sent to the Device; the second message is the Device's reply. Note that time always flows from top to bottom.

4.3 Finding the right information

The Use Case Functions are described in section 5. Each Use Case Function is documented in detail as a SPINE or ECHONET Lite reference solution.

5 Use Case Function (UCF) details

5.1 General

In the following, the mapping of the use case functions from IEC 63380-1 to SPINE and ECHONET Lite is described. Specifically, it describes SPINE Resources and ECHONET Lite Resources mapped from the high-level Use Case Functions.

5.2 Mapping to SPINE

5.2.1 Concepts

5.2.1.1 General rules and information

5.2.1.1.1 Underlying technology documents

This technical solution relies on the SPINE and the SHIP protocols as transport protocol (see IEC 63380-3).

5.2.1.1.2 Use Case Discovery rules

5.2.1.1.2.1 Charging Station Commissioning and Configuration

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "evseCommissioningAndConfiguration". The string content SHALL only be defined by this Use Case.

- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.1.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.2 Coordinated EV Charging

Use Case Discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "coordinatedEvCharging". The string content SHALL only be defined by this Use Case.
- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.1.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.3 EV Charging Electricity Measurement

The Use Case Discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case Discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "measurementOfElectricityDuringEvCharging". The string content SHALL only be defined by this Use Case.

- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case Discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.1".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.4 EV Charging Summary

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "evChargingSummary". The string content SHALL only be defined by this Use Case.
- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.1.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.5 EV Commissioning and Configuration

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "evCommissioningAndConfiguration". The string content SHALL only be defined by this Use Case.

- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.1".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.6 EV State of Charge

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "evStateOfCharge". The string content SHALL only be defined by this Use Case.
- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.7 Limitation of Active Power Consumption

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "limitationOfPowerConsumption". The string content SHALL only be defined by this Use Case.

- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.8 Monitoring of Active Power Consumption

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "monitoringOfPowerConsumption". The string content SHALL only be defined by this Use Case.
- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.9 Optimization of Self-Consumption during EV Charging

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case Discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "optimizationOfSelfConsumptionDuringEvCharging". The string content SHALL only be defined by this Use Case.

- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case Discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.1".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.10 Overload Protection by EV Charging Current Curtailment

The Use Case Discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case Discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "overloadProtectionByEvChargingCurrentCurtailment". The string content SHALL only be defined by this Use Case.
- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case Discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.1".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.11 Dynamic Bidirectional EV Charging

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be "dynamicBidirectionalEvCharging". The string content SHALL only be defined by this Use Case.

- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to SPINE Protocol in IEC 63380-3) to "1.0.0".
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.3 Rules for " Information content" tables

5.2.1.1.3.1 General presence indication definitions

Abbreviations for the presence indication of Elements listed in Table 1 are defined as follows:

Table 1 - Presence indication description

Abbreviation	Meaning	Link to requirement keywords
M	Mandatory	SHALL
R	Recommended	SHOULD
O	Optional	MAY
F	Forbidden	SHALL NOT

An Actor MAY support Elements that are not listed in the tables. However, another Actor MAY ignore these Elements.

The presence indications "M", "R" and "O" are always meant relative to the respective parent Element. I.e. if a parent Element is optional ("O") and a child is mandatory ("M") the child Element can only be present if the parent Element is present as well.

NOTE The indications and the aforementioned rules apply for "complete messages" (so-called "full function exchange", please refer to SPINE Protocol in IEC 63380-3). In contrast, the so-called "restricted function exchange" is designed to permit exchange of specific excerpts of data, i.e. fewer Elements than potentially available from the data owner (partially even not all "mandatory" Elements).

In some cases, an Element may have a double presence indication, separated by a colon. Examples:

M, O

M W, O W

The description (rules) of the Element details in such a case the presence requirement. A typical example is a list-based Element where the "first" (or "last") Element has a different presence requirement than the other list Elements.

5.2.1.1.3.2 Presence indications for "Content of Specialization..." tables

This section only defines rules for the client side.

Elements that are marked with "M" SHALL be supported by the client in case of readable as well as writeable data. This Element may be optional on the server side.

The following applies for readable data that is exchanged in a "read/reply" or "notify" operation:

- "R" means that the data SHOULD be supported by the client. In other words: If the server responds with the according Element, the client SHOULD be able to interpret the according Elements.
- "O" means that the data MAY be supported by the client. In other words: If the server responds with the according Element, the client MAY be able to interpret the according Elements.

The following applies for writeable data that is exchanged in a "write" operation:

- "R" means that the data SHOULD be written by the client.
- "O" means that the data MAY be written by the client.
- "F" means that the data SHALL NOT be written by the client.

The following applies for Elements that are not listed in the Actor section:

- In case of a received "reply" message: The client MAY ignore the Element.
- In case of a "write" operation to be created: The client MAY set the Element but SHALL consider that the server may ignore the Element.
- In case of a received "notify" message: The client MAY ignore the Element.

M, R or O may be combined with the suffix "(event)" to express that a supported Element or value only has to be supported during a certain event and hence does not need to be present at all times. If the event is not active the Element may be omitted, or another value may be set. In most cases a High-Level requirement reference for the event is given in the rules column.

5.2.1.1.3.3 Presence indications for "Content of Function..." tables

This section only defines rules for the server side.

Elements that are marked with "M" SHALL be supported by the server in case of readable as well as writeable data. In case of writeable data (marked with "M \W") the server does not need to set the Element, because the Element is set only by the client.

The following applies for readable data that is exchanged in a "read/reply" or "notify" operation:

- "R" means that the data SHOULD be provided by the server.
- "O" means that the data MAY be provided by the server.
- "F" means that the data SHALL NOT be provided by the server.

The following applies for writeable data that is exchanged in a "write" operation:

- "R" means that the data SHOULD be supported. In other words: If the client writes the Element, the server SHOULD accept those messages and the contained Elements.
- "O" means that the data MAY be supported. In other words: If the client writes the Element, the server MAY accept those messages and the contained Elements.

The following applies for Elements that are not listed in the Actor section:

- In case of a received "read" request: The according Element MAY be set in the reply.
- In case of a received "write" operation: The server MAY ignore the Element.
- In case of a "notify" operation to be created: The server MAY set the Element.

NOTE The server will only accept write operations if the result fulfils the server Function requirements (permitted values, e.g.). Write operations on Elements that are not writeable MAY result in an error message.

M, R or O may be combined with the suffix "(event)" to express that a supported Element or value only has to be supported during a certain event and hence does not need to be present at all times. If the event is not active the Element may be omitted or another value may be set. In most cases a High-Level requirement reference for the event is given in the rules column.

5.2.1.1.3.4 Cardinality indications on Elements and list items

A cardinality indication on an Element or list item expresses constraints on the number of occurrences of a given Element or data set. In this section we use "X" as representation for such an Element or data set. Furthermore, "a" and "b" represent constraints. The following rules apply for the occurrence of "X" and its content related to a specific Scenario (see note underneath the list):

1. X
No cardinality indication.
2. X (a..b)
This means "X" SHALL occur at least "a" times and at maximum "b" times.
3. X (a..
This means "X" SHALL occur at least "a" times and MAY occur more than "a" times.
4. X (..b)
This means "X" SHALL occur at maximum "b" times and MAY occur less than "b" times (even zero occurrences are permissive).

NOTE These rules apply only under consideration of presence indications and with regards to the given Scenario or Function definition for the Use Case.

Table 2 is an example to explain this for two different placements.

Table 2 - Example table for cardinality indications on Elements and list items

Scenario {...}: M/R/O [W][C]	Element	Value	Element and value rules
...	...	...	...
2: M \W	xFeatureType. xListData. xData. (1..3)		
2: M \W	xId	<*(1..)>	PRIMARY IDENTIFIER
2: M \W	timePeriod		...
2: M \W	timePeriod. startTime	<xs:duration>	
2: M \W	xSlot. (1..)		
2: M \W	xSlot. xSlotId		...
2: M \W	xSlot. duration	<xs:duration>	...
...	...	...	...

1153 The field

1154 xFeatureType. xListData. xData. (1..3)

1155 introduces a data pattern (required Elements and values) for "xData" instances used for Scenario 2.
 1156 The field itself specifies that such an "xData" instance SHALL occur at least 1 time and at maximum 3
 1157 times within "xListData" of Feature Type "xFeatureType". However, this constraint holds only for
 1158 Scenario 2 and only if such "xData" are required. In this case, they are required, as the left field

1159 2: M \W

1160 denotes that this data set is mandatory for Scenario 2.

1161 The field

1162 xSlot. (1..)

1163 expresses that the Element "xSlot" SHALL occur at least one time within its "xData", but MAY occur
 1164 more than one time.

1165 For the expression "<*(1..)>" of Element "xId" please see section 5.2.1.1.3.6.

1166 The remaining fields do not have an explicit cardinality indication.

1167 NOTE Cardinality expressions are also used within placeholder expressions as defined in section 5.2.1.1.3.6. In
 1168 many cases such placeholder expressions define the number of required or permitted Elements or list items as
 1169 they explicitly define how many different values for a given Identifier are required or permitted for a given
 1170 Scenario.

1171 5.2.1.1.3.5 Writability and changeability indication

1172 In the same column where the presence indications are denoted, a mark is used to distinguish
 1173 between writeable, changeable or readable Elements:

- 1174 - Elements that are marked with "W" are written by a client and SHALL be writeable at the
 1175 server according to their presence indications. The client is not obliged to read the according
 1176 data. Received notifications do not need to be evaluated.
- 1177 - Elements that are marked with "C" are changed by a client and SHALL be changeable at the
 1178 server according to their presence indications. The client is not obliged to read the according
 1179 data. Received notifications do not need to be evaluated.
- 1180 - Elements that are marked with "\RW" are read and written by a client and SHALL be writeable
 1181 and provided by the server according to their presence indications. Received notifications
 1182 SHALL be evaluated according to their presence indications.
- 1183 - Elements that are marked with "\RC" are read and changed by a client and SHALL be
 1184 changeable and provided by the server according to their presence indications. Received
 1185 notifications SHALL be evaluated according to their presence indications.
- 1186 - Elements that are not marked are only read by a client and SHALL be provided by the server
 1187 according to their presence indications. Received notifications SHALL be evaluated according
 1188 to their presence indications.

1189 "Writeable" means that the Element and its value may be written by a client. This includes the
 1190 possibility to modify (if the Element is already present), create (if the Element is not present yet), and
 1191 delete the Element. The server SHALL adjust its Function according to the received "write" operation
 1192 (unless the server cannot accept the "write" operation).

1193 "Changeable" means that the Element's value may be changed by a client. If the Element is not
 1194 present at the resource before, it probably cannot be created by the client via the "write" operation. In
 1195 this case the server MAY decline such a message.

1196 NOTE 1 "W" includes "C" already.

1197 NOTE 2 Depending on the resource a client might need to request a proper binding before the server accepts a
1198 "write" operation.

1199 **5.2.1.1.3.6 "Value" placeholders**

1200 **5.2.1.1.3.6.1 Introduction**

1201 Lists of message content may use placeholders to model relations between different Elements or even
1202 list items of different Functions. The main purpose is to declare which Identifier values relate to each
1203 other. As a Use Case does not prescribe specific values to be used for a given Identifier, a
1204 placeholder like "<x1>" can be used in "Value" columns to express the intended relations.

1205 There are two styles to identify a placeholder that can be referenced:

- 1206 1. <xM>
- 1207 2. <xM#S>

1208 where

- 1209 1. "x" is any alphabetical prefix like "m", "t", "ec", "cc", etc.
- 1210 2. "M" is a (major) number like "1", "2", "15", etc.
- 1211 3. "S" is a sub-number like "1", "7", "10", etc.

1212 Examples for the first style are "<ec1>", "<z12>". Examples for the second style are "<p4#2>",
1213 "<m22#3>". For a given placeholder, only one of the styles can be used.

1214 In addition, there are also styles for placeholders that do not need to be referenced:

- 1215 1. <*>
- 1216 2. <*#S>

1217 The second style is only used with so-called cardinality expressions.

1218 **5.2.1.1.3.6.2 Uniqueness of placeholders**

1219 A given placeholder <xM> or <xM#S> represents the same value throughout a given Use
1220 Case specification for a given set of its parent Identifier values. This shall be explained in a
1221 brief example:

1222 We assume a list item with PRIMARY IDENTIFIER "pId". It also has a SUB IDENTIFIER "sId"
1223 with placeholder "<s1>". Then, each occurrence of "<s1>" represents the same value for a
1224 given value of pId. This means that "<s1>" of a list item with pId=1 can differ from "<s1>" of a
1225 list item with pId=2. But it also means that "<s1>" represents the same value in all list items
1226 with pId=1.

1227 NOTE Typically, parent Identifiers like "pId" will also be expressed with a placeholder like "<p5>", e.g.
1228 In this case, the uniqueness rule applies for "<p5>" likewise.

1229 NOTE The uniqueness also applies for placeholders used as FOREIGN IDENTIFIER.

1230 **5.2.1.1.3.6.3 Placeholder expressions with cardinalities**

1231 For some Identifiers, more than one placeholder is needed. Several notations are used for
1232 this purpose, which make use of cardinality expressions. The general notation is as follows:

- 1233 1. <xM#(a..b)>

1234 This is equivalent to this explicit definition:

1235 At least a and at maximum b placeholders of this list: <xM#1> <xM#2> ... <xM#b>

1236 This means that the implementation of a given Use Case (or Scenario) requires a minimum of "a"
 1237 distinct values of the respective Identifier. In total, there can be up to "b" distinct values of the
 1238 respective Identifier.

1239 Additionally, the following notations may occur:

1240 2. $\langle xM\#(a..b) \rangle$

1241 This is equivalent to " $\langle xM\#(a..b) \rangle$ " with "b" equal to infinity.

1242 3. $\langle xM\#(..b) \rangle$

1243 This is equivalent to " $\langle xM\#(a..b) \rangle$ " with "a" equal to zero.

1244 " $\langle xM\#(a..) \rangle$ " has only a lower bound of "a" distinct value, but no upper bound. " $\langle xM\#(..b) \rangle$ ",
 1245 on the other hand, expresses that the Identifier may not be required at all, but it is permitted
 1246 to have up to "b" distinct values.

1247 Similarly, the cardinality can be used for placeholders that are not referenced, i.e. $\langle * \#(a..b) \rangle$
 1248 etc.

1249 NOTE The cardinality does NOT express which of the sub-numbers have to be used! I.e., it does NOT
 1250 mean that the Identifiers $\langle xM\#1 \rangle$... $\langle xM\#a \rangle$ are always used and just those with larger sub-numbers
 1251 ($\langle xM\#a+1 \rangle$... $\langle xM\#b \rangle$) are optional. If, for instance, a placeholder expression " $\langle xM\#(3..5) \rangle$ " is given, it
 1252 may well happen that an implementation makes use of $\langle xM\#2 \rangle$, $\langle xM\#4 \rangle$, and $\langle xM\#5 \rangle$ (i.e., it does
 1253 NOT use $\langle xM\#1 \rangle$, $\langle xM\#3 \rangle$). Which sub-numbers are used usually depends on other parts of a
 1254 Message and their references to required placeholders, which is explained in section 5.2.1.1.3.6.4.

1255 5.2.1.1.3.6.4 References to placeholders and relations

1256 According to the styles for placeholders that can be referenced, an enumeration value "e" can
 1257 refer to a particular placeholder:

1258 1. $e(-\rightarrow \langle xM \rangle)$

1259 2. $e(-\rightarrow \langle xM\#S \rangle)$

1260 This denotes that "e" is to be used with " $\langle xM \rangle$ " or " $\langle xM\#S \rangle$ ", resp.

1261 Example: A message contains the Elements "mld" and "phase". "mld" is an Identifier with
 1262 placeholder definition $\langle m2\#(1..3) \rangle$. "phase" is a string that permits the values "a", "b", and "c"
 1263 using this expression:

1264 $"a"(-\rightarrow \langle m2\#1 \rangle)$

1265 $"b"(-\rightarrow \langle m2\#2 \rangle)$

1266 $"c"(-\rightarrow \langle m2\#3 \rangle)$

1267 This expresses that the enumeration value "a" is to be used with the placeholder $\langle m2\#1 \rangle$, "b"
 1268 is to be used with $\langle m2\#2 \rangle$ and "c" with $\langle m2\#3 \rangle$.

1269 Similarly, a placeholder "yN" can refer to a particular placeholder:

1270 3. $\langle yN-\rightarrow xM \rangle$

1271 4. $\langle yN-\rightarrow xM\#S \rangle$

1272 5. $\langle yN\#T-\rightarrow xM \rangle$

1273 6. $\langle yN\#T-\rightarrow xM\#S \rangle$

1274 where "T" is a sub-number of "yN".

1275 It is also feasible to associate placeholders with cardinalities:

1276 7. $\langle yN\#(a..b)-\rightarrow xM\#(a..b) \rangle$

denotes that <yN#1> is to be used with <xM#1>, <yN#2> is to be used with <xM#2>, etc.

NOTE In this case, the placeholder expressions of yN and xM must have the same cardinality.

In some cases, there is a need to express that multiple list items with similar values are feasible or required, but only particular combinations of these different data are permitted. The following example shows that several "fData" list items with different "phase" value are required, but that these list items may only express either the "phase" value combination { "a", "b", "c" } or the "phase" value combination { "a", "abb", "neutral" }. The permitted combinations are defined in a note below Table 3:

Table 3 - Content of an example table

Scenario [{...}]: M/R/O [W][C]	Element	Value	Element and value rules
2: M	F. fListData. fData.		
2: M	zId	<z3#(3..5)>	
2: M	phase	"a"(-><z3#1>)	
		"b"(-><z3#2>)	
		"c"(-><z3#3>)	
		"abc"(-><z3#4>)	
		"neutral"(-><z3#5>)	

NOTE One of the following combinations SHALL be used at least: {<z3#1>, <z3#2>, <z3#3>} or {<z3#1>, <z3#4>, <z3#5>}.

5.2.1.1.3.7 Rules for content of "Value" column

For a given Scenario, the "Value" column may restrict the permitted content of an Element to one or more particular values. This means that Elements with values deviating from the restriction (i.e. from the permitted values) do not belong to the respective Scenario and need to be considered as if the Element is not set. If more than one particular value is permitted for an Element, the values are in a single line each.

If a presence indication is set for the value (in an additional column before the value), the following rules SHALL be applied:

- "M" means that the value SHALL be supported. This means the value needs to be set at a certain point in time (depending on the value rules) or for a certain Element within a list entry.
- "R" means that the value SHOULD be supported.
- "O" means that the value MAY be supported.

If all possible values of a given mandatory Element are optional or recommended and this Element is used for the purpose of the respective Scenario, one of the values SHALL be set. If all possible values of a given optional or recommended Element are optional or recommended, this Element MAY contain also other values, but then this Element SHALL NOT be considered as part of the respective Scenario.

M, R or O may be combined with the suffix "(event)" to express that a supported value only has to be supported during a certain event and hence does not need to be present at all times. If the event is not active another value may be set. In most cases a High-Level requirement reference for the event is given in the rules column.

If no presence indication is set for the value, the following rules SHALL be applied:

- In case of Elements where the server may set or change an Element on its own (see section 5.2.1.1.3.5):
 - o the server SHALL support at least one of the listed values.
 - o the client SHALL support all listed values.
- In case of Elements that are writeable or changeable (see section 5.2.1.1.3.5):
 - o the server SHALL support all listed values.
 - o the client SHALL support at least one of the listed values.

Depending on the Element, different values may be used during runtime. If this is the case, those rules are described within the value rules.

If a value is placed in parenthesis, the corresponding value is a recommendation. The actual value MAY deviate from this, e.g. "(1024)".

5.2.1.1.4 "Actor ... overview" diagram rules

Within the "Actor [...] overview" diagrams in the "Actors" sub-sections the complete functionality of the Use Case is provided, including optional Scenarios. Which Scenarios are optional can be found in the table under „Scenario Support Requirements“. The Actor MAY have more functionality implemented than needed for the Use Case.

For the following Actor overview example in Figure 4, a brief description of the graphical symbols will be described.

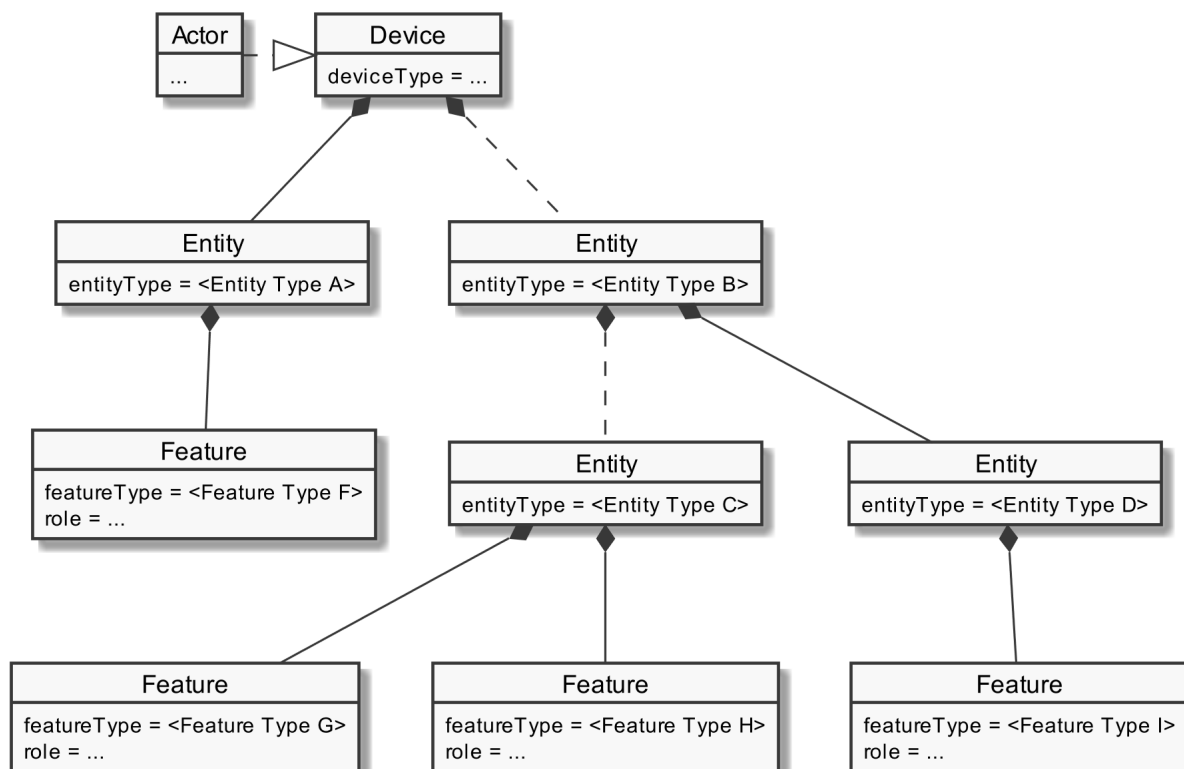


Figure 4 - Actor overview example

The solid lines in the figure represent an immediate parent-childhood relation: The Entity with "<Entity Type A>" is a direct child of "Device". The Entity with "<Entity Type D>" is a direct child of the Entity with "<Entity Type B>". All Features are immediate child of the respective Entity.

The dashed lines in the figure express that there MAY be additional Entities between the shown Entities: A vendor's implementation MAY have one or more Entities between "Device" and the Entity

with "<Entity Type B>". Likewise, a vendor's implementation MAY have one or more Entities between the Entity with "<Entity Type B>" and the Entity with "<Entity Type C>".

5.2.1.1.5 Order of messages within the sequence diagrams

There are several sequence diagrams in this document describing message flows. The order of the messages SHOULD be kept by the communications partners, but there might be cases where a different order makes sense. The communications partners SHALL be able to handle the Scenario functionalities even if the messages are transmitted in a different order by the other Actor(s). The sequence diagrams can be seen as examples.

5.2.1.1.6 Further information and rules

5.2.1.1.6.1 Frequently used Element rules

This section serves as a collection of rules frequently used by the tables of the subsequent sections. Each rule applies only where referenced explicitly in the tables.

NOTE The purpose of this collection is just to reduce the size of the tables. As such, no rule has a meaning without a reference indicating the required rule. A reference looks like "See [Measurement value rules]", e.g.

[Measurement value rules]:

SHALL be set if a value is available. Otherwise, the whole list entry SHALL be omitted or the Element *valueState* SHALL be set to "error".

If *valueState* is set to "error", but *value* is set, the content of *value* SHALL be ignored.

If *valueState* is set to "outOfRange", but *value* is set, the content of *value* SHALL be interpreted as being out of range.

If *valueState* is set to "outOfRange", *measurementConstraintsListData.valueRangeMax* is set and *value* is equal or bigger than *valueRangeMax*, *value* SHALL be interpreted as above *valueRangeMax*.

If *valueState* is set to "outOfRange", *measurementConstraintsListData.valueRangeMin* is set and *value* is equal or smaller than *valueRangeMin*, *value* SHALL be interpreted as below *valueRangeMin*.

If set, *measurementDescriptionListData.measurementType* SHALL be set, too.

[Value state rules]:

The Element *valueState* SHALL be set if its content differs from "normal". This means, if the state of the value is "outOfRange" or "error" this SHALL be denoted in the *valueState* Element. A client SHALL always consider the content of *valueState*, if set. If omitted, a value of "normal" is assumed.

[String-length rules]:

The string-length SHOULD NOT be longer than 256 characters. If it is longer, the sender SHALL consider the possibility that the receiver will shorten the string to 256 characters.

[Scaled number rules]:

The sub-Elements "number" and "scale" represent a value according to the following formula: $\text{number} \times 10^{\text{scale}}$

[Evaluation period rules]:

1375 The "evaluationPeriod" expresses the analysis period for the according value.

1376 **5.2.1.1.6.2 Applied sign convention**

1377 Throughout the whole Use Case the "load convention" (i.e. "passive sign convention") is applied for
1378 measurement values. This means measured electrical current, active power and exchanged energy
1379 are expressed with positive values in case of energy consumption whereas negative values are used
1380 in case of energy production. Voltages are measured independent of the energy direction.

1381 **5.2.1.1.6.3 Rules regarding the usage of time-related information**

1382 All time-related information within the Use Case SHALL be presented as absolute times. This means
1383 relative times SHALL NOT be used, unless the data point only supports relative times (e.g. for a
1384 "duration").

1385 NOTE This means the Actors need to have a common understanding of these absolute times. It is strongly
1386 recommended that each Actor is "sufficiently synchronised" with the official "Coordinated Universal Time" (UTC).

1387 **5.2.1.2 Pre-Scenario communication**

1388 **5.2.1.2.1 General information**

1389 The Pre-Scenario communication is needed if a client does not know the corresponding addresses on
1390 the server or if the required subscriptions or bindings are not active. In this case certain general
1391 communication mechanisms SHALL be used within SPINE:

- 1392 a) Detailed discovery: allows to discover resource addresses.
- 1393 b) Binding: allows to bind to resource address, which is frequently necessary to obtain write
1394 privileges.
- 1395 c) Subscription: allows to subscribe to resource addresses, which is necessary to receive
1396 unsolicited notifications if a resource changes during runtime.

1397 It is possible to combine those steps for multiple Scenarios or also multiple Use Cases:

- 1398 - E.g. if multiple Scenarios in multiple Use Cases use the same Feature, only one subscription
1399 needs to occur.
- 1400 - E.g. a complete detailed discovery or a subscription to the NodeManagement Feature needs
1401 to occur only once for all Use Cases.

1402 Depending on which Entity, Feature and Functions are used within a Scenario the payload of the
1403 corresponding messages may slightly differ, but the basic principles and messages used stay the
1404 same.

1405 The subsequent messages SHALL be exchanged for those parts that have not already been
1406 performed since the current connection is established or if those parts are outdated for another reason
1407 (e.g. if the detailed discovery is needed, but the bindings and subscriptions are still active from a
1408 previous connection only the detailed discovery messages need to be exchanged). If all Pre-Scenario
1409 communication parts are up-to-date, this section MAY be skipped, and the implementation can
1410 proceed as described in the corresponding "Scenario communication" sections.

1411 After the connection is re-established (e.g. due to a power loss or a firmware update) the Pre-Scenario
1412 communication SHALL be performed as well. There may be circumstances where messages from the
1413 Pre-Scenario communication may be exchanged again.

1414 Often the necessary messages of different Scenarios can be combined, so that only one single
1415 message is needed instead of multiple messages for the different Scenarios. This also is the case for
1416 the Pre-Scenario communication. In most cases only one "read" operation on the detailed discovery is
1417 necessary, as well as only one subscription request or binding request is needed for each Feature.
1418 Often multiple Scenarios within a Use Case access the same Feature, so only one subscription or
1419 binding is necessary.

5.2.1.2.2 Detailed discovery

For the functionality where a client already has current detailed discovery information (i.e. independent of the Use Case or any Scenario of it) the remainder of this section SHOULD be skipped.

Otherwise, the following procedure SHALL be performed in the given order:

1. If a client is not subscribed to the primary NodeManagement instance, the client SHALL acquire a subscription according to Figure 5.
2. A client SHALL read the detailed discovery information according to Figure 5. It SHALL keep the received information as far as it concerns mandatory and supported optional Entity Types, Feature Types and Functions of the Use Case that are needed by the client. This means that a client may choose how to store the necessary information. E.g. a client Actor can store the information how to address the necessary Features of the implemented Scenarios but may discard the Entity information.
3. If and as long as a client has a subscription to the detailed discovery information of an Actor and receives proper notifications, it SHALL consider (i.e. integrate into the kept detailed discovery information) the received information as far as it concerns mandatory and supported optional Entity Types, Feature Types and Functions of the Use Case.

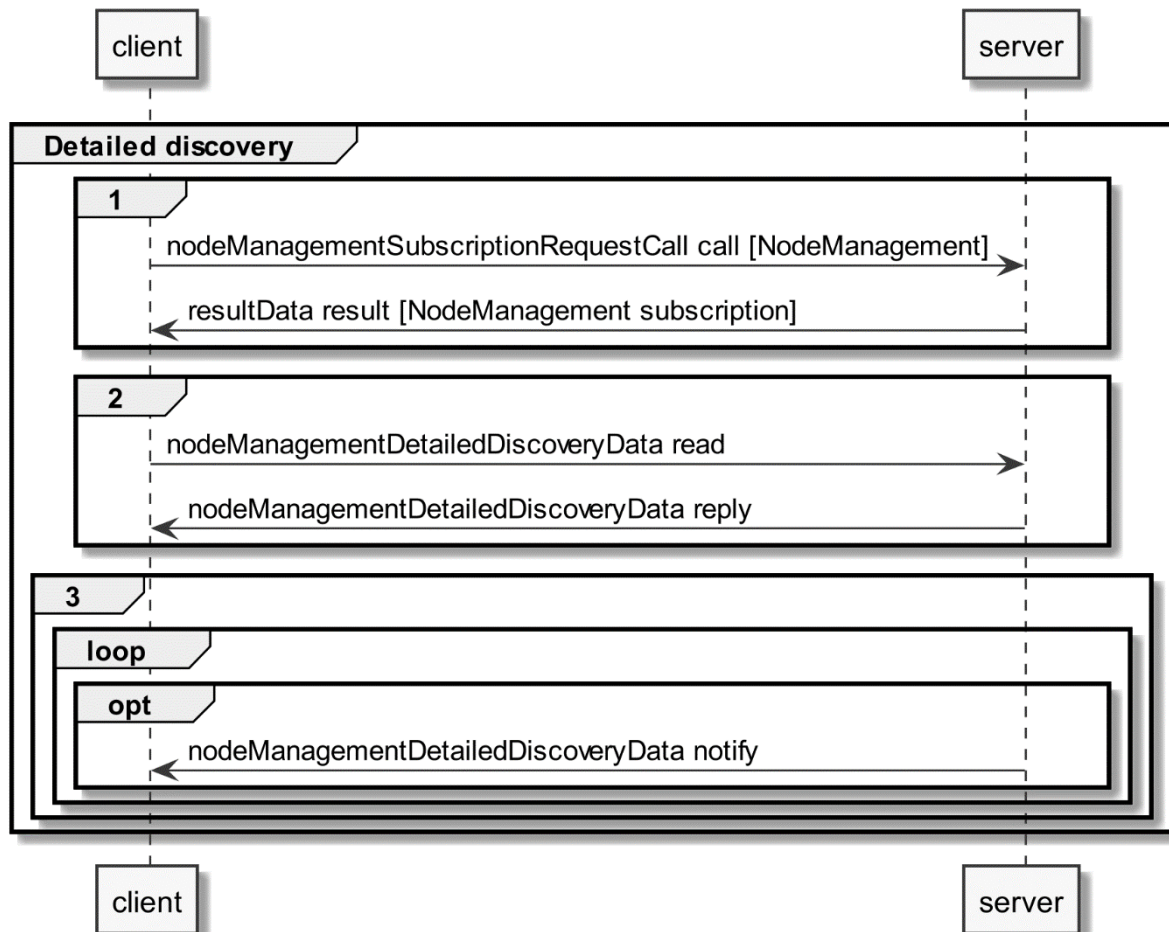


Figure 5 - Pre-Scenario communication - Detailed discovery sequence diagram

If the "nodeManagementDetailedDiscoveryData read" fails, the client SHOULD retry to read the detailed discovery information until the "nodeManagementDetailedDiscoveryData reply" message was received successfully.

If all functionality is present at all times: The "nodeManagementDetailedDiscoveryData reply" message contains at least the mandatory Entities and Features given in the "Actor [...] overview" diagrams as well as the used Functions and their "possible operations" described.

1444 If functionality is added or removed dynamically: The "nodeManagementDetailedDiscoveryData reply"
 1445 message does not need to contain all mandatory Entities and Features given in the "Actor [...] overview"
 1446 diagrams as well as all needed Functions and their "possible operations". However, as soon
 1447 as the functionality is available it will be announced via a "nodeManagementDetailedDiscoveryData
 1448 notify" message.

1449 For the nodeManagementDetailedDiscoveryData read Function it is recommended to use a partial
 1450 read with separated Selectors that may use one of the following Elements:

- 1451 - entityType
- 1452 - featureType

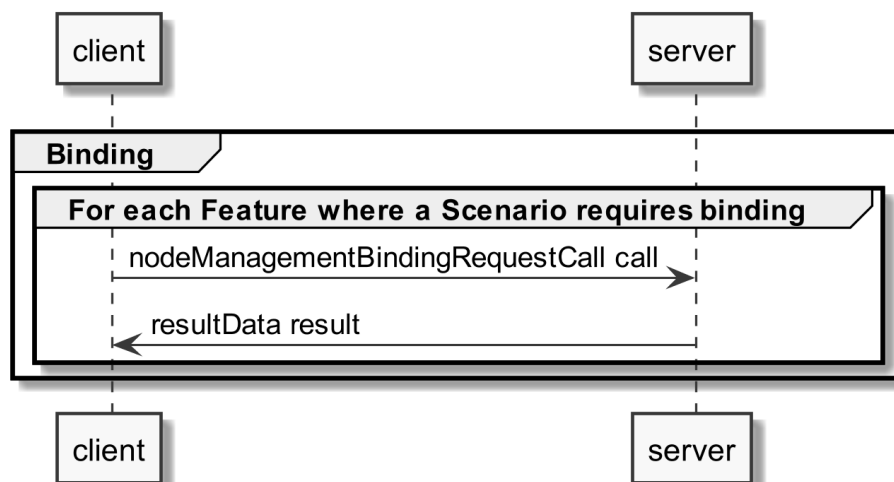
1453 NOTE Even with the usage of Selectors Features and Entities that are not relevant for the Use Case may be
 1454 discovered. However, only Features and Entities that fulfil the hierarchical order as described within the Actors'
 1455 sections shall be considered for the Use Case.

1456 A "partial" notify SHALL be supported without using Selectors and Elements. Partial "delete" notify
 1457 SHOULD also be supported with separated Selectors that may use one of the following Elements:

- 1458 - entityAddress
- 1459 - featureAddress

1460 5.2.1.2.3 Binding

1461 If binding is required by a Scenario that uses Features with writeable or changeable data, the server
 1462 SHALL support binding for the respective Features. Before a write on a Function of a Feature occurs,
 1463 the client SHALL create a binding to the corresponding Feature. For this the
 1464 nodeManagementBindingRequestCall Function is used as shown in Figure 6.



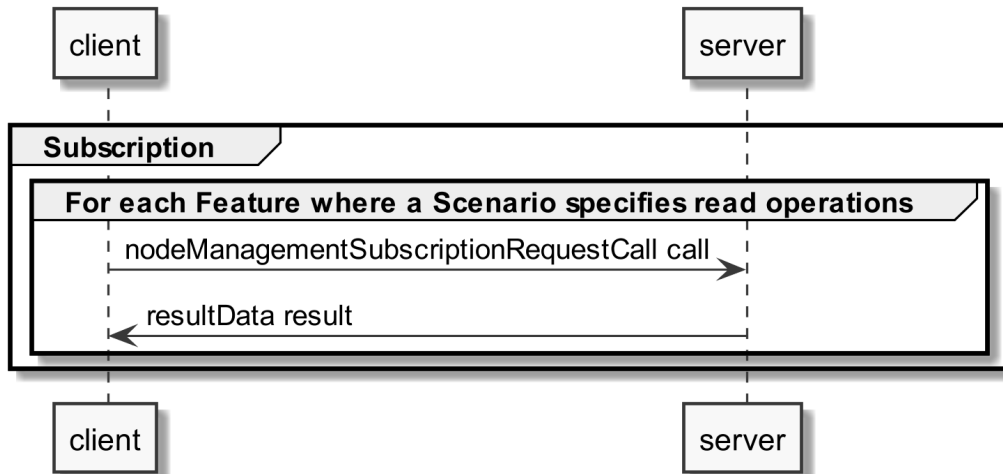
1465

1466 **Figure 6 - Pre-Scenario communication - Binding sequence diagram**

1467 If functionality is added or removed dynamically, binding may not be possible at all times on the
 1468 required Functions. A client SHALL retry to create a binding again when receiving according updated
 1469 detailed discovery information.

1470 5.2.1.2.4 Subscription

1471 A server SHALL support subscription for all Features that contain readable data that may change
 1472 during runtime. The client SHALL create a subscription for all Features that the client wants to read.
 1473 For this the nodeManagementSubscriptionRequestCall Function is used as shown in Figure 7.



1474

1475

Figure 7 - Pre-Scenario communication - Subscription sequence diagram

1476

If the subscription request fails (e.g. because it is not supported by the server or the maximum number of possible subscriptions is reached), the client SHOULD read the data periodically (so-called "polling").

1477

1478

1479

If functionality is added or removed dynamically, subscription may not be possible at all times on the required Functions. A client SHALL retry its subscription procedure again when receiving according updated detailed discovery information.

1480

1481

1482

5.2.1.2.5 Dynamic behaviour

1483

In case Entities or Features are removed, a nodeManagementDetailedDiscoveryData "notify" is transmitted that informs about the deleted Entities and Features. All existing binding or subscription entries on the deleted Features SHALL be deleted by each device.

1484

1485

1486

In case Entities or Features are added the Pre-Scenario communication starts with transmitting a nodeManagementDetailedDiscoveryData "notify" that contains the added Entities and Features.

1487

1488

5.2.2 UCF_AC_Measurement

1489

5.2.2.1 Generic Sequence Diagram

1490

The purpose of this use case function is to allow a Charging Station to send a measurement of the current power, current, or energy consumption to an EMS, as described in Figure 8.

1491

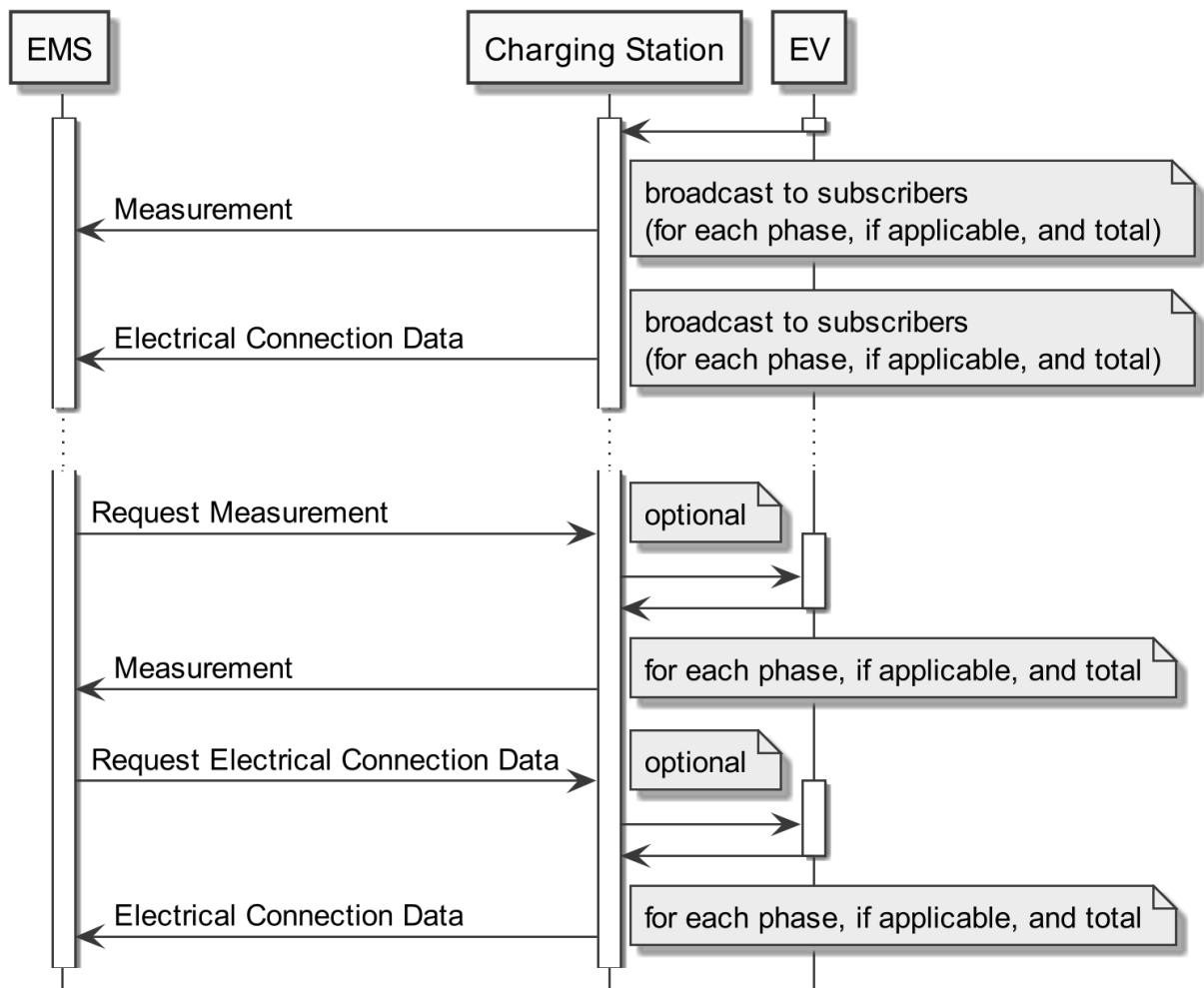


Figure 8: Messaging sequence for UCF_AC_Measurement

5.2.2.2 SPINE Mapping

5.2.2.2.1 Request Measurement

This is a set of three SPINE partial "read" messages. It is considered best practice to send them in the following sequence, as described in Figure 9.

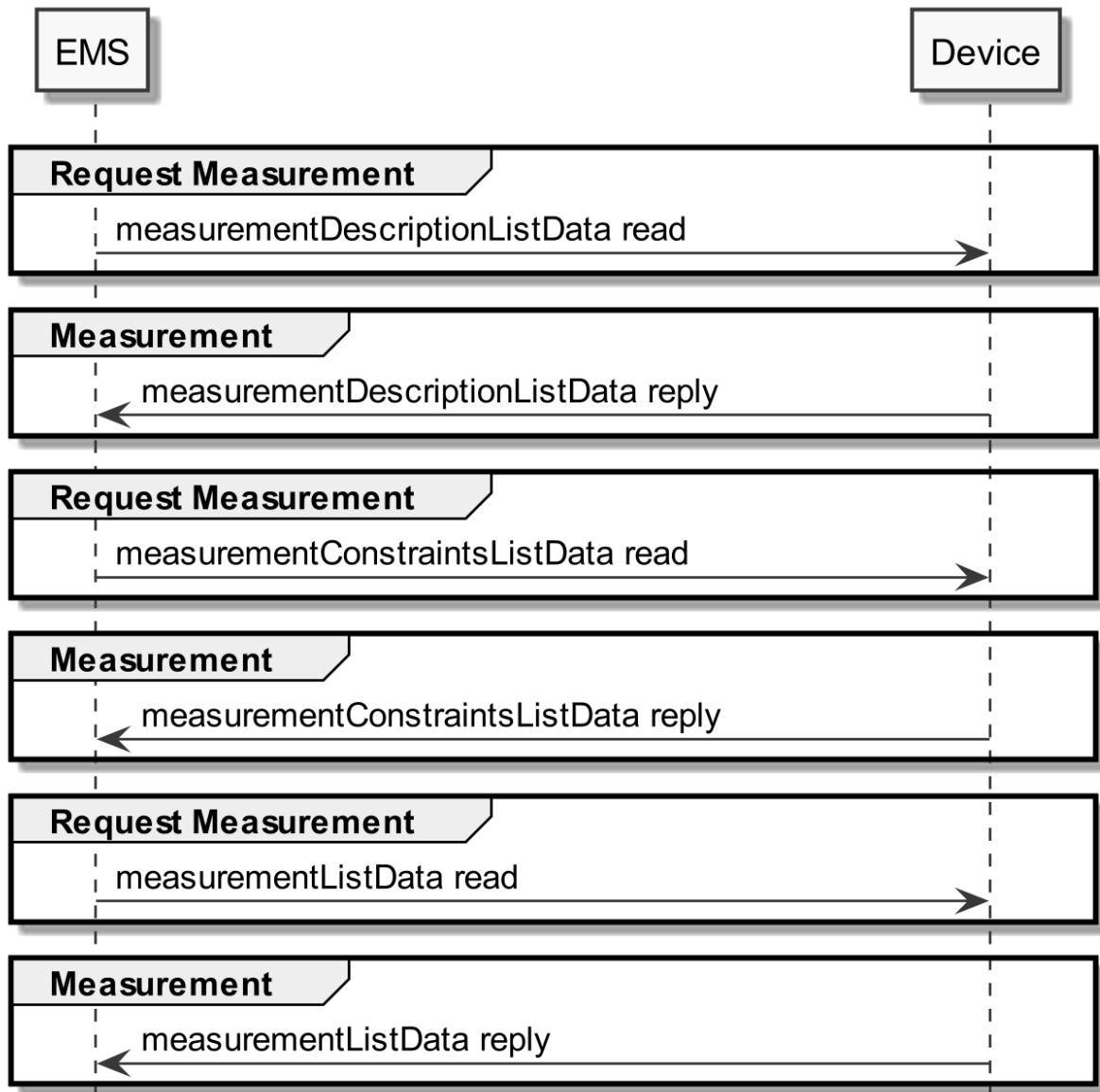


Figure 9: UCF_AC_Measurement: Request Measurement/Measurement communication sequence diagram

The messages have the following payload as described in Table 4-Table 6:

5.2.2.2.1.1 measurementDescriptionListData read:

Table 4 - Content of measurementDescriptionListData read at Actor EMS – Use Case "Monitoring of Power Consumption", "EV Charging Electricity Measurement"

Element		Value	
function		measurementDescriptionListData	
filter			
	cmdControl	partial	
measurementDescriptionDataSelectors			
	scopeType	Scope Type	Used for Measurement of:
		acPowerTotal	AC Power (non-phase specific)

		acPower	AC power (phase-specific)
		acEnergyConsumed	Consumed AC energy
		acEnergyProduced	Produced AC energy
		acCurrent	AC current.
		acVoltage	AC voltage.
		acFrequency	AC Frequency
		charge	Charging Energy (Use Cases "EV Charging Electricity Measurement" Scenario 3)

1505

1506 **5.2.2.2.1.2 measurementConstraintListData read:**1507 **Table 5 - Content of measurementConstraintListData read at Actor EMS**

Element		Value
function		measurementConstraintListData
filter		
cmdControl		partial
measurementConstraintListDataSelectors		
	measurementId	measurementId (derived from the measurementDescriptionListData reply)

1508

1509 **5.2.2.2.1.3 measurementListData read:**1510 **Table 6 - Content of measurementListData read at Actor EMS**

Element		Value
function		measurementListData
filter		
cmdControl		partial
measurementListDataSelectors		
	measurementId	measurementId (derived from the measurementDescriptionListData reply)

1511

1512 These messages are sent during the initial communication phase, as well as on (re-)connect.

1513 **5.2.2.2.2 Measurement**

1514 For each read from "Request Measurement" above, there is a SPINE "reply" with the following
1515 payload, as described in Table 7 - Table 36:

1516 **5.2.2.2.2.1 For Power:**

1517 **5.2.2.2.2.1.1 measurementDescriptionListData reply:**

1518 Non-phase specific:

Table 7 - Content of measurementDescriptionListData reply or notify at Actor Device – Power, non-phase specific – Use Case "Monitoring of Power Consumption"

Scenario [...]: M/R/O [W][C]	Element	Value	Element and value rules
1: M	Measurement. measurementDescriptionListData. measurementDescriptionData.		
1: M	measurementId	<m1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	measurementType	"power"	
1: M	commodityType	"electricity"	
1: M	unit	"W"	
1: M	scopeType	"acPowerTotal"	

Table 8 - Content of measurementDescriptionListData reply or notify at Actor Device – Power, non-phase specific – Use Case "EV Charging Electricity Measurement"

Scenario [...]: M/R/O [W][C]	Element	Value	Element and value rules
2: M	Measurement. measurementDescriptionListData. measurementDescriptionData.		
2: M	measurementId	<<x4> [<x5>] [<x6>]	SHALL be set as PRIMARY IDENTIFIER.
2: M	measurementType	"power"	
2: M	commodityType	"electricity"	
2: M	unit	"W"	
2: M	scopeType	"acPower"	

Phase-specific:

1526 **Table 9 - Content of measurementDescriptionListData reply or notify at Actor Device –**
 1527 **Power, phase-specific – Use Case "Monitoring of Power Consumption"**

Scenario [{...}]: M/R/O [W][C]	Element	Value	Element and value rules
1: M	Measurement. measurementDescriptionListData. measurementDescriptionData.		
1: M	measurementId	<m2#(1..3)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	measurementType	"power"	
1: M	commodityType	"electricity"	
1: M	unit	"W"	
1: M	scopeType	"acPower"	

1528

1529 **5.2.2.2.2.1.2 measurementConstraintsListData reply:**

1530 non-Phase specific:

1531 **Table 10 - Content of measurementConstraintsListData reply or notify at Actor Device –**
 1532 **Power, non-phase specific – Use Case "Monitoring of Power Consumption"**

Scenario [{...}]: M/R/O [W][C]	Element	Value	Element and value rules
1: R	Measurement. measurementConstraintsListData. measurementConstraintsData.		
1: M	measurementId	<m1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: R	valueRangeMin.		SHOULD be used. [Scaled number rules]
1: M	valueRangeMin. number		SHALL be used.
1: O	valueRangeMin. scale		"SHALL be interpreted". If absent, a default value of "0" applies.
1: R	valueRangeMax.		SHOULD be used. [Scaled number rules]
1: M	valueRangeMax. number		SHALL be used.
1: O	valueRangeMax. scale		"SHALL be interpreted". If absent, a default value of "0" applies.
1: R	valueStepSize.		SHOULD be used. [Scaled number rules]
1: M	valueStepSize. number		SHALL be used.
1: O	valueStepSize. scale		"SHALL be interpreted". If absent, a default value of "0" applies.

1533

1534 **Table 11 - Content of measurementConstraintsListData reply or notify at Actor Device –**
 1535 **Power, non-phase specific – Use Case "EV Charging Electricity Measurement"**

Scenario [{...}]: M/R/O [W][C]	Element	Value	Element and value rules
2: R	Measurement. measurementConstraintsListData. measurementConstraintsData.		
2: M	measurementId	<x4> [<x5>] [<x6>]	SHALL be set as PRIMARY IDENTIFIER.
2: R	valueRangeMin.		The sub-Elements "number" and "scale" represent a value according to the following formula: $\text{number} * 10^{\text{scale}}$
2: M	valueRangeMin. number		SHALL be used.

2: O	valueRangeMin. scale		MAY be used. If absent, a default value of "0" applies.
2: R	valueRangeMax.		The sub-Elements "number" and "scale" represent a value according to the following formula: $\text{number} * 10^{\text{scale}}$
2: M	valueRangeMax. number		SHALL be used.
2: O	valueRangeMax. scale		MAY be used. If absent, a default value of "0" applies.
2: R	valueStepSize.		The sub-Elements "number" and "scale" represent a value according to the following formula: $\text{number} * 10^{\text{scale}}$
2: M	valueStepSize. number		SHALL be used.
2: O	valueStepSize. scale		MAY be used. If absent, a default value of "0" applies.

1536

1537 phase-specific:

1538 **Table 12 - Content of measurementConstraintsListData reply or notify at Actor Device –**
 1539 **Power, phase-specific – Use Case "Monitoring of Power Consumption"**

Scenario [{...}]: M/R/O [W][C]	Element	Value	Element and value rules
1: R	Measurement. measurementConstraintsListData. measurementConstraintsData.		
1: M	measurementId	<m2#(1..3)>	SHALL be set as PRIMARY IDENTIFIER.
1: R	valueRangeMin.		SHOULD be used. [Scaled number rules]
1: M	valueRangeMin. number		SHALL be used.
1: O	valueRangeMin. scale		"SHALL be interpreted". If absent, a default value of "0" applies.
1: R	valueRangeMax.		SHOULD be used. [Scaled number rules]
1: M	valueRangeMax. number		SHALL be used.
1: O	valueRangeMax. scale		"SHALL be interpreted". If absent, a default value of "0" applies.
1: R	valueStepSize.		SHOULD be used. [Scaled number rules]
1: M	valueStepSize. number		SHALL be used.
1: O	valueStepSize. scale		"SHALL be interpreted". If absent, a default value of "0" applies.

1540 **5.2.2.2.2.1.3 measurementListData reply:**

1541 non-phase specific:

1542
1543

Table 13 - Content of measurementListData reply or notify at Actor Device – Power, non-phase specific – Use Case "Monitoring of Power Consumption"

Scenario [{...}]: M/R/O [W][C]	Element	Value	Element and value rules
1: M	Measurement. measurementListData. measurementData.		
1: M	measurementId	<m1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	valueType	"value"	SHALL be set as SUB IDENTIFIER.
1: O	timestamp	<t#(1..1)->m1#1>	MAY be used. Within this Use Case, only the newest measurement value SHALL be stated. Additional historical values are forbidden.
1: M	value.		See [Measurement value rules]. See [Scaled number rules].
1: M	value. number		SHALL be used.
1: O	value. scale		"SHALL be interpreted". If absent, a default value of "0" applies.
1: M	valueSource	"measuredValue"	
		"calculatedValue"	
		"empiricalValue"	
1: R	valueState		[Value state rules]

1544