

# DIN/TS 70121:2024-11 (E)

## Electromobility - Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging System; Text in English

---

Inhalt	Seite
Foreword .....	11
Introduction.....	12
1 Scope.....	13
2 Normative references .....	13
3 Terms and definitions.....	15
4 Symbols and abbreviations .....	20
5 Relation to other standards .....	22
6 Conventions.....	22
6.1 Definition of OSI based services .....	22
6.2 Requirement structure.....	22
6.2.1 Requirement format.....	22
6.2.2 Applicability .....	23
6.2.3 Usage of RFC references .....	23
6.3 Notation used for XML schema diagrams .....	23
7 DC charging system architecture.....	24
7.1 System schematics of DC charging system .....	24
7.2 Pilot function .....	24
7.3 Communication stack.....	24
8 EV-EVSE communication .....	25
8.1 Basic requirements for V2G communication .....	25
8.1.1 General information and definitions .....	25
8.2 Service primitive concept of OSI layered architecture.....	25
8.2.1 Overview .....	25
8.2.2 Syntax of service primitives.....	26
8.3 Physical and Data Link Layer .....	26
8.3.1 System architecture.....	26
8.3.2 Connection coordination .....	29
8.3.3 EV - EVSE matching process.....	29
8.3.4 Timings, parameters and error handling .....	48
8.3.5 Error handling.....	52
8.3.6 EMC requirements.....	64
8.3.7 Coupling circuit.....	65
8.3.8 Layer 2 interfaces.....	74
8.3.9 Sleep and Wake-up Handling.....	75
8.4 V2G communication states.....	76
8.4.1 V2G communication of the EVCC .....	76
8.4.2 V2G communication of the SECC.....	78
8.5 Network layer.....	81
8.5.1 General.....	81
8.5.2 Applicable RFCs and limitations and protocol parameter settings.....	81
8.5.3 IP addressing .....	82
8.5.4 Network Layer service primitive — N-IP_Address.indication.....	83

8.5.5	SECC discovery .....	83
8.6	Transport Layer.....	84
8.6.1	Transmission control protocol (TCP).....	84
8.6.2	User datagram protocol (UDP) .....	85
8.7	V2G transfer protocol .....	85
8.7.1	General information.....	85
8.7.2	Supported ports.....	85
8.7.3	Protocol data unit.....	86
8.8	Presentation layer .....	89
8.8.1	XML and efficient XML interchange (EXI).....	89
8.9	Application layer .....	92
8.9.1	Vehicle to grid application layer messages.....	92
8.9.2	Application layer service primitives.....	92
8.9.3	SECC Discovery protocol .....	95
9	Application layer messages .....	101
9.1	General information and definitions.....	101
9.2	Protocol handshake.....	101
9.2.1	Handshake request-response message pair.....	101
9.2.2	Message definition supportedAppProtocolReq and supportedAppProtocolRes .....	102
9.3	Message structure .....	106
9.3.1	Overview .....	106
9.3.2	Message definition.....	106
9.3.3	Message header definition .....	108
9.3.4	Message body definition .....	109
9.4	BodyElement Definitions.....	109
9.4.1	Common Messages.....	109
9.4.2	DC messages.....	124
9.5	Complex data types.....	133
9.5.1	Overview .....	133
9.5.2	Common types.....	133
9.5.3	DC specific types.....	143
9.5.4	Use of optional schema elements.....	152
9.6	Session timing and error handling .....	157
9.6.1	Overview .....	157
9.6.2	Message sequence and performance timing definitions .....	158
9.6.3	EVCC timing and error handling for request-response message pairs.....	162
9.6.4	SECC timing and error handling for response-request message sequence .....	162
9.6.5	V2G communication session timing definitions.....	163
9.7	Message sequences .....	169
9.7.1	Protocol flow stages and associated messages.....	169
9.7.2	Basic definitions for error handling.....	170
9.7.3	Response code usage by the SECC .....	170
9.7.4	Request-response message sequence requirements.....	172
9.7.5	Message sequence example of successful DC charging session.....	186
Annex A (normative)	XML Schema application layer messages.....	189
A.1	Overview .....	189
A.2	V2G_CI_AppProtocol.xsd .....	189
A.3	V2G_CI_MsgDef.xsd.....	190
A.4	V2G_CI_MsgHeader.xsd.....	191
A.5	V2G_CI_MsgBody.xsd .....	191
A.6	V2G_CI_MsgDataTypes.xsd .....	201
A.7	xmldsig-core-schema.xsd .....	214
Annex B (informative)	Difference between multi-network broadcast, broadcast and unicast .....	220
Annex C (informative)	SLAC attenuation calculation example .....	221
Annex D (informative)	Begriffe .....	223

<b>Annex E (informative) Modified requirements.....</b>	<b>229</b>
<b>Bibliography.....</b>	<b>231</b>

## Figures

<b>Figure 1 — Communication relationship between EV, EVSE, and BS.....</b>	<b>13</b>
<b>Figure 2 — Protocol stack for DC charging control without security.....</b>	<b>25</b>
<b>Figure 3 — OSI layered architecture principles.....</b>	<b>25</b>
<b>Figure 4 — EVSE discovery process from EV side.....</b>	<b>32</b>
<b>Figure 5 — Matching state machine.....</b>	<b>33</b>
<b>Figure 6 — Sequence chart of HomePlug Green PHY matching process.....</b>	<b>34</b>
<b>Figure 7 — Example of toggle sequence with 2 toggles.....</b>	<b>41</b>
<b>Figure 8 — Matching timing sequence chart.....</b>	<b>50</b>
<b>Figure 9 — CM_SLAC_PARM.REQ/CNF sequence chart.....</b>	<b>53</b>
<b>Figure 10 — Signal strength measurement Sequence Chart.....</b>	<b>55</b>
<b>Figure 11 — Matching validation sequence chart.....</b>	<b>58</b>
<b>Figure 12 — Logical network parameter exchange sequence chart.....</b>	<b>60</b>
<b>Figure 13 — Joining the logical network sequence chart.....</b>	<b>62</b>
<b>Figure 14 — Amplitude map exchange sequence chart.....</b>	<b>63</b>
<b>Figure 15 — Implementation of parallel injection.....</b>	<b>65</b>
<b>Figure 16 — HomePlug Green PHY-transmission path example with SLAC relevant attenuations and calculations.....</b>	<b>68</b>
<b>Figure 17 — Measurement setup.....</b>	<b>70</b>
<b>Figure 18 — Implementation example with a HomePlug Green PHY coupling transformer.....</b>	<b>72</b>
<b>Figure 19 — Overview sources of crosstalk.....</b>	<b>73</b>
<b>Figure 20 — Example of valid crosstalk filter in the case of HPGP signals.....</b>	<b>74</b>
<b>Figure 21 — OSI Layer 1-2 overview.....</b>	<b>74</b>
<b>Figure 22 — Overview V2G communication states EVCC.....</b>	<b>78</b>
<b>Figure 23 — Overview V2G communication states SECC.....</b>	<b>80</b>
<b>Figure 24 — V2GTP message structure.....</b>	<b>86</b>
<b>Figure 25 — V2GTP message header structure.....</b>	<b>87</b>

<b>Figure 26 — V2GTP generic header handler.....</b>	<b>89</b>
<b>Figure 27 — Basic concept of EXI.....</b>	<b>91</b>
<b>Figure 28 — SECC discovery request message payload.....</b>	<b>97</b>
<b>Figure 29 — SECC discovery response message payload.....</b>	<b>99</b>
<b>Figure 30 — Schema Diagram — supportedAppProtocolReq.....</b>	<b>103</b>
<b>Figure 31 — Schema Diagram — supportedAppProtocolRes.....</b>	<b>103</b>
<b>Figure 32 — Schema diagram — V2G message .....</b>	<b>107</b>
<b>Figure 33 — Schema diagram — message header .....</b>	<b>108</b>
<b>Figure 34 — Schema diagram — message body.....</b>	<b>109</b>
<b>Figure 35 — Schema diagram — SessionSetupReq.....</b>	<b>110</b>
<b>Figure 36 — Schema diagram — SessionSetupRes .....</b>	<b>111</b>
<b>Figure 37 — Schema diagram — ServiceDiscoveryReq.....</b>	<b>112</b>
<b>Figure 38 — Schema diagram — ServiceDiscoveryRes .....</b>	<b>114</b>
<b>Figure 39 — Schema diagram — ServicePaymentSelectionReq.....</b>	<b>115</b>
<b>Figure 40 — Schema diagram — ServicePaymentSelectionRes .....</b>	<b>115</b>
<b>Figure 41 — Schema diagram — ContractAuthenticationReq .....</b>	<b>116</b>
<b>Figure 42 — Schema diagram — ContractAuthenticationRes.....</b>	<b>117</b>
<b>Figure 43 — Schema diagram — ChargeParameterDiscoveryReq .....</b>	<b>118</b>
<b>Figure 44 — Schema diagram — ChargeParameterDiscoveryRes.....</b>	<b>119</b>
<b>Figure 45 — Schema diagram — PowerDeliveryReq.....</b>	<b>121</b>
<b>Figure 46 — Schema diagram — PowerDeliveryRes.....</b>	<b>122</b>
<b>Figure 47 — Schema diagram — SessionStopReq .....</b>	<b>123</b>
<b>Figure 48 — Schema diagram — SessionStopRes.....</b>	<b>123</b>
<b>Figure 49 — Schema diagram — CableCheckReq.....</b>	<b>124</b>
<b>Figure 50 — Schema diagram — CableCheckRes .....</b>	<b>125</b>
<b>Figure 51 — Schema diagram — PreChargeReq.....</b>	<b>126</b>
<b>Figure 52 — Schema diagram — PreChargeRes .....</b>	<b>126</b>
<b>Figure 53 — Schema diagram — CurrentDemandReq.....</b>	<b>128</b>
<b>Figure 54 — Schema diagram — CurrentDemandRes .....</b>	<b>130</b>

<b>Figure 55 — Schema diagram — WeldingDetectionReq .....</b>	<b>132</b>
<b>Figure 56 — Schema diagram — WeldingDetectionRes.....</b>	<b>133</b>
<b>Figure 57 — Schema diagram — ServiceTagType.....</b>	<b>133</b>
<b>Figure 58 — Schema diagram — ServiceType .....</b>	<b>134</b>
<b>Figure 59 — Schema diagram — ServiceChargeType .....</b>	<b>135</b>
<b>Figure 60 — Schema diagram — PhysicalValueType.....</b>	<b>136</b>
<b>Figure 61 — Schema diagram — PaymentOptionsType.....</b>	<b>137</b>
<b>Figure 62 — Schema diagram — XML Schema Definition for the ChargingProfileType .....</b>	<b>138</b>
<b>Figure 63 — Schema diagram — ProfileEntryType .....</b>	<b>138</b>
<b>Figure 64 — Schema diagram — SAScheduleListType.....</b>	<b>139</b>
<b>Figure 65 — Schema diagram — SAScheduleTupleType .....</b>	<b>140</b>
<b>Figure 66 — Schema diagram — PMaxScheduleType.....</b>	<b>141</b>
<b>Figure 67 — Schema diagram — PMaxScheduleEntryType .....</b>	<b>141</b>
<b>Figure 68 — Schema diagram — RelativeTimeIntervalType .....</b>	<b>142</b>
<b>Figure 69 — Schema diagram — SelectedServiceListType .....</b>	<b>143</b>
<b>Figure 70 — Schema Diagram — SelectedServiceType .....</b>	<b>143</b>
<b>Figure 71 — Schema diagram — DC_EVSEStatusType .....</b>	<b>144</b>
<b>Figure 72 — Schema diagram — DC_EVStatusType .....</b>	<b>146</b>
<b>Figure 73 — Schema diagram — DC_EVChargeParameterType .....</b>	<b>148</b>
<b>Figure 74 — Schema diagram — DC_EVSEChargeParameterType.....</b>	<b>150</b>
<b>Figure 75 — Schema diagram — DC_EVPowerDeliveryParameterType.....</b>	<b>151</b>
<b>Figure 76 — Message sequence and performance timing .....</b>	<b>161</b>
<b>Figure 77 — V2G communication session timing.....</b>	<b>168</b>
<b>Figure 78 — Initialization sequence between EV and EVSE.....</b>	<b>186</b>
<b>Figure 79 — Initialization sequence (cont.) between EV and EVSE.....</b>	<b>187</b>
<b>Figure 80 — Pre-charge and energy transfer sequence between EV and EVSE .....</b>	<b>188</b>
<b>Figure 81 — Welding Detection and terminate charging sequence between EV and EVSE .....</b>	<b>188</b>
<b>Figure A.1 — Dependency chart of the V2G CI XML schema definitions .....</b>	<b>189</b>
<b>Figure C.1 — SLAC attenuation calculation example .....</b>	<b>222</b>

**Tables**

**Table 1 — ROBO modes and PHY data rate ..... 28**

**Table 2 — SLAC MME parameter values ..... 35**

**Table 3 — EV\_Discovering\_Status definition ..... 40**

**Table 4 — MME parameters for Validation, first request-response ..... 43**

**Table 5 — MME parameters for validation, second request-response ..... 44**

**Table 6 — CM\_AMP\_MAP.REQ parameters ..... 47**

**Table 7 — CM\_AMP\_MAP.CNF parameters ..... 47**

**Table 8 — Timings and parameters ..... 51**

**Table 9 — Notched carriers ..... 64**

**Table 10 — Signal requirements for parallel HomePlug Green PHY injection to Control Pilot ..... 66**

**Table 11 — Component values of HomePlug Green PHY coupling Implementation example ..... 72**

**Table 12 — Mandatory ICMP message set ..... 82**

**Table 13 — N-IP\_Address.indication service primitive ..... 83**

**Table 14 — Supported ports for V2GTP ..... 85**

**Table 15 — Generic V2GTP header structure ..... 87**

**Table 16 — Overview on V2GTP payload types ..... 88**

**Table 17 — Excluded EXI coding options ..... 91**

**Table 18 — EXI profile settings ..... 91**

**Table 19 — A-Data.confirmation service primitive ..... 92**

**Table 20 — A-Data.response service primitive ..... 93**

**Table 21 — A-Data.request service primitive ..... 94**

**Table 22 — A-Data.indication service primitive ..... 95**

**Table 23 — Payload type SECC discover request message ..... 98**

**Table 24 — N-SECC\_Address.indication service primitive ..... 100**

**Table 25 — Semantics and type definition for supportedAppProtocol message elements ..... 103**

**Table 26 — Semantics and type definition for a V2G message ..... 107**

**Table 27 — Semantics and type definition for a V2G message header ..... 109**

**Table 28 — Semantics and type definition for a V2G message body ..... 109**

<b>Table 29 — Semantics and type definition for SessionSetupReq .....</b>	<b>111</b>
<b>Table 30 — Semantics and type definition for SessionSetupRes.....</b>	<b>111</b>
<b>Table 31 — Semantics and type definition for ServiceDiscoveryReq .....</b>	<b>113</b>
<b>Table 32 — Semantics and type definition for ServiceDiscoveryRes.....</b>	<b>114</b>
<b>Table 33 — Semantics and type definition for ServicePaymentSelectionReq .....</b>	<b>115</b>
<b>Table 34 — Semantics and type definition for ServicePaymentSelectionRes .....</b>	<b>115</b>
<b>Table 35 — Semantics and type definition for ContractAuthenticationReq.....</b>	<b>116</b>
<b>Table 36 — Semantics and type definition for ContractAuthenticationRes .....</b>	<b>117</b>
<b>Table 37 — Semantics and type definition for ChargeParameterDiscoveryReq.....</b>	<b>118</b>
<b>Table 38 — Semantics for EVRequestedEnergyTransferType .....</b>	<b>118</b>
<b>Table 39 — Semantics and type definition for ChargeParameterDiscoveryRes .....</b>	<b>120</b>
<b>Table 40 — Semantics and type definition for PowerDeliveryReq.....</b>	<b>121</b>
<b>Table 41 — Semantics and type definition for PowerDeliveryRes .....</b>	<b>122</b>
<b>Table 42 — Semantics and type definition for SessionStopRes .....</b>	<b>123</b>
<b>Table 43 — Semantics and type definition for CableCheckReq .....</b>	<b>124</b>
<b>Table 44 — Semantics and type definition for CableCheckRes .....</b>	<b>125</b>
<b>Table 45 — Semantics and type definition for PreChargeReq .....</b>	<b>126</b>
<b>Table 46 — Semantics and type definition for PreChargeRes.....</b>	<b>127</b>
<b>Table 47 — Semantics and type definition for CurrentDemandReq .....</b>	<b>129</b>
<b>Table 48 — Semantics and type definition for CurrentDemandRes.....</b>	<b>131</b>
<b>Table 49 — Semantics and type definition for WeldingDetectionReq.....</b>	<b>132</b>
<b>Table 50 — Semantics and type definition for WeldingDetectionRes .....</b>	<b>133</b>
<b>Table 51 — Semantics and type definition for ServiceTagType .....</b>	<b>134</b>
<b>Table 52 — Semantics and type definition for ServiceType .....</b>	<b>135</b>
<b>Table 53 — Semantics and type definition for ServiceChargeType.....</b>	<b>135</b>
<b>Table 54 — Semantics for EVSESupportedEnergyTransferType.....</b>	<b>136</b>
<b>Table 55 — Semantics and type definition for PhysicalValueType .....</b>	<b>137</b>
<b>Table 56 — Semantics and type definition for PaymentOptionsType .....</b>	<b>137</b>
<b>Table 57 — Semantics and type definition for ChargingProfileType.....</b>	<b>138</b>

<b>Table 58 — Semantics and type definition for ProfileEntryType .....</b>	<b>139</b>
<b>Table 59 — Semantics and type definition for SAScheduleListType.....</b>	<b>139</b>
<b>Table 60 — Semantics and type definition for SAScheduleTupleType.....</b>	<b>140</b>
<b>Table 61 — Semantics and type definition for PMaxScheduleType .....</b>	<b>141</b>
<b>Table 62 — Semantics and type definition for PMaxScheduleEntryType .....</b>	<b>142</b>
<b>Table 63 — Semantics and type definition for RelativeTimeIntervalType.....</b>	<b>142</b>
<b>Table 64 — Semantics and type definition for SelectedServiceListType.....</b>	<b>143</b>
<b>Table 65 — Semantics and type definition for SelectedServiceType.....</b>	<b>143</b>
<b>Table 66 — Semantics and type definition for DC_EVSEStatusType.....</b>	<b>144</b>
<b>Table 67 — Semantics &amp; Types of Elements in the isolationLevelType.....</b>	<b>145</b>
<b>Table 68 — Semantics and type definition for DC_EVSEStatusCodeType.....</b>	<b>145</b>
<b>Table 69 — Semantics and type definition for DC_EVStatusType .....</b>	<b>146</b>
<b>Table 70 — Semantics and type definition for EVErrorCodeType.....</b>	<b>147</b>
<b>Table 71 — Semantics and type definition for DC_EVChargeParameterType.....</b>	<b>149</b>
<b>Table 72 — Semantics and type definition for DC_EVSEChargeParameterType.....</b>	<b>151</b>
<b>Table 73 — Semantics and type definition for DC_EVPowerDeliveryParameterType .....</b>	<b>152</b>
<b>Table 74 — Optional schema elements.....</b>	<b>152</b>
<b>Table 75 — EVCC and SECC timers, timeouts, performance times.....</b>	<b>158</b>
<b>Table 76 — EVCC and SECC message timeouts and performance times.....</b>	<b>160</b>
<b>Table 77 — EVCC and SECC V2G communication session timing parameters.....</b>	<b>166</b>
<b>Table 78 — EVCC and SECC V2G communication session timing parameter values .....</b>	<b>167</b>
<b>Table 79 — Overview on the use of ResponseCodes .....</b>	<b>171</b>
<b>Table E.1 — Modified requirements.....</b>	<b>229</b>