



SURFACE VEHICLE STANDARD

J2847™/2

SEP2023

Issued 2011-10
Revised 2023-09

Superseding J2847/2 APR2015

(R) Communication Between Plug-in Vehicles and Off-Board DC Chargers

RATIONALE

SAE J2847-2 provides messages for DC energy transfer. This is based on the use cases in SAE J2836/2 that established the DC charging requirements. This revision adds Section 6, which includes the digital communication messages and signals for off-board inverters that are described in SAE J2836/3 for DC vehicle-to-grid (V2G) and vehicle-to-home (V2H). The system for V2G/V2H is also included such as pre-charging the DC EVSE and the home system requirements for isolation for V2H.

TABLE OF CONTENTS

1.	SCOPE.....	9
1.1	Purpose.....	10
2.	REFERENCES.....	11
2.1	Applicable Documents	11
2.1.1	SAE Publications.....	11
2.2	Related Publications	11
2.2.1	SAE Publications.....	11
2.2.2	IEC Publications.....	12
2.2.3	ISO Publications.....	12
2.2.4	IEEE Publications.....	12
2.2.5	UL Publications	13
2.2.6	DIN Publications.....	13
2.2.7	Sunspec Modbus	13
3.	DEFINITIONS	13
4.	TECHNICAL REQUIREMENTS.....	16
4.1	Charging Phases.....	16
4.1.1	Message Sequences.....	16
4.1.2	Charging Limits	17
4.1.3	Requirement Structure	18
4.2	Signal Definitions	19
4.2.1	App Protocol (AppProtocol)	19
4.2.2	Bulk Charging Complete (BulkChargingComplete)	20
4.2.3	Bulk SOC (BulkSOC)	20
4.2.4	Charge Service (ChargeService)	20
4.2.5	Charging Complete (ChargingComplete).....	20
4.2.6	Charging Profile (ChargingProfile).....	21

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2023 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

Full document details: SAE J2847_2_202309

For more information on this standard, visit
https://www.sae.org/standards/content/J2847/2_202309/

Documents

Document Sharing Hub

4.2.7	Charging Profile Entry Max Power (ChargingProfileEntryMaxPower).....	21
4.2.8	Charging Profile Entry Start (ChargingProfileEntryStart).....	22
4.2.9	Contract (Contract).....	22
4.2.10	Date Time Now (DateTimeNow).....	22
4.2.11	DC EV Charge Parameter (DC_EVChargeParameter).....	22
4.2.12	DC EV Charge Parameter Type (DC_EVChargeParameterType).....	23
4.2.13	DC EV Power Delivery Parameter (DC_EVPowerDeliveryParameter).....	23
4.2.14	DC EV Power Delivery Parameter Type (DC_EVPowerDeliveryParameterType).....	24
4.2.15	DC EV Status (DC_EVStatus).....	24
4.2.16	DC EV Status Type (DC_EVStatusType).....	24
4.2.17	DC EVSE Charge Parameter (DC_EVSEChargeParameter).....	25
4.2.18	DC EVSE Charge Parameter Type (DC_EVSEChargeParameterType).....	25
4.2.19	DC EVSE Status (DC_EVSEStatus).....	25
4.2.20	DC EVSE Status Type (DC_EVSEStatusType).....	26
4.2.21	Duration (Duration).....	26
4.2.22	Energy Transfer Type (EnergyTransferType).....	26
4.2.23	EV Cabin Conditioning (EVCabinConditioning).....	27
4.2.24	EV Energy Capacity (EVEnergyCapacity).....	27
4.2.25	EV Energy Request (EVEnergyRequest).....	28
4.2.26	EV Error Code (EVErrorCode).....	28
4.2.27	EV ID (EVCCID).....	29
4.2.28	EV Maximum Current Limit (EVMaximumCurrentLimit).....	30
4.2.29	EV Maximum Power Limit (EVMaximumPowerLimit).....	30
4.2.30	EV Maximum Voltage Limit (EVMaximumVoltageLimit).....	31
4.2.31	EV Ready (EVReady).....	31
4.2.32	EV Requested Energy Transfer Type (EVRequestedEnergyTransferType).....	31
4.2.33	EV RESS Conditioning (EVRESSConditioning).....	32
4.2.34	EV RESS SOC (EVRESSSOC).....	33
4.2.35	EV Target Current (EVTARGETCurrent).....	33
4.2.36	EV Target Voltage (EVTARGETVoltage).....	34
4.2.37	EVSE Current Limit Achieved (EVSECurrentLimitAchieved).....	34
4.2.38	EVSE Current Regulation Tolerance (EVSECurrentRegulationTolerance).....	34
4.2.39	EVSE Energy to be Delivered (EVSEEnergyToBeDelivered).....	35
4.2.40	EVSE ID (EVSEID).....	35
4.2.41	EVSE Isolation Status (EVSEIsolationStatus).....	35
4.2.42	EVSE Maximum Current Limit (EVSEMaximumCurrentLimit).....	36
4.2.43	EVSE Maximum Power Limit (EVSEMaximumPowerLimit).....	37
4.2.44	EVSE Maximum Voltage Limit (EVSEMaximumVoltageLimit).....	37
4.2.45	EVSE Minimum Current Limit (EVSEMinimumCurrentLimit).....	37
4.2.46	EVSE Minimum Voltage Limit (EVSEMinimumVoltageLimit).....	38
4.2.47	EVSE Notification (EVSENotification).....	38
4.2.48	EVSE Peak Current Ripple (EVSEPeakCurrentRipple).....	38
4.2.49	EVSE Power Limit Achieved (EVSEPowerLimitAchieved).....	39
4.2.50	EVSE Present Current (EVSEPresentCurrent).....	39
4.2.51	EVSE Present Voltage (EVSEPresentVoltage).....	39
4.2.52	EVSE Processing (EVSEProcessing).....	40
4.2.53	EVSE Status Code (EVSEStatusCode).....	40
4.2.54	EVSE Voltage Limit Achieved (EVSEVoltageLimitAchieved).....	41
4.2.55	External Payment (ExternalPayment).....	41
4.2.56	Free Service (FreeService).....	41
4.2.57	Full SOC (FullSOC).....	42
4.2.58	General Challenge (GeneralChallenge).....	42
4.2.59	ID (Identification).....	42
4.2.60	Multiplier (Multiplier).....	42
4.2.61	Notification Max Delay (NotificationMaxDelay).....	43
4.2.62	P Max (PMax).....	43

4.2.63	P Max Schedule (PMaxSchedule)	43
4.2.64	P Max Schedule Entry (PMaxScheduleEntry)	44
4.2.65	P Max Schedule Entry Type (PMaxScheduleEntryType)	44
4.2.66	P Max Schedule ID (PMaxScheduleID)	44
4.2.67	Parameter Set ID (ParameterSetID)	45
4.2.68	Payment Options (PaymentOptions)	45
4.2.69	Physical Value Type (PhysicalValueType)	46
4.2.70	Priority (Priority)	46
4.2.71	Profile Entry (ProfileEntry)	46
4.2.72	Profile Entry Type (ProfileEntryType)	47
4.2.73	Protocol Namespace (ProtocolNamespace)	47
4.2.74	Ready to Charge State (ReadyToChargeState)	47
4.2.75	Relative Time Interval (RelativeTimeInterval)	48
4.2.76	Remaining Time to Bulk SOC (RemainingTimetoBulkSOC)	48
4.2.77	Remaining Time to Full SOC (RemainingTimetoFullSOC)	48
4.2.78	Response Code (ResponseCode)	49
4.2.79	SA Schedule List (SAScheduleList)	50
4.2.80	SA Schedule List Type (SAScheduleListType)	51
4.2.81	SA Schedule Tuple (SAScheduleTuple)	51
4.2.82	SA Schedule Tuple ID (SAScheduleTupleID)	51
4.2.83	SA Schedule Tuple Type (SAScheduleTupleType)	52
4.2.84	Schema ID (SchemaID)	52
4.2.85	Selected Payment Option (SelectedPaymentOption)	53
4.2.86	Selected Service (SelectedService)	53
4.2.87	Selected Service List (SelectedServiceList)	53
4.2.88	Selected Service List Type (SelectedServiceListType)	54
4.2.89	Selected Service Type (SelectedServiceType)	54
4.2.90	Service Category (ServiceCategory)	55
4.2.91	Service Charge Type (ServiceChargeType)	55
4.2.92	Service ID (ServiceID)	56
4.2.93	Service List (ServiceList)	56
4.2.94	Service Name (ServiceName)	56
4.2.95	Service Payment Selection Req Type (ServicePaymentSelectionReqType)	56
4.2.96	Service Scope (ServiceScope)	57
4.2.97	Service Tag (ServiceTag)	57
4.2.98	Service Tag Type (ServiceTagType)	57
4.2.99	Service Type (ServiceType)	58
4.2.100	Session Setup Code (ResponseCode)	58
4.2.101	Start (Start)	58
4.2.102	Unit (Unit)	58
4.2.103	Value (Value)	59
4.2.104	Version Number Major (VersionNumberMajor)	59
4.2.105	Version Number Minor (VersionNumberMinor)	59
5.	MESSAGES	60
5.1	Message Summary	60
5.1.1	Supported Application Protocol Request (SupportedAppProtocolReq)	60
5.1.2	Supported Application Protocol Response (SupportedAppProtocolRes)	60
5.1.3	Session Setup Request (SessionSetupReq)	60
5.1.4	Session Setup Response (SessionSetupRes)	60
5.1.5	Service Discovery Request (ServiceDiscoveryReq)	60
5.1.6	Service Discovery Response (ServiceDiscoveryRes)	60
5.1.7	Service and Payment Selection Request (ServicePaymentSelectionReq)	60
5.1.8	Service and Payment Selection Response (ServicePaymentSelectionRes)	60
5.1.9	Contract Authentication Request (ContractAuthenticationReq)	60
5.1.10	Contract Authentication Response (ContractAuthenticationRes)	60
5.1.11	Charge Parameter Discovery Request (ChargeParameterDiscoveryReq)	61
5.1.12	Charge Parameter Discovery Response (ChargeParameterDiscoveryRes)	61
5.1.13	Power Delivery Request (PowerDeliveryReq)	61



5.1.14	Power Delivery Response (PowerDeliveryRes)	61
5.1.15	Cable Check Request (CableCheckReq)	61
5.1.16	Cable Check Response (CableCheckRes).....	61
5.1.17	Pre Charging Request (PreChargeReq)	61
5.1.18	Pre Charging Response (PreChargeRes)	61
5.1.19	Current Demand Request (CurrentDemandReq)	61
5.1.20	Current Demand Response (CurrentDemandRes).....	61
5.1.21	Welding Detection Request (WeldingDetectionReq)	62
5.1.22	Welding Detection Response (WeldingDetectionRes)	62
5.1.23	Session Stop Request (SessionStopReq)	62
5.1.24	Session Stop Response (SessionStopRes)	62
5.2	Message List Table	62
5.3	Message Sequences.....	69
5.3.1	Protocol Flow Stages and Associated Messages	69
5.3.2	Basic Definitions for Error Handling	70
5.3.3	Response Code Usage by the SECC	70
5.3.4	Request-Response Message Sequence Requirements	71
5.4	Request Message Parameters (Mandatory/Optional) Modes.....	82
5.5	Response Message Parameters (Mandatory/Optional) Modes.....	84
5.6	Session Timing and Error Handling	86
5.6.1	Overview	86
5.6.2	Message Sequence and Performance Timing Definitions.....	87
5.6.3	EVCC Timing and Error Handling for Request-Response Message Pairs	90
5.6.4	SECC Timing and Error Handling for Response-Request Message Sequence	90
5.6.5	V2G Communication Session Timing Definitions	91
6.	DC VEHICLE-TO-HOME (V2H) AND VEHICLE TO GRID (V2G) REQUIREMENTS	95
6.1	Requirements:	96
6.2	Security	96
6.3	Switching Between V2H and V2G	96
6.4	DC Vehicle-to-Home Overview	97
6.5	Communications Summary	100
6.6	Pairing the EV and EVSE.....	104
6.7	Service Negotiation for V2H.....	104
6.8	Signal Variations for V2H (versus Charging or V2G).....	106
6.8.1	DC V2H Success and Failure Conditions	106
6.9	Additional V2H items.....	109
6.9.1	Isolation Monitoring	109
6.9.2	Pre-Charge.....	110
6.9.3	Backup Energy Source	115
6.9.4	Shared V2H Resources	117
6.9.5	Manual Override.....	119
6.10	V2G	119
6.10.1	Service Negotiation for V2G	120
6.10.2	V2G Signals	121
6.10.3	Switching Between Charging (Positive) and V2G (Negative) Signals and Vice Versa	124
6.10.4	Items Not Required for V2G.....	124
6.10.5	Applications for V2G	124
6.11	ISO 15118-20 Light Design.....	125
6.11.1	Private Environment.....	125
6.11.2	CPM4PE	125
6.11.3	Protocol	126
6.11.4	Message Sequence Description	127
7.	APPLICATION LAYER MESSAGE PROTOCOL	147
7.1	General Information and Definitions	147
7.2	Protocol Handshake.....	148
7.2.1	Handshake Request-Response Message Pair	148
7.2.2	Message Definition supportedAppProtocolReq and supportedAppProtocolRes	149

7.3	Message Structure	151
7.3.1	Overview	151
7.3.2	Message Definition.....	151
7.3.3	Message Header Definition.....	152
7.3.4	Message Body Definition	153
7.4	BodyElement Definitions	153
7.4.1	Common Messages	153
7.4.2	DC-Messages	161
8.	NOTES	166
8.1	Revision Indicator.....	166
8.2	Acknowledgement.....	167
APPENDIX A	MESSAGE SEQUENCE EXAMPLES.....	168
APPENDIX B	SIGNALS TABLE	171
APPENDIX C	RESPONSE CODE CORRELATION MATRIX.....	174
APPENDIX D	REQUIREMENTS SUMMARY.....	176
APPENDIX E	XML SCHEMA (FOR REFERENCE BACK TO DIN DOCUMENT).....	202
APPENDIX F	APPLICATION LAYER SERVICE PRIMITIVES	230
Figure 1	Document interaction	10
Figure 2	Charging limits	18
Figure 3	XML schema definition for the ChargingProfileType	21
Figure 4	Schema diagram—DC_EVChargeParameterType	23
Figure 5	Schema diagram—DC_EVPowerDeliveryParameterType	24
Figure 6	Schema diagram—DC_EVStatusType	24
Figure 7	Schema diagram—DC_EVSEChargeParameterType.....	25
Figure 8	Schema diagram—DC_EVSEStatusType	26
Figure 9	Schema diagram—PMaxScheduleType	43
Figure 10	Schema diagram—PMaxScheduleEntryType	44
Figure 11	Schema diagram—PaymentOptionsType.....	45
Figure 12	Schema diagram—PhysicalValueType.....	46
Figure 13	Schema diagram—ProfileEntryType.....	47
Figure 14	Schema diagram—RelativeTimeIntervalType	48
Figure 15	Schema diagram—SAScheduleListType.....	51
Figure 16	Schema diagram—SAScheduleTupleType	52
Figure 17	Schema diagram—SelectedServiceListType	54
Figure 18	Schema diagram—SelectedServiceType	54
Figure 19	Schema diagram—ServiceChargeType	55
Figure 20	Schema diagram—ServiceTagType.....	57
Figure 21	Schema diagram—ServiceType	58
Figure 22	Message sequence and performance timing.....	89
Figure 23	V2G communication session timing.....	94
Figure 24	V2H and V2G sequence diagram	97
Figure 25	Charging/V2G/V2H system boundary.....	98
Figure 26	System schematic.....	99
Figure 27	EVSE-ATS communication layers over UARTs.....	101
Figure 28	Pairing signals.....	104
Figure 29	Initial ChargeParameterDiscovery messages.....	107
Figure 30	Final ChargeParameterDiscovery messages	108
Figure 31	Negative format summary	109
Figure 32	Charging system schematic.....	110
Figure 33	Option 1 DC V2H system schematic—DC EVSE pre-charges from home	111
Figure 34	Option 2 DC V2H system schematic.....	



Figure 35	Pre-charge and PowerDelivery messages.....	114
Figure 36	CurrentDemand message	116
Figure 37	DC EVSE	118
Figure 38	(V2M) DC EVSE and ESS	118
Figure 39	(V2M)—DC EVSE (V2G—or charging), ESS (V2H), and PV	119
Figure 40	Direct communication primary actors and optional paths	121
Figure 41	EVSE initiated V2G	122
Figure 42	EV initiated V2G	123
Figure 43	V2G to eliminate demand charges.....	124
Figure 44	V2G to eliminate high cost during peak load periods	125
Figure 45	ISO 15118-20 light handshake diagram	126
Figure 46	Schema diagram—SupportedAppProtocolReq	149
Figure 47	Schema diagram—supportedAppProtocolRes	149
Figure 48	Schema diagram—V2G message	151
Figure 49	Schema diagram—message header	152
Figure 50	Schema diagram—message body.....	153
Figure 51	Schema diagram—SessionSetupReq	153
Figure 52	Schema diagram—SessionSetupRes.....	154
Figure 53	Schema diagram—ServiceDiscoveryReq.....	155
Figure 54	Schema diagram—ServiceDiscoveryRes	155
Figure 55	Schema diagram—ServicePaymentSelectionReq	156
Figure 56	Schema diagram—ServicePaymentSelectionRes.....	156
Figure 57	Schema diagram—ContractAuthenticationReq	157
Figure 58	Schema diagram—ContractAuthenticationRes	157
Figure 59	Schema diagram—ChargeParameterDiscoveryReq	158
Figure 60	Schema diagram—charge parameter discovery res	159
Figure 61	Schema diagram—PowerDeliveryReq	160
Figure 62	Schema diagram—PowerDeliveryRes.....	160
Figure 63	Schema diagram—SessionStopReq	161
Figure 64	Schema diagram—SessionStopRes.....	161
Figure 65	Schema diagram—CableCheckReq.....	162
Figure 66	Schema diagram—CableCheckRes	162
Figure 67	Schema diagram—PreChargeReq	163
Figure 68	Schema diagram—PreChargeRes	163
Figure 69	Schema diagram—CurrentDemandReq	164
Figure 70	Schema diagram—CurrentDemandRes	165
Figure 71	Schema diagram—WeldingDetectionReq	166
Figure 72	Schema diagram—WeldingDetectionRes.....	166
Table 1	AppProtocol entry.....	19
Table 2	Bulk charging complete.....	20
Table 3	Bulk SOC	20
Table 4	Charge service	20
Table 5	Charging complete	20
Table 6	Charging profile	21
Table 7	Charging profile entry max power	21
Table 8	Charging profile entry start.....	22
Table 9	Date time now	22
Table 10	DC EV charge parameter.....	22
Table 11	DC EV power delivery parameter	23
Table 12	DC EV status.....	24
Table 13	DC EVSE charge parameter	25
Table 14	DC EVSE status.....	25
Table 15	Duration.....	26
Table 16	Energy transfer type.....	26
Table 17	Semantics for EVSESupportedEnergyTransferType.....	27
Table 18	EV cabin conditioning.....	27
Table 19	EV energy capacity	27
Table 20	EV energy request	28

Table 21	EV error code	28
Table 22	Semantics and type definition for EVErrorCodeType	29
Table 23	EV ID	29
Table 24	EV maximum current limit	30
Table 25	EV maximum power limit	30
Table 26	EV maximum voltage limit	31
Table 27	EV ready	31
Table 28	EV requested energy transfer type	31
Table 29	Value defined by the enumerated type EVSESupportedEnergyTransferType	32
Table 30	EV RESS conditioning	32
Table 31	EV RESS SOC	33
Table 32	EV target current	33
Table 33	EV target voltage	34
Table 34	EVSE current limit achieved	34
Table 35	EVSE current regulation tolerance	34
Table 36	EVSE energy to be delivered	35
Table 37	EVSE ID	35
Table 38	EVSE isolation status value	36
Table 39	EVSE isolation status meaning	36
Table 40	Semantics and types of elements in the IsolationLevelType	36
Table 41	EVSE maximum current limit	36
Table 42	EVSE maximum power limit	37
Table 43	EVSE maximum voltage limit	37
Table 44	EVSE minimum current limit	37
Table 45	EVSE minimum voltage limit	38
Table 46	EVSE notification	38
Table 47	EVSE peak current ripple	38
Table 48	EVSE power limit achieved	39
Table 49	EVSE present current	39
Table 50	EVSE present voltage	39
Table 51	EVSE processing	40
Table 52	EVSE status code	40
Table 53	Semantics and type definition for EVSEStatusCodeType	40
Table 54	EVSE voltage limit achieved	41
Table 55	External payment	41
Table 56	Full SOC	42
Table 57	General challenge	42
Table 58	ID	42
Table 59	Multiplier	42
Table 60	Notification max delay	43
Table 61	P max	43
Table 62	P max schedule entry	44
Table 63	P max schedule ID	44
Table 64	Parameter set ID	45
Table 65	Payment options	45
Table 66	Semantics and type definition for PhysicalValueType	46
Table 67	Priority	46
Table 68	Profile entry	46
Table 69	Protocol namespace	47
Table 70	Relative Time Interval	48
Table 71	Remaining time to bulk SOC	48
Table 72	Remaining time to full SOC	48
Table 73	Response code	49
Table 74	Response code values	50
Table 75	SA schedule list	50
Table 76	SA schedule tuple	51
Table 77	SA schedule tuple ID	51
Table 78	Schema ID	52
Table 79	Selected payment option	52

Table 80	Selected payment option used.....	53
Table 81	Selected service.....	53
Table 82	Selected service list	53
Table 83	Semantics and type definition for SelectedServiceListType	54
Table 84	Semantics and type definition for SelectedServiceType.....	54
Table 85	Service category	55
Table 86	Service charge type	55
Table 87	Service ID.....	56
Table 88	Service list.....	56
Table 89	Service name	56
Table 90	Service scope.....	57
Table 91	Service tag	57
Table 92	Session setup code.....	58
Table 93	Start.....	58
Table 94	Unit.....	58
Table 95	Value	59
Table 96	Version number major.....	59
Table 97	Version number minor.....	59
Table 98	Message list table	62
Table 99	Request message parameters modes	82
Table 100	Response message parameters modes	84
Table 101	EVCC and SECC timers, timeouts, and performance times.....	87
Table 102	EVCC and SECC message timeouts and performance times.....	88
Table 103	EVCC and SECC communication session timing parameters.....	93
Table 104	EVCC and SECC communication session timing parameter values	93
Table 105	Controls and monitoring summary	100
Table 106	Service negotiation for V2H	104
Table 107	Pre-charge steps for charging or V2G	110
Table 108	Option 1 pre-charge steps for DC V2H.....	111
Table 109	Option 2 pre-charge steps for DC V2H.....	112
Table 110	EVSE status code	113
Table 111	EVSEStatusCode values	116
Table 112	ServiceDetailsReq/Res values.....	133
Table 113	ScheduleExchangeReq/Res	138
Table 114	General error handling	147
Table 115	Semantics and type definition for a V2G message.....	151
Table 116	Semantics and type definition for a V2G message header.....	152
Table 117	Semantics and type definition for a V2G message body	153

1. SCOPE

This SAE Recommended Practice establishes requirements and specifications for communication between plug-in electric vehicle (PEV) and the DC off-board charger. Where relevant, this document notes, but does not formally specify, interactions between the vehicle and vehicle operator.

This document applies to the off-board DC charger for conductive charging, which supplies DC current to the rechargeable energy storage system (RESS) of the electric vehicle through a SAE J1772 coupler. Communications will be on the SAE J1772 pilot line for PLC communication. The details of powerline communications (PLC) are found in SAE J2931/4.

This document supports DC energy transfer via forward power flow (FPF) from source to vehicle.

SAE has published multiple documents relating to PEV and vehicle-to-grid interfaces. The various document series are listed below, with a brief explanation of each.

SAE J2836	General Requirements and Use Cases. This document is divided into several sections. SAE J2836/1 is for utility/smart grid messaging. SAE J2836/2 is for DC charge control. SAE J2836/3 is for reverse energy flow. SAE J2836/4 is for diagnostics. SAE J2836/5 is for consumer requirements and the HAN. SAE J2836/6 is for wireless charging.
SAE J2847	Functional Messaging Requirements. This document defines the functional messages required for a given function. This document is divided into several sections that correspond to SAE J2836 above. SAE J2847/1 is for utility/smart grid messaging. SAE J2847/2 is for DC charge control. SAE J2847/3 is for reverse energy flow. SAE J2847/4 is for diagnostics. SAE J2847/5 is for consumer requirements. SAE J2847/6 is for wireless charging.
SAE J2931	Digital Communications for PEVs. This series of documents defines the requirements to enable digital communications for PEVs. It is divided into several sections. SAE J2931/1 describes overall requirements. SAE J2931/4 is wired communications using PLC. SAE J2931/5 is telematics. SAE J2931/6 is for wireless charging. SAE J2931/7 includes the security for each of these.
SAE J2953	Plug-In Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE). This is the series that include the requirements in SAE J2953/1 and test procedures in SAE J2953/2, for all the previous documents, including SAE J1772's control pilot and proximity circuits and functions.
SAE J3072	Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems. This document includes the requirements for onboard inverters to send/receive the grid signals for vehicle-to-grid (V2G) functions.

Figure 1 shows the sequencing of these documents and their primary function (e.g., the SAE J2836 and SAE J2847/1 documents start with smart charging, SAE J2836 and SAE J2847/2 then adds DC charging, etc.). The intent is to have subsequent slash sheets complement each other as more functions and features are included. The /6 series of documents add wireless charging items not already included in the proceeding slash sheets. These are all then included in interoperability in SAE J2953 and security in SAE J2931/7. SAE J3072 then includes the PEV to grid requirements for vehicle-to-grid (V2G) power and communication to match SAE J2836/3 use cases.

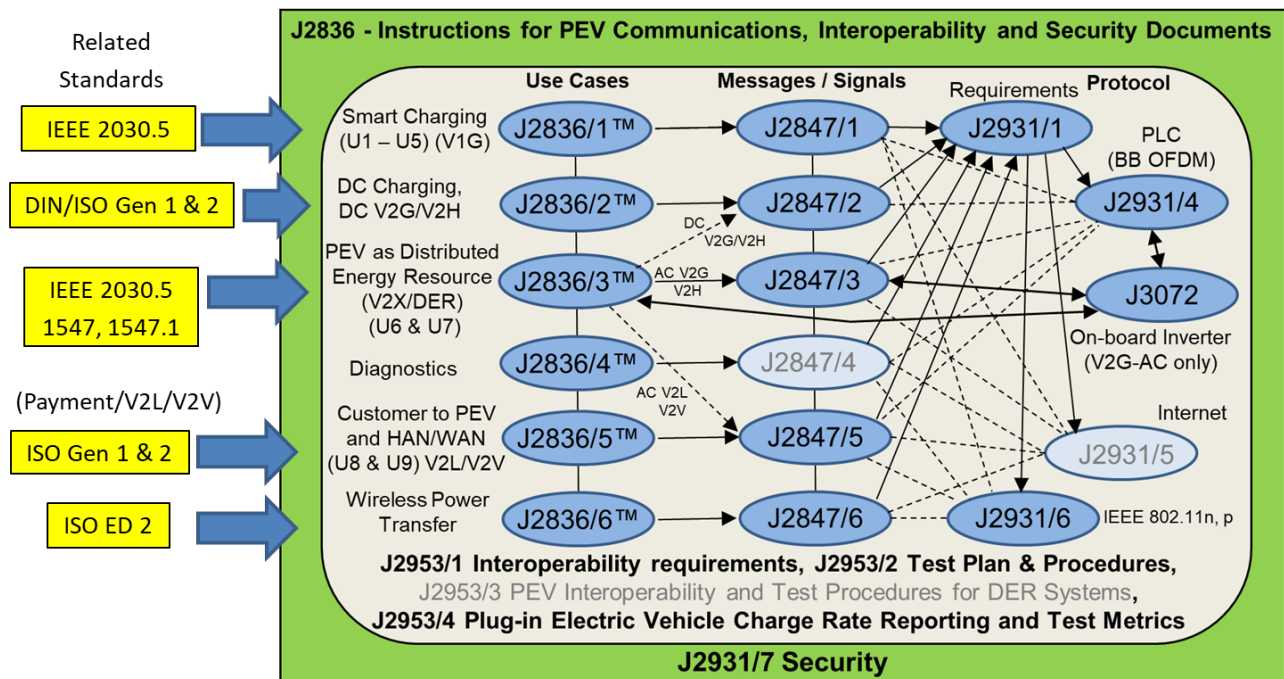


Figure 1 - Document interaction

The summary of documents for DC charging is then as follows:

- SAE J1772 is the PEV to EVSE systems document and includes the system and timing diagrams for DC charging.
- SAE J2836/2 starts with the use cases for DC charging communications.
- SAE J2847/2 then transforms these use case requirements into the signals and messages.
- SAE J2931/1 is where the protocol requirements are placed for all PEV communications.
- SAE J2931/4 is used for the PLC communication requirements for DC charging since it is only a wired median.
- SAE J2953/1 is the interoperability requirements.
- SAE J2953/2 is the interoperability procedure and plan.
- SAE J2931/7 includes the security.

1.1 Purpose

The primary purpose of SAE J2847/2 is to provide the communication to achieve RESS charging control irrespective of RESS variations or energy storage technology.

SAE J2847/1 identifies the functional messaging for the PEV to connect to the utility or service provider and participate in available programs. This document, SAE J2847/2, identifies the additional messages for DC energy transfer to the PEV.

The specification supports DC energy transfer via forward power flow (FPF) from grid to vehicle, and DC reverse power flow (RPF) from vehicle to grid is included in SAE J2847/3. DC forward power flow is used to charge the vehicle's rechargeable energy storage system (RESS).

NOTE: In this specification, we use the terms "FPF" and "RPF" as precisely defined, and avoid the term "V2G" because its meaning has become ambiguous through divergent common usages.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1772	SAE Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler
SAE J2836/1	Use Cases for Communication Between Plug-in Vehicles and the Utility Grid
SAE J2836/2	Use Cases for Communication Between Plug-in Vehicles and Off-Board DC Charger
SAE J2836/3	Use Cases for Plug-in Vehicle Communication as a Distributed Energy Resource
SAE J2847/1	Communication for Smart Charging of Plug-in Electric Vehicles Using Smart Energy Profile 2.0
SAE J2931/1	Digital Communications for Plug-in Electric Vehicles
SAE J2931/4	Broadband PLC Communication for Plug-in Electric Vehicles
SAE J2931/7	Security for Plug-in Electric Vehicle Communications
SAE J2953/1	Plug-in Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)
SAE J2953/2	Test Procedures for the Plug-in Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1715	Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology
SAE J1939	Serial Control and Communications Heavy-Duty Vehicle Network - Top-Level Document
SAE J2894/1	Power Quality Requirements for Plug-in Electric Vehicle Chargers

2.2.2 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

IEC 61851-1	Electric vehicle conductive charging system - Part 1: General requirements
IEC 61851-23	Electric vehicle conductive charging system - Part 23: D.C. electric vehicle charging station
IEC 61851-24	Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging
IEC 62196-3	Plugs, socket-outlets, and vehicle couplers - Conductive charging of electric vehicles - Part 3: Dimensional interchangeability requirements for d.c. pin and contact-tube vehicle couplers

2.2.3 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 15118-1	Road vehicles - Vehicle-to-grid communication interface - Part 1: General information and use-case definition
ISO 15118-2	Road vehicles - Vehicle-to-Grid Communication Interface - Part 2: Network and application protocol requirements
ISO 15118-3	Road vehicles - Vehicle-to-Grid Communication Interface - Part 3: Physical and data link layer requirements
ISO 15118-4	Road vehicles - Vehicle-to-Grid Communication Interface - Part 2: Network and application protocol requirements
ISO 15118-5	Road vehicles - Vehicle-to-grid communication interface - Part 5: Physical and data link layer conformance tests
ISO 15118-20	Road vehicles - Vehicle-to-grid communication interface - Part 20: Network and application protocol requirements

2.2.4 IEEE Publications

Available from IEEE Operations Center, 445 and 501 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, www.ieee.org.

IEEE 1815	Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3)
IEEE 1547-2003	Standard for Interconnecting Distributed Resources with Electric Power Systems
IEEE 1547-2018	Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
IEEE 1547.1-2005	Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
IEEE 1547.1-2020	Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces
IEEE 2030.5-2018	Standard for Smart Energy Profile Application Protocol (SEP2)

2.2.5 UL Publications

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 1741 Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 9741 Outline of Investigation for Bidirectional Electric Vehicle (EV) Charging System Equipment

2.2.6 DIN Publications

Copies of these documents are available online at <https://www.en-standard.eu/din-standards/>.

DIN SPEC 70121 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

DIN SPEC 70122 Conformance tests for digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging System;

DIN SPEC 91286 DIN SPEC 91286:2011-11 Electric mobility - Schemes of identifiers for E-Roaming -Contract ID and Electric Vehicle Supply Equipment ID

2.2.7 Sunspec Modbus

Available from Sunspec Organization

<https://sunspec.org/sunspec-modbus-specifications/>

SunSpec DER Information Model Specification

3. DEFINITIONS

3.1 ADVANCED METERING INFRASTRUCTURE (AMI)

This typically refers to the full measurement and collection system that includes meters at the customer site, communication networks between the customer and a service provider, such as an electric, gas, or water utility, and data reception and management systems that make the information available to the service provider.

3.2 BATTERY

See electric vehicle storage battery (3.10).

3.3 BATTERY ELECTRIC VEHICLE (BEV)

A vehicle that receives its power solely from batteries, unlike a hybrid vehicle that may receive a portion of its power from an internal combustion engine (ICE). See also PEV (3.16).

3.4 BRANCH CIRCUIT

The circuit conductors between the final overcurrent device protecting the circuit and the equipment supplied by the circuit. It is typically an unswitched circuit from the service equipment (fuse box) to an appliance. For this application, the appliance is the electric vehicle supply equipment (EVSE).

3.5 COMPATIBILITY CHECK

The PEV and the off-board charger should check if they are compatible. For example, the PEV RESS voltage may be higher than what the DC supply can support. Another example is where the PEV RESS maximum voltage is lower than what the DC supply can regulate down to. The vehicle will evaluate the DC supply limit parameters and the vehicle decides whether to proceed with charging. Also see conformance (3.6) and interoperability (3.13).

3.6 CONFORMANCE

A statement of successful measureable verification that a device has implemented a standard as written. A compatible device may claim it conforms to a standard only after comprehensive conformance testing.

3.7 CONSISTENT OVERHEAD BYTE STUFFING (COBS)

An algorithm for encoding data bytes that results in efficient, reliable, unambiguous packet framing regardless of packet content, thus making it easy for receiving applications to recover from malformed packets.

3.8 DC SUPPLY

It converts AC energy from the grid to the DC energy for the rechargeable energy storage system (RESS). It is also referred as the off-board charger.

3.9 ELECTRIC VEHICLE COMMUNICATION CONTROLLER (EVCC)

This is the module in the PEV that includes the PLC communication signals transmitted and received to the supply equipment communication controller (SECC), within the EVSE.

3.10 ELECTRIC VEHICLE STORAGE BATTERY (BATTERY)

A group of electrochemical cells electrically connected in a series and/or parallel arrangement, the principal purpose of which is to provide DC electrical energy to propel the EV. May also be called rechargeable energy storage system (RESS), or energy storage system (ESS).

3.11 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

The equipment from the branch circuit to, and including, the connector that couples to the electric vehicle inlet, the purpose of which is to transfer electric energy to a PEV. This equipment is located off-board the vehicle.

3.12 HANDSHAKING COMPLETE

This is not a signal. This is a state from a combination of several signals between the PEV and the off-board charger. After initiating high level communications, the DC off-board charger must receive: vehicle ready, vehicle maximum current limit, vehicle voltage upper limit and vehicle error code. The PEV must receive: charger maximum current limit, charger maximum voltage limit, charger minimum current limit, and charger minimum voltage limit and charger status code. The vehicle must confirm the connector lock status and will implicitly reflect the lock state in the vehicle ready status. The lock status is not explicitly sent from the vehicle to the DC off-board charger. After all of these signals have been exchanged between the PEV and the off-board DC charger then handshaking complete state is reached.

3.13 INTEROPERABILITY

The capability of a standards conforming device to function as intended with other standards conforming devices without special effort by the user.

3.14 MESSAGE

A message may include several signals packaged together in a group such that the entire group can be sent together over a physical layer interface. The physical layer will be defined in the SAE J2931 documents.

3.15 NO DATA PARAMETER

This defines a means for the vehicle or DC supply to indicate that a signal is not available (i.e., hasn't been read yet).

3.16 PLUG-IN ELECTRIC VEHICLE (PEV)

Any class of vehicle: BEV, plug-in hybrid electric vehicle (PHEV), electric tug, etc., which can be plugged into to receive power from the electrical grid where this power is then used to apply traction to the vehicle wheels.

3.17 POWER LINE COMMUNICATION (PLC)

This is called power line carrier, mains communication, power line telecom (PLT), or power line networking (PLN), are terms describing several different systems for using electric power lines to carry information over the power line.

Electrical power is transmitted over high voltage transmission lines, distributed over medium voltage, and used inside buildings at lower voltages. Power line communications can be applied at each stage. Most PLC technologies limit themselves to one set of wires (for example, premises wiring), but some can cross between two levels (for example, both the distribution network and premises wiring).

All power line communications systems operate by impressing a modulated carrier signal on the wiring system. Different types of power line communications use different frequency bands, depending on the signal transmission characteristics of the power wiring used. Since the power wiring system was originally intended for transmission of AC power, the power wire circuits have only a limited ability to carry higher frequencies. The propagation problem is a limiting factor for each type of power line communications.

Data rates over a power line communication system vary widely. Low-frequency (about 100 to 200 kHz) carriers impressed on high-voltage transmission lines may carry one or two analog voice circuits, or telemetry and control circuits with an equivalent data rate of a few hundred bits per second; however, these circuits may be many miles (kilometers) long. Higher data rates generally imply shorter ranges; a local area network operating at millions of bits per second may only cover one floor of an office building, but eliminates installation of dedicated network cabling.

3.18 PRE-CHARGE

Pre-charging the DC bus ensures that the voltage supplied by the EVSE is nearly matched to the vehicle RESS voltage prior to closing the vehicle contactors. This ensures that there is no possibility of a high in-rush current at the time of contactor closure.

3.19 RECHARGEABLE ENERGY STORAGE SYSTEM (RESS)

Any energy storage system that has the capability to be charged and discharged. (Examples: batteries, capacitors, and electro-mechanical flywheels.)

3.20 SUPPLY EQUIPMENT COMMUNICATION CONTROLLER (SECC)

This is the module in the EVSE that includes the PLC communication signals transmitted and received to the EVCC, within the PEV.

3.21 SIGNAL

The individual data elements that are communicated between the Plug-In Vehicle and the off-board charger. The signals are listed in 4.1.3 and in the table in Appendix B.

3.22 SIGNAL BIT SIZE

The bit size defines how many digital bits are needed to represent the full range signal, including no data.

3.23 SIGNAL DEFAULT VALUE

The default value is what is assumed if a signal has not yet been received over the communications bus.

3.24 SIGNAL OFF-SET

This defines how an integer is adjusted to achieve the full range at the defined resolution. Offset can be positive or negative.

3.25 SIGNAL RANGE

The range defines the signal limits in engineering units.

3.26 SIGNAL RESOLUTION

The resolution determines how much a signal can change with each bit step in the integer representation.

3.27 SIGNAL UPDATE RATE

This defines the expected frequency at which a periodic signal must be received over the communications bus for proper system control. If a particular signal is missing for more than ten full rate cycles (based on 5.6.2), then the system should enter a faulted state and proceed to shutdown energy transfer.

DC off-board charger must receive: vehicle ready, vehicle maximum current limit, vehicle voltage upper limit and vehicle error code.

3.28 STATE OF CHARGE (SOC) (%)

Obtained by subtracting the depth of discharge from 100.

3.29 UART

A hardware communication protocol that uses asynchronous serial communication with configurable speed. Asynchronous means there is no clock signal to synchronize the output bits from the transmitting device going to the receiving end

3.30 V1G

A form of managed charging in which the charging (power level and time of charge) is adjusted to meet the prioritized needs of the EV owner and the grid.

3.31 VEHICLE-TO-GRID (V2G)

A form of managed charging, where, in addition to adjusting charging behavior (V1G), a vehicle RESS can discharge to the utility grid. The charging time, charging power level, discharge time, and discharge power levels are all manageable in order to meet the prioritized needs of the EV owner and the grid.

3.32 VEHICLE-TO-HOME (V2H)

An inverter intended to provide electrical energy to a load not associated with the electric utility or grid. Generally applied only to V2H or V2L situations and not V2G.

4. TECHNICAL REQUIREMENTS

4.1 Charging Phases

Refer to Appendices F and G in the SAE J1772 document for details about the charging phases. A normal charging session is broken up into four phases: (1) initialization, (2) pre-charge, (3) energy transfer, and (4) shutdown. Additionally, there are three types of emergency shutdown: (1) vehicle initiated, (2) supply initiated, and (3) cord disconnection.

4.1.1 Message Sequences

[V2G-DC-005] The basic signaling follows SAE J1772. All the timings shall be compliant with SAE J1772.

During the charging process, a bidirectional signaling according to SAE J1772 is used to indicate EV-related information via control pilot (CP) states and EVSE-related information via the CP duty cycle.

Message sequences are defined for several scenarios in SAE J1772, Appendix F:

- Normal startup
- Normal shutdown
- Vehicle initiated shutdown
- Charger initiated shutdown
- Loss of pilot shutdown

[V2G-DC-560] For DC charging, the EV shall apply CP State C or D during the energy transfer and CP State B otherwise, unless an error condition occurring at any point in time requires changing to CP State B. For more details, please see [V2G-DC-501] and [V2G-DC502].

[V2G-DC-561] An EVSE that supports only DC charging on a connector shall apply a CP duty cycle of 5 % on this connector after detection of CP State B, so that the high-level communication can start, and until high-level communication stops, unless an error condition requires applying a different CP duty cycle or CP voltage.

NOTE 1: An EVSE that supports other charging types than DC charging on a connector may, in accordance with the specification of those charging types, apply other CP duty cycles, including 100 %, on this connector until it sends a ChargeParameterDiscoveryRes message with ResponseCode equal to "OK." Please see [V2G-DC-671].

NOTE 2: According to SAE J1772, if the SECC detects CP State A or an unexpected CP State B, it carries out, without any delay, an "EVSE-initiated emergency shutdown," which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

4.1.2 Charging Limits

Throughout the charging session the vehicle and DC charger will both communicate their respective operation limits. These limits include the maximum and minimum for current, maximum voltage and maximum power. The charger will regulate its output control to maintain these limits.

Figure 2 shows how those limits are to be maintained at a few sample operating points.

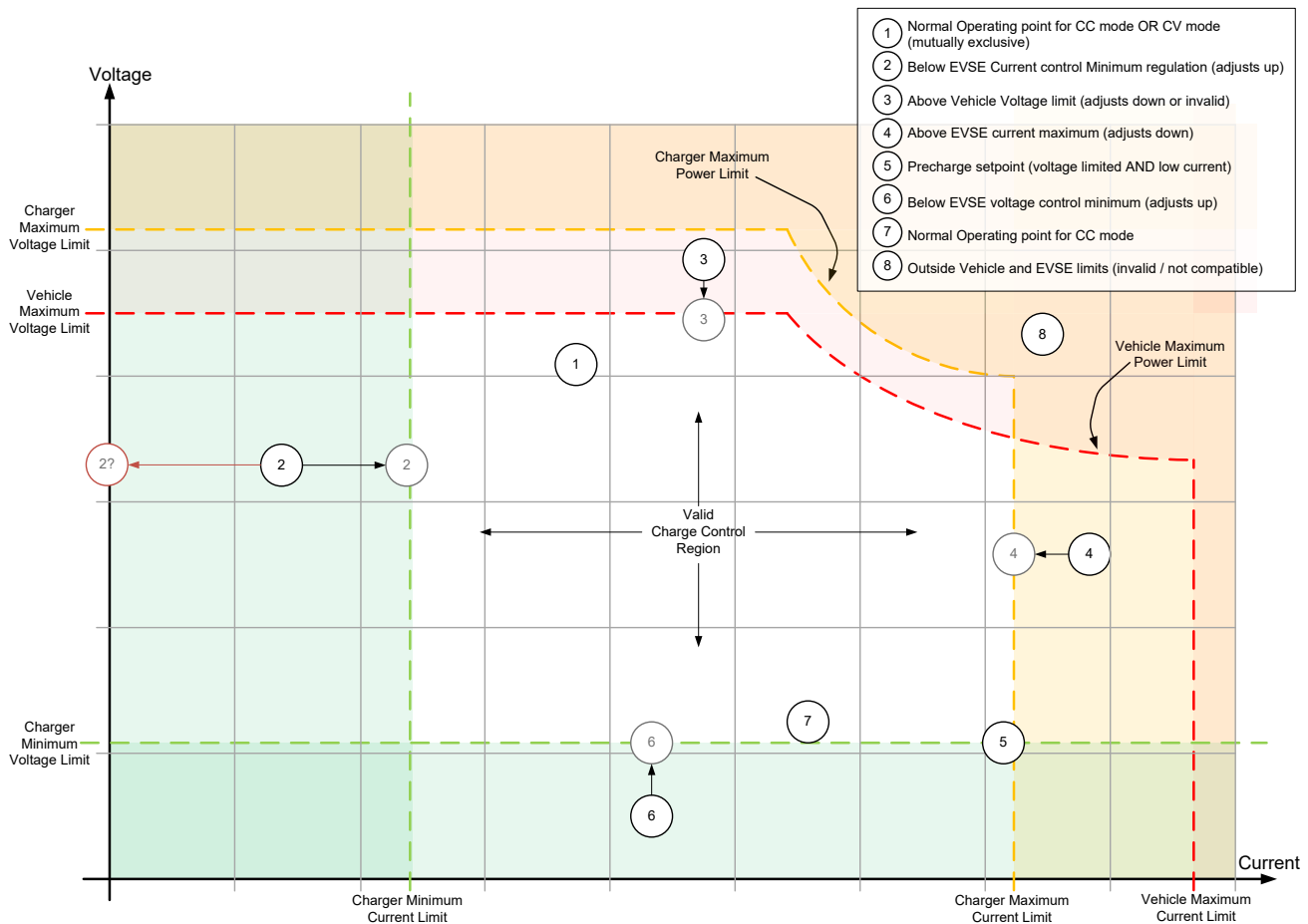


Figure 2 - Charging limits

4.1.3 Requirement Structure

4.1.3.1 Requirement Format

This document uses a requirement structure; i.e., a unique number that identifies each individual requirement included in this clause. This requirement structure allows for easier requirement tracking and test case specification. The following formats are used:

“**[V2G-DC-xyz]** requirement text,” where:

- “V2G-DC” represents the DIN SPEC 70121 standard.
- “xyz” represents the individual requirement number.
- “requirement text” represents the actual text of the requirement.

Example:

[V2G-DC-001] This shall be an example.

4.1.3.2 Applicability

This clause specifies the requirements to be implemented by the EV and the EVSE in order to allow communication between both entities. Usually the requirements of this standard are implemented by one vehicle entity and additionally at least by one EVSE entity depending on the EVSE network architecture.

The requirements of this specification will refer to as “The EV shall implement...” implying that the vehicle communication entity shall implement the required functionality if not explicitly stated otherwise.

The requirements of this specification will refer to as “The EVSE shall implement...” implying that at least one EVSE entity shall implement the required functionality if not explicitly stated otherwise.

The requirements of this specification will refer to as “The V2G entities shall implement...” implying that all V2G entities involved in the V2G communication shall implement the required functionality if not explicitly stated otherwise.

[V2G-DC-001] The EV shall implement all mandatory requirements defined in this document for an EV.

[V2G-DC-002] The EVSE shall implement all mandatory requirements defined in this document for an EVSE.

4.1.3.3 Usage of Request for Comment (RFC) References

When RFCs are referenced, all “must/must not” requirements are mandatory.

[V2G-DC-003] If a referenced RFC has been updated by one or several RFC, the update is fully applicable for this standard.

[V2G-DC-004] If an update or part of an update applicable to an RFC referenced herein is not compatible with the original RFC or the implementation described by this standard the update shall not apply.

4.2 Signal Definitions

This section describes the details of the signals used to control an off-board charger. Several signals will be combined together to form an EXI encoded XML schema (see Section 6). The message packaging structure is outside the scope of this document in this current revision.

See the message list table in 5.2 for the messages containing these signals. See Table B1 in Appendix B for signal details.

4.2.1 App Protocol (AppProtocol)

Source: EVCC

Destination: SECC

This message element is used by the EVCC for transmitting the list of supported protocols. Each protocol with a particular version supported by the EVCC is represented by one AppProtocol entry in the request message (maximum number of entries: 20).

Table 1 - AppProtocol entry

Element/Attribute Name	Type	Semantics
AppProtocol	complexType: includes the message elements defined in this table	This message element is used by the EVCC for transmitting the list of supported protocols. Each protocol with a particular version supported by the EVCC is represented by one AppProtocol entry in the request message (maximum number of entries: 20).

4.2.2 Bulk Charging Complete (BulkChargingComplete)

Source: EVCC

Destination: SECC

This signal represents that the RESS has reached the bulk charge level (generally up to 80 to 100% SOC). This is optional, and is used for display purposes on the charging station. See 4.1 for more details. Indicates that the RESS system has completed the high-power charging.

Table 2 - Bulk charging complete

Element/Attribute Name	Type	Semantics
BulkChargingComplete	simpleType: boolean	Optional Element: If set to TRUE, the EV indicates that bulk charge (approx. 80 % SOC) is complete.

4.2.3 Bulk SOC (BulkSOC)

Source: EVCC

Destination: SECC

This signal represents the end point (SOC) where optimum fast charge ends. Each vehicle OEM will decide the bulk level value (80% for example). The displayed SOC could indicate this from actual SOC to bulk percent if desired.

Table 3 - Bulk SOC

Element/Attribute Name	Type	Semantics
BulkSOC	simpleType: percentValueType byte (range: 0-100)	Optional Element: SOC at which the PEV considers a fast charging process to complete.

4.2.4 Charge Service (ChargeService)

Source: SECC

Destination: EVCC

Available charging services supported by the EVSE. See 4.2.91 for additional signal details.

Table 4 - Charge service

Element/Attribute Name	Type	Semantics
ChargeService	complexType: ServiceChargeType	Available charging services supported by the EVSE.

4.2.5 Charging Complete (ChargingComplete)

Source: EVCC

Destination: SECC

This signal indicates that the RESS has reached the full charge level (up to 100% SOC). The status is reported to the DC supply for presentation in a display. Note that the charge process may continue with energy transfer to support vehicle accessory loads (cabin conditioning, RESS conditioning, etc.) after this signal transitions to TRUE.

Table 5 - Charging complete

Element/Attribute Name	Type	Semantics
ChargingComplete	simpleType: boolean	If set to TRUE, the EV indicates that full charge (100 % SOC) is complete.

4.2.6 Charging Profile (ChargingProfile)

Source: EVCC
Destination: SECC

This signal represents available charging services supported by the EVSE.

[V2G-DC-303] The SECC and the EVCC shall implement this type as defined in Figure 3.

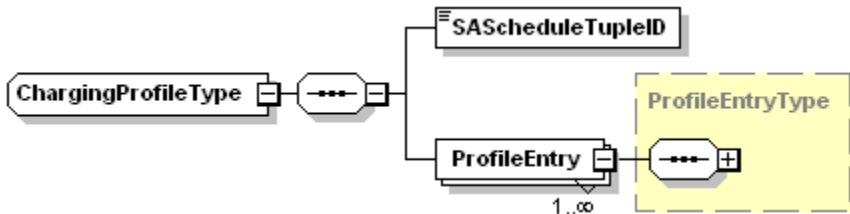


Figure 3 - XML schema definition for the ChargingProfileType

Table 6 - Charging profile

Element/Attribute Name	Type	Semantics
ChargingProfile	complexType: ChargingProfileType	Optional Element: Charge reservation of the EV as maximum amount of power drawn over time for this charging session.

[V2G-DC-266] The SECC shall always accept the ChargingProfile of the EVCC if it does not exceed the PMax values of all PMaxScheduleEntry elements according to the chosen SAScheduleTuple element in the charge parameter discovery response message.

[V2G-DC-267] The SECC shall send the negative response code FAILED_ChargingProfileInvalid in the PowerDelivery response message if the EVCC sends a ChargingProfile which is not adhering to the PMax values of all PMaxScheduleEntry elements according to the chosen SAScheduleTuple element in the charge parameter discovery response message.

4.2.7 Charging Profile Entry Max Power (ChargingProfileEntryMaxPower)

Source: EVCC
Destination: SECC

Table 7 - Charging profile entry max power

Element/Attribute Name	Type	Semantics
ChargingProfileEntryMaxPower	simpleType: PMaxType short	Maximum power in Watts consumed by the EV within the current charging profile entry (beginning from ChargingProfileEntryStart).

[V2G-DC-313] The value of the ChargingProfileEntryMaxPower element shall be defined as maximum power in Watts consumed by the EV within the active period of an element of type ProfileEntryType.

[V2G-DC-314] The values of the ChargingProfileEntryMaxPower element shall be equal to or smaller than the limits in the respective elements of the PMaxScheduleType provided in the charge parameter discovery response message.

4.2.8 Charging Profile Entry Start (ChargingProfileEntryStart)

Source: EVCC

Destination: SECC

Table 8 - Charging profile entry start

Element/Attribute Name	Type	Semantics
ChargingProfileEntryStart	simpleType unsignedInt	Time when chargingProfileEntry starts to be valid. Offset in seconds from NOW.

[V2G-DC-310] The value of the ChargingProfileEntryStart element shall be defined as the point in time when this element of ProfileEntryType starts to be active.

[V2G-DC-311] The value of the next ChargingProfileEntryStart element in the list of elements of ProfileEntryType shall be defined as the point in time when this element of ProfileEntryType becomes inactive.

NOTE: [V2G-DC-310] and [V2G-DC-311] define the period of time an element of ProfileEntryType is active.

[V2G-DC-312] The last element in the list of elements of type ProfileEntryType is active until the list is updated.

4.2.9 Contract (Contract)

Source: EVCC

Destination: SECC

Not used for DC charging. See 4.2.85.

4.2.10 Date Time Now (DateTimeNow)

Source: SECC

Destination: EVCC

This signal represents the timestamp of the current time using the unix time stamp format. This signal is used by the vehicle to check the validity of the certificates for contract based charging and as an external time reference. Based on this information, the vehicle might implement a strategy when certificate updates are required. Using this signal avoids requiring the time base of the vehicle and EVSE to be synchronized.

Table 9 - Date time now

Element/Attribute Name	Type	Semantics
DateTimeNow	simpleType long	Optional Element: Timestamp of the current SECC time using the unix time stamp format.

4.2.11 DC EV Charge Parameter (DC_EVChargeParameter)

Source: EVCC

Destination: SECC

Table 10 - DC EV charge parameter

Element/Attribute Name	Type	Semantics
DC_EVChargeParameter	complexType: DC_EVChargeParameterType substitutes abstract type EV_ChargeParameterType	This element is used by the EVCC for initiating the target setting process for DC charging.

4.2.12 DC EV Charge Parameter Type (DC_EVChargeParameterType)

Source: EVCC
Destination: SECC

[V2G-DC-351] The EVCC and the SECC shall implement this type as defined in Figure 4.

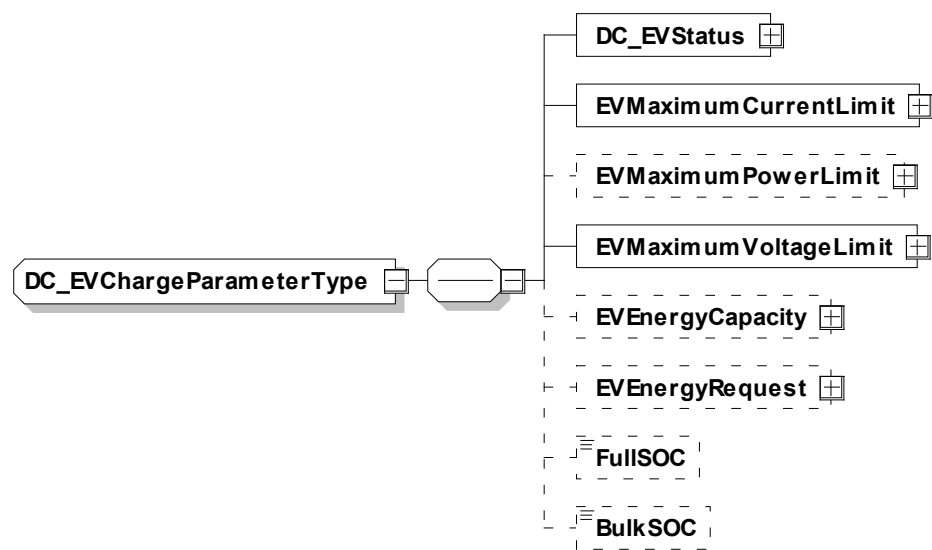


Figure 4 - Schema diagram—DC_EVChargeParameterType

4.2.13 DC EV Power Delivery Parameter (DC_EVPowerDeliveryParameter)

Source: EVCC
Destination: SECC

Table 11 - DC EV power delivery parameter

Element/Attribute Name	Type	Semantics
DC_EVPowerDeliveryParameter	complexType: DC_EVPowerDeliveryParameterType substitutes abstract type EVPowerDeliveryParameter	Optional Element: This element is used by the EVCC for transmitting the parameters for power delivery. NOTE: In the scope of SAE, this optional element shall be used.

[V2G-DC-558] In the scope of SAE, the optional element “DC_EVPowerDeliveryParameter” shall be used.

4.2.14 DC EV Power Delivery Parameter Type (DC_EVPowerDeliveryParameterType)

Source: EVCC
Destination: SECC

[V2G-DC-355] The EVCC and the SECC shall implement this type as defined in Figure 5.

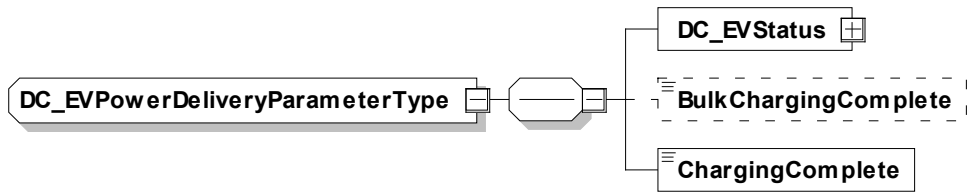


Figure 5 - Schema diagram—DC_EVPowerDeliveryParameterType

[V2G-DC-356] The message element shall be used.

4.2.15 DC EV Status (DC_EVStatus)

Source: EVCC
Destination: SECC

Table 12 - DC EV status

Element/Attribute Name	Type	Semantics
DC_EVStatus	complexType DC_EVStatusType	Current status of the EV.

4.2.16 DC EV Status Type (DC_EVStatusType)

Source: EVCC
Destination: SECC

[V2G-DC-348] The EVCC and the SECC shall implement this type as defined in Figure 6.

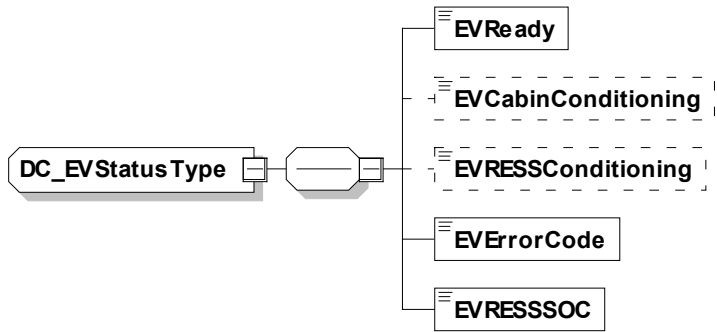


Figure 6 - Schema diagram—DC_EVStatusType

4.2.17 DC EVSE Charge Parameter (DC_EVSEChargeParameter)

Source: SECC

Destination: EVCC

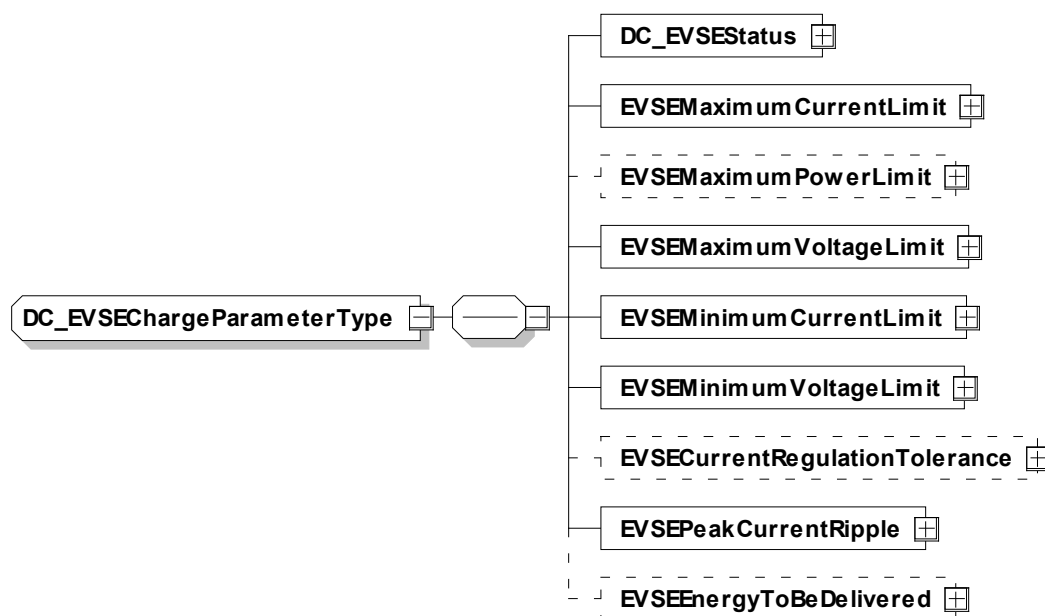
Table 13 - DC EVSE charge parameter

Element/Attribute Name	Type	Semantics
DC_EVSEChargeParameter	complexType: DC_EVSEChargeParameterType substitutes abstract type EVSE_ChargeParameterType	This element is used by the SECC for initiating the target setting process for DC charging

4.2.18 DC EVSE Charge Parameter Type (DC_EVSEChargeParameterType)

Source: SECC

Destination: EVCC

[V2G-DC-353] The EVCC and the SECC shall implement this type as defined in Figure 7.**Figure 7 - Schema diagram—DC_EVSEChargeParameterType**

4.2.19 DC EVSE Status (DC_EVSEStatus)

Source: SECC

Destination: EVCC

Table 14 - DC EVSE status

Element/Attribute Name	Type	Semantics
DC_EVSEStatus	complexType: DC_EVSEStatusType substitutes abstract type EVSE_StatusType	This element is used by the SECC for indicating the SECC status. Current status of the EVSE.

4.2.20 DC EVSE Status Type (DC_EVSEStatusType)

Source: SECC

Destination: EVCC

[V2G-DC-344] The EVCC and the SECC shall implement this type as defined in Figure 8.

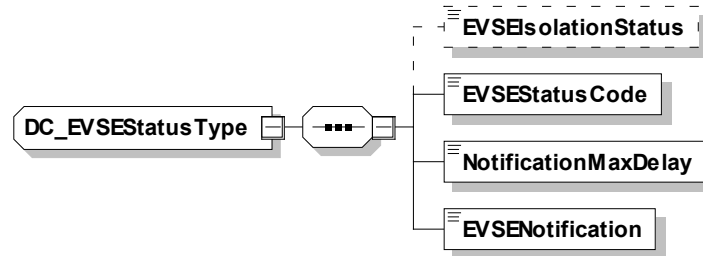


Figure 8 - Schema diagram—DC_EVSEStatusType

[V2G-DC-639] For DC charging, the elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.21 Duration (Duration)

Source: SECC

Destination: EVCC

Table 15 - Duration

Element/Attribute Name	Type	Semantics
duration	simpleType unsignedInt	Optional Element: Duration of the interval, in seconds.

[V2G-DC-338] The value of the duration element shall be defined as a period of time in seconds.

[V2G-DC-339] The duration element shall only be used for the last interval of the PMaxSchedule.

NOTE: It indicates the end of the coverage time of the delivered PMaxSchedule information.

4.2.22 Energy Transfer Type (EnergyTransferType)

Source: SECC

Destination: EVCC

Table 16 - Energy transfer type

Element/Attribute Name	Type	Semantics
EnergyTransferType	simpleType: EVSESupportedEnergyTransferType enumeration	Available charging types or methods supported by the EVSE.

The definition of the EVSESupportedEnergyTransferType supports connectors Configuration CC (corresponding to Type 1), Configuration DD (corresponding to Type 2), Configuration EE, and Configuration FF. Based on the supported connectors, the SECC can offer charging services as defined in Table 1.

[V2G-DC-296] The SECC shall use the EVSESupportedEnergyTransferType as described in Table 1.

Table 17 - Semantics for EVSESupportedEnergyTransferType

EnergyTransferType	Offered charging service.
AC_single_phase_core	Not used in the scope of SAE.
AC_three_phase_core	Not used in the scope of SAE.
DC_core	EVSE supports DC charging using the core pins of a Configuration CC connector (corresponding to a Type 1 connector) or of a Configuration DD connector (corresponding to a Type 2 connector).
DC_extended	EVSE supports DC charging using the extended pins of a Configuration EE or Configuration FF connector.
DC_combo_core	Not used in the scope of SAE.
DC_dual	Not used in the scope of SAE.
AC_core1p_DC_extended	Not used in the scope of SAE.
AC_single_DC_core	Not used in the scope of SAE.
AC_single_phase_three_phase_core_DC_extended	Not used in the scope of SAE.
AC_core3p_DC_extended	Not used in the scope of SAE.

[V2G-DC-630] If the EVSE supports DC charging using the extended pins of a vehicle connector according to SAE J1772 or IEC 62196 Configuration EE or Configuration FF, the SECC shall transmit “DC_extended” in EnergyTransferType.

[V2G-DC-631] If the EVSE supports DC charging using the core pins of an connector according to Configuration CC (corresponding to Type 1) or according to Configuration DD (corresponding to Type 2), the SECC shall transmit “DC_core” in EnergyTransferType.

[V2G-DC-632] The SECC shall not transmit values other than “DC_extended” and “DC_core” in EnergyTransferType.

4.2.23 EV Cabin Conditioning (EVCabinConditioning)

Source: EVCC

Destination: SECC

This signal represents a Boolean state that informs the charger that the EVCC is performing some type of cabin conditioning. This can be used for display purposes on the charge station.

Table 18 - EV cabin conditioning

Element/Attribute Name	Type	Semantics
EVCabinConditioning	simpleType: boolean	Optional Element: Vehicle Cabin Conditioning, The EV is using energy from the DC supply to heat or cool the passenger compartment.

[V2G-DC-639] For DC charging, the elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.24 EV Energy Capacity (EVEnergyCapacity)

Source: EVCC

Destination: SECC

This signal indicates the maximum designed energy capacity allowed by the vehicle manufacturer. The DC supply could use this signal for safety mitigation from the charger side. Charger may optionally stop after delivering this amount of energy the vehicle would accept. That value includes RESS capacity and vehicle auxiliary energy.

Table 19 - EV energy capacity

Element/Attribute Name	Type	Semantics
EVEnergyCapacity	complexType	Optional Element:

	PhysicalValueType	Maximum energy capacity supported by the EV.
--	-------------------	--

4.2.25 EV Energy Request (EVEnergyRequest)

Source: EVCC

Destination: SECC

This signal provides the EVSE with an indication of the amount of energy that will be requested during the current charging session.

Table 20 - EV energy request

Element/Attribute Name	Type	Semantics
EVEnergyRequest	complexType PhysicalValueType	Optional Element: Amount of energy the EV requests from the EVSE.

[V2G-DC-642] In the scope of SAE, if the element “EVEnergyRequest” is contained the message ChargeParameterDiscoveryReq, it shall represent the maximum amount of energy that the EV will request (by means of CurrentDemandReq) throughout the entire charging process.

NOTE: If the element “EVEnergyRequest” is contained in the message ChargeParameterDiscoveryReq, this allows the EVSE to compute suitable PMaxSchedules and perform energy management functions.

4.2.26 EV Error Code (EVErrrorCode)

Source: EVCC

Destination: SECC

This signal indicates the PEV internal error state that will inhibit/abort charging. This is for display purposes only to guide the user through the charging process for the particular vehicle. Not all vehicle manufacturers will have this feature.

In situations where a vehicle might have more than one state from the list below, the vehicle (or OEM) will determine the highest priority item to send to the charger for display. Only one item from the list can be sent in this signal.

This signal may contain any value defined by the enumerated type DC_EVErrrorCodeType. The value and meaning of each enumeration is described in the table below.

Table 21 - EV error code

Element/Attribute Name	Type	Semantics
EVErrrorCode	simpleType: DC_EVErrrorCodeType enumeration	Indicates the EV internal status. See Table 2 for details.

[V2G-DC-350] The EVCC shall use the EVErrrorCodes as described in Table 2.

Table 22 - Semantics and type definition for EVErrorCodeType

Element Name	Semantics
NO_ERROR	Default value, when EV has no error detected.
FAILED_RESSTemperatureInhibit	Battery temperature Inhibit, battery too hot/cold to accept charge.
FAILED_EVShiftPosition	Vehicle shift position, vehicle is not in park.
FAILED_ChargerConnectorLockFault	Charger connector lock fault, Vehicle has not detected the charge cord connector locked into the inlet or a failure exists where connector cannot be unlocked from the charging inlet.
FAILED_EVRESSMalfunction	Vehicle RESS malfunction, Any non-recoverable fault or error condition of the vehicle RESS.
FAILED_ChargingCurrentdifferential	Charging current differential, Indication that vehicle has stopped the communication session after detecting that the charging station is not able to maintain an output current that fulfills the current request.
FAILED_ChargingVoltageOutOfRange	Charging voltage out of range, Indication that vehicle has stopped the communication session after detecting that the RESS is either under or above the normal operating voltage range.
Reserved A-C	Reserved by ISO/IEC for future use.
FAILED_ChargingSystemIncompatibility	Charging system incompatibility, if the vehicle determines that the charging station is incompatible. Using this value is optional; as an alternative, the vehicle can use EVReady in DC EVStatusType equal to "FALSE."
NoData	No data. Only used when vehicle has not yet determined its operating state.

[V2G-DC-640] All EVErrorCodes in Table 2 for which there are no explicit requirements in this document are for information purpose only. They may be used for information to the customer, but they shall not influence the EVSE charging process.

NOTE: In the context of SAE this means that the EVSE shall not change its behavior based on the value of EVErrorCode. If the EV detects a situation that requires a termination of the charging process, the EV will use other means to execute this shutdown, e.g., ramp down the current request, or, in case an emergency shutdown is required, change to CP State B in accordance with SAE J1772. In all other cases, the expected value for EVErrorCode is "NO_ERROR."

4.2.27 EV ID (EVCCID)

Source: EVCC

Destination: SECC

This signal tells the EVSE the unique identification number of a vehicle. It contains the HPGP Ethernet MAC address of the vehicle.

Table 23 - EV ID

Element Name	Type	Semantics
EVCCID	simpleType: evccIDType hexBinary (max length: 8)	Specifies the EV's identification in a readable format. It contains the MAC address of the EVCC as six hex binary encoded bytes; i.e., the element shall have a length of six bytes.

4.2.28 EV Maximum Current Limit (EVMaximumCurrentLimit)

Source: EVCC

Destination: SECC

This is a signal from the vehicle to the DC supply indicating its maximum allowed current. In other words, it's the maximum current limit allowed by the vehicle. It may depend on RESS temperature, SOC, etc. The charger shall not exceed the minimum of this signal and the charger maximum current limit. The primary purpose of the current limit signal is for the DC charger to regulate its fast internal (ms) regulation loops. The DC supply hardware and software shall control the output so that there will be no violations of this limit. The vehicle may optionally change this signal dynamically throughout the charging session.

Table 24 - EV maximum current limit

Element/Attribute Name	Type	Semantics
EVMaximumCurrentLimit	complexType PhysicalValueType	Maximum current supported by the EV.

NOTE: For details on the processing of EVMaximumCurrentLimit and EVMaximumVoltageLimit by the EVSE, please see 4.2.42 and 4.2.44.

4.2.29 EV Maximum Power Limit (EVMaximumPowerLimit)

Source: EVCC

Destination: SECC

This signal represents the maximum power limit allowed by the vehicle. It may depend on RESS temperature, SOC, etc. The charger shall not exceed the minimum of this signal and the charger maximum power limit. The primary purpose of the Power Limit signal is for the DC charger to regulate its fast internal (ms) regulation loops. The vehicle may optionally change this signal dynamically throughout the charging session.

Table 25 - EV maximum power limit

Element/Attribute Name	Type	Semantics
EVMaximumPowerLimit	complexType PhysicalValueType	Optional Element: Maximum power supported by the EV.

[V2G-DC-641] In the scope of SAE, if the element “EVMaximumPowerLimit” is contained within the message ChargeParameterDiscoveryReq, it shall represent the maximum power that the EV will request (by means of CurrentDemandReq) at any time during the charging process. The value of EVMaximumPowerLimit that is sent in any CurrentDemandReq message shall not exceed the value of EVMaximumPowerLimit that is sent in the ChargeParameterDiscoveryReq message.

NOTE: If the element “EVMaximumPowerLimit” is contained in the message ChargeParameterDiscoveryReq, this allows the EVSE to compute suitable PMaxSchedules.

4.2.30 EV Maximum Voltage Limit (EVMaximumVoltageLimit)

Source: EVCC

Destination: SECC

This signal represents the maximum voltage limit allowed by the vehicle. The value may depend on Inlet rating, RESS temperature, SOC, etc. The charger shall not exceed the minimum of this signal and the charger maximum voltage limit. The primary purpose of the voltage limit signal is for the DC charger to regulate its fast internal (ms) regulation loops. The vehicle may optionally change this signal dynamically throughout the charging session.

When the vehicle needs to use constant voltage mode, this signal will be adjusted by the vehicle RESS controls to maintain a constant voltage around a low current.

Table 26 - EV maximum voltage limit

Element/Attribute Name	Type	Semantics
EVMaximumVoltageLimit	complexType PhysicalValueType	Optional Element: Maximum voltage supported by the EV.

NOTE: For details on the processing of “EVMaximumCurrentLimit” and “EVMaximumVoltageLimit” by the EVSE, please see 4.2.42 and 4.2.44.

4.2.31 EV Ready (EVReady)

Source: EVCC

Destination: SECC

This signal informs the charger that the PEV is ready to be charged. It is needed if there is no control pilot signal. It's redundant to control pilot signal.

Table 27 - EV ready

Element/Attribute Name	Type	Semantics
EVReady	simpleType: boolean	If set to TRUE, the EV is ready to charge.

[V2G-DC-639] For DC charging, the elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.32 EV Requested Energy Transfer Type (EVRequestedEnergyTransferType)

Source: EVCC

Destination: SECC

Table 28 - EV requested energy transfer type

Element Name	Type	Semantics
EVRequestedEnergyTransferType	simpleType: EVRequestedEnergyTransferType enumeration	Selected energy transfer type for charging that is requested by the EVCC.

This signal informs the DC supply of the type of energy transfer that the EVCC wishes to perform. This allows a vehicle to connect to an EVSE that can provide either DC or AC energy transfer.

This signal allows the vehicle to select its desired energy transfer type in the case that both the EVSE and vehicle support multiple energy transfer types and SAE J1772 connector variations (AC, DC type 1, DC combo). The charging station should confirm that it is capable of supporting the requested type, and should only complete handshaking if it is compatible.

This signal may contain any value defined by the enumerated type EVRequestedEnergyTransferType. The value and meaning of each enumeration is described in the table below. This signal may contain any value defined by the enumerated type EVSESupportedEnergyTransferType. The value and meaning of each enumeration is described in Table 29.

Table 29 - Value defined by the enumerated type EVSESupportedEnergyTransferType

XML Enumeration	Comments/Description
AC_single_phase_core	Vehicle is requesting single phase AC energy transfer on core pins as specified through the SAE J1772 type 1 or type 2 connector.
AC_three_phase_core	Vehicle is requesting three phase AC energy transfer as specified through the SAE 1772 type 1 or type 2 connector on Type 2 core pins.
DC_core	Vehicle is requesting DC energy transfer as specified through the SAE 1772 type 1 or type 2 connector using the standard core connector pins (couple type C1).
DC_extended	Vehicle is requesting DC energy transfer as specified through the SAE 1772 type 1 or type 2 combo connector over the additional pins outside the core (coupler type C2).
DC_combo_core	Vehicle is requesting DC energy transfer as specified through the SAE 1772 type 1 or type 2 combo connector over the core pins (coupler type C2).
DC_unique	In the case of a dedicated coupler for Level 3 DC charging (coupler type C3).

[V2G-DC-623] If the EV requests DC charging using the extended pins of a vehicle connector Configuration EE or Configuration FF, the EVCC shall transmit “DC_extended” in EVRequestedEnergyTransferType.

[V2G-DC-624] If the EV requests DC charging using the core pins of an connector Configuration CC (corresponding to Type 1) or according to Configuration DD (corresponding to Type 2), the EVCC shall transmit “DC_core” in EVRequestedEnergyTransferType.

[V2G-DC-625] The EVCC shall not transmit values other than “DC_extended” and “DC_core” in EVRequestedEnergyTransferType.

4.2.33 EV RESS Conditioning (EVRESSConditioning)

Source: EVCC

Destination: SECC

This signal represents a Boolean state that informs the charger that the EVCC is performing some type of HV battery thermal conditioning. This can be used for display purposes on the charge station.

Table 30 - EV RESS conditioning

Element/Attribute Name	Type	Semantics
EVRESSConditioning	simpleType: boolean	Optional Element: Vehicle RESS conditioning. The vehicle is using energy from the DC charger to condition the RESS to a target temperature.

4.2.34 EV RESS SOC (EVRESSSOC)

*Source: EVCC**Destination: SECC*

This signal is defined by the vehicle manufacture to represent the relative charge level as a percentage of the full energy storage of the vehicle RESS. It's primarily used for display on the charging supply. If the vehicle uses a battery for energy storage, then this would be battery SOC.

Table 31 - EV RESS SOC

Element/Attribute Name	Type	Semantics
EVRESSSOC	simpleType: percentValueType byte (range: 0-100)	State of charge of the EV's battery (RESS).

[V2G-DC-639] The elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.35 EV Target Current (EVTargetCurrent)

*Source: EVCC**Destination: SECC*

This signal represents the instantaneous charging current request from the vehicle. The request should be within the established charger and vehicle limits from handshaking. In accordance with SAE J1772, the current request is allowed to be higher than the EVSE maximum current limit but the DC supply will reduce the output to maintain the limit. The DC supply is allowed to overshoot or undershoot around this target as long as it doesn't violate vehicle maximum current limit and the requirements specified in SAE J1772. In the case where any of the EVSE limits have been achieved (current, voltage or power), the charge current request may be higher than the actual measured current reading. Since the vehicle is controlling charge current and reading on-vehicle current sensors, the vehicle will ensure that the request is adjusted to achieve the vehicle control target.

Since it is not always possible to achieve the EV target current being requested and EV target voltage simultaneously, the DC supply will only regulate to one of the requests. The EV should not issue a fault when both cannot be achieved simultaneously.

Table 32 - EV target current

Element/Attribute Name	Type	Semantics
EVTargetCurrent	complexType PhysicalValueType	Instantaneous current requested by the EV.

NOTE 1: If the EVCC wishes to stop the Communication Session for a non-critical reason (e.g., user interaction) after having sent a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE" and before having sent a CurrentDemandReq message, the EVCC, in accordance with [V2G-DC-424], shall send a CurrentDemandReq message, e.g., with EVTargetCurrent equal to 0 A, and wait for a CurrentDemandRes message before continuing according to [V2G-DC-673].

NOTE 2: If the parameter EVSEStatusCode equal to "EVSE_Shutdown" is contained in a PowerDeliveryRes message sent in response to a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE," the EVCC, in accordance with [V2G-DC-424], shall send a CurrentDemandReq message, e.g., with EVTargetCurrent equal to "0 A" (zero ampere), and wait for a CurrentDemandRes message before continuing according to [V2G-DC-673].

4.2.36 EV Target Voltage (EVTargetVoltage)

Source: EVCC

Destination: SECC

This signal tells the charger the target voltage request of the vehicle. This signal shall not exceed the vehicle maximum voltage limit. During the charge process, the EVSE must regulate the current output to close loop around the target voltage as it may be used by the vehicle for voltage control charging. This signal shall be used during the pre-charge Phase of Initialization to command the DC supply voltage to match the RESS.

Since it is not always possible to achieve the PEV charge current request and PEV target voltage simultaneously, the DC supply will only regulate to one of the requests. The PEV should not issue a fault when both cannot be achieved simultaneously.

Table 33 - EV target voltage

Element/Attribute Name	Type	Semantics
EVTargetVoltage	complexType PhysicalValueType	Target Voltage requested by EV.

4.2.37 EVSE Current Limit Achieved (EVSECurrentLimitAchieved)

Source: SECC

Destination: EVCC

This signal represents that the charger is at the limit of its source capability (saturation). The charger becomes saturated when either the charger limits are achieved or the vehicle limits from handshaking have been achieved. It's used by the PEV control to compensate for reaching the limit. This would allow vehicle to refrain from setting a fault when the charger is providing current to the limit of the present operating conditions.

The default state for this signal is FALSE.

Table 34 - EVSE current limit achieved

Element/Attribute Name	Type	Semantics
EVSECurrentLimitAchieved	simpleType boolean	If set to TRUE, the EVSE has reached its current limit.

4.2.38 EVSE Current Regulation Tolerance (EVSECurrentRegulationTolerance)

Source: SECC

Destination: EVCC

This signal represents the DC supply's ability to regulate current with respect to the current request. This signal informs the PEV what absolute magnitude of the DC supply regulation tolerance can be expected at any charge level. This is dependent on the charger filter and control design. It is expected that quick chargers will have a larger tolerance, and may not be suitable for low current totopoff charging (bulk level to full level). The vehicle may modify its charging strategy using this information. The vehicle may chose not to initiate the charging session if the value is not compatible with the RESS charging strategy. The vehicle may not support totopoff charging if it cannot accept this tolerance of current. The vehicle manufacturer can use this signal to optimize the charging algorithm.

Table 35 - EVSE current regulation tolerance

Element/Attribute Name	Type	Semantics
EVSECurrentRegulationTolerance	complexType PhysicalValueType	Optional Element: Absolute magnitude of the regulation tolerance of the EVSE.

4.2.39 EVSE Energy to be Delivered (EVSEEnergyToBeDelivered)

Source: SECC

Destination: EVCC

This signal represents the allowed or requested units of energy to be delivered during charging (a charging target). This allows public charging stations to limit charging session by limiting the energy transfer (i.e., for a prepaid amount).

Table 36 - EVSE energy to be delivered

Element/Attribute Name	Type	Semantics
EVSEEnergyToBeDelivered	complexType PhysicalValueType	Optional Element: Amount of energy to be delivered by the EVSE

[V2G-DC-643] If the element EVSEEnergyToBeDelivered is contained in the message ChargeParameterDiscoveryRes, it shall represent the amount of energy that the EVSE will be able to provide to the EV throughout the entire charging process.

4.2.40 EVSE ID (EVSEID)

Source: SECC

Destination: EVCC

This signal tells the vehicle the unique identification number of an EVSE.

Table 37 - EVSE ID

Element/Attribute Name	Type	Semantics
EVSEID	simpleType: evseIDType hexBinary (max length: 32)	Any ID that uniquely identifies the EVSE. The format of this message element is defined in DIN SPEC 91286. If an SECC cannot provide such ID data, the value of the EVSEID is set to zero (00 hex).

[V2G-DC-247] The SECC and the EVCC shall use the format for EVSEID.

[V2G-DC-620] The power outlet ID shall use the following pattern: <Power Outlet ID> = DIGIT * 31 (DIGIT/"").

[V2G-DC-621] To transform a string-based EVSE ID to hexBinary representation and vice versa, the following conversion rules shall be used for each character and hex digit: "0" <--> 0x0, "1" <--> 0x1, "2" <--> 0x2, "3" <--> 0x3, "4" <--> 0x4, "5" <--> 0x5, "6" <--> 0x6, "7" <--> 0x7, "8" <--> 0x8, "9" <--> 0x9, "*" <--> 0xA, Unused <--> 0xB .. 0xF.

NOTE: Example: The EVSE ID "49*89*6360" is represented as "0x49 0xA8 0x9A 0x63 0x60."

4.2.41 EVSE Isolation Status (EVSEIsolationStatus)

Source: SECC

Destination: EVCC

This signal informs the PEV the status of the isolation monitoring on the DC supply. This signal is sent to the vehicle periodically throughout the charging session. Consult the SAE J1772 and IEC 61851 part 23 documents for further details regarding the isolation thresholds. Until the first reading has been measured, the DC supply must report the Invalid state.

This signal may contain any value defined by the enumerated type EVSESupportedEnergyTransferType. The value and meaning of each enumeration is described in Table 38 and 39.

Table 38 - EVSE isolation status value

XML Enumeration	Comments/Description
Valid	Isolation measurement confirms the system is within the valid region above thresholds.
Warning	Isolation has detected a measurement below the warning level threshold.
Fault	Isolation has detected a measurement below the fault level threshold.
Invalid	DC supply may transmit this enumeration at startup before measurement has been confirmed.

Table 39 - EVSE isolation status meaning

Element/Attribute Name	Type	Semantics
EVSEIsolationStatus	simpleType: isolationLevelType enumeration	Optional Element: Indicates the isolation condition (result of the isolation test/monitoring). See Table 3 for details.

[V2G-DC-346] The SECC shall use the EVSEIsolationStatus as described in Table 40.

NOTE: For further information on the isolation status, please refer to SAE J1772.

Table 40 - Semantics and types of elements in the IsolationLevelType

Element Name	Semantics
Invalid	An isolation test has not been carried out.
Valid	The isolation test has been carried out successfully and did not result in an isolation warning or fault.
Warning	The measured isolation resistance is below the warning level defined in SAE J1772.
Fault	The measured isolation resistance is below the fault level defined in SAE J1772.

4.2.42 EVSE Maximum Current Limit (EVSEMaximumCurrentLimit)

Source: SECC

Destination: EVCC

This signal represents the maximum current that can be delivered to the PEV. The charger should regulate this value. The charger shall not exceed the minimum of this signal and the vehicle maximum current limit. This value can change dynamically through the charging session.

Table 41 - EVSE maximum current limit

Element/Attribute Name	Type	Semantics
EVSEMaximumCurrentLimit	complexType PhysicalValueType	Optional Element: Maximum current the EVSE can deliver.

4.2.43 EVSE Maximum Power Limit (EVSEMaximumPowerLimit)

*Source: SECC**Destination: EVCC*

This signal represents the maximum power that can be delivered to the PEV. The charger should regulate this value. The charger shall not exceed the minimum of this signal and the vehicle maximum power limit. The DC supply can dynamically change this value throughout the charging session (as in the case where a utility demand reduces the available power).

Table 42 - EVSE maximum power limit

Element/Attribute Name	Type	Semantics
EVSEMaximumPowerLimit	complexType PhysicalValueType	Optional Element: Maximum power the EVSE can deliver.

4.2.44 EVSE Maximum Voltage Limit (EVSEMaximumVoltageLimit)

*Source: SECC**Destination: EVCC*

This signal represents the maximum voltage that can be maintained by the charger. The value may depend on coupler rating, ambient temperature, etc. The charger should regulate this value. The charger shall not exceed the minimum of this signal and the vehicle maximum voltage limit. This value can change dynamically through the charging session.

Table 43 - EVSE maximum voltage limit

Element/Attribute Name	Type	Semantics
EVSEMaximumVoltageLimit	complexType PhysicalValueType	Optional Element: Maximum voltage the EVSE can deliver.

4.2.45 EVSE Minimum Current Limit (EVSEMinimumCurrentLimit)

*Source: SECC**Destination: EVCC*

This signal represents the Minimum Current available from the charger to the vehicle. It informs the PEV that the DC supply can only regulate its current output down to this level. If a vehicle has RESS that must operate below this level, then the vehicle will determine that the charging station is incompatible. The vehicle will not start charging or will stop a charging session if the target RESS current falls below this value. The charger should regulate down to this value while still meeting the accuracy requirements. All chargers should be able to respond when the vehicle requests zero, that the output of the charger should be shut off to zero current.

Table 44 - EVSE minimum current limit

Element/Attribute Name	Type	Semantics
EVSEMinimumCurrentLimit	complexType PhysicalValueType	Minimum current the EVSE can deliver with the expected accuracy.

4.2.46 EVSE Minimum Voltage Limit (EVSEMinimumVoltageLimit)

Source: SECC

Destination: EVCC

This signal represents the minimum voltage available from the charger to the vehicle. It informs the PEV that the DC supply can only regulate its voltage output down to this level. If a vehicle has an RESS that must operate below this level, then the vehicle will determine that the charging station is incompatible. The vehicle will not start charging or will stop a charging session if the target RESS voltage falls below this value. The charger should regulate down to this value. The vehicle will decide if this is compatible with its RESS. A vehicle with an RESS below this value would not be compatible with the charger.

Table 45 - EVSE minimum voltage limit

Element/Attribute Name	Type	Semantics
EVSEMinimumVoltageLimit	complexType PhysicalValueType	Minimum voltage the EVSE can deliver with the expected accuracy.

4.2.47 EVSE Notification (EVSENotification)

Source: SECC

Destination: EVCC

Table 46 - EVSE notification

Element/Attribute Name	Type	Semantics
EVSENotification	simpleType EVSENotificationType enumeration	This value is used by the SECC to influence the behaviour of the EVCC. The EVSENotification contains an action that the SECC wants the EVCC to perform. The requested action is expected by the EVCC until the time provided in NotificationMaxDelay. If the target time is not in the future, the EVCC is expected to perform the action immediately. During normal operation, the value of EVSENotification is set to "None."

[V2G-DC-500] For DC charging, the value of EVSENotification shall always be set to "None."

4.2.48 EVSE Peak Current Ripple (EVSEPeakCurrentRipple)

Source: SECC

Destination: EVCC

This signal represents the DC supply's peak to peak ripple current amplitude of the regulated output at any current request. This signal informs the PEV what peak-to-peak magnitude of the DC supply current ripple can be expected at any charge level. This is dependent on the charger filter and control design. It is expected that quick chargers will have higher ripple, and may not be suitable for low current topeff charging (bulk level to full level). The vehicle may modify its charging strategy using this information. The vehicle may chose not to initiate the charging session if the value is not compatible with the RESS charging strategy. The vehicle may not support topeff charging if it cannot accept this amplitude of ripple current. The vehicle manufacturer can use this signal to optimize the charging algorithm.

Table 47 - EVSE peak current ripple

Element/Attribute Name	Type	Semantics
EVSEPeakCurrentRipple	complexType PhysicalValueType	Peak-to-peak magnitude of the current ripple of the EVSE.

4.2.49 EVSE Power Limit Achieved (EVSEPowerLimitAchieved)

*Source: SECC**Destination: EVCC*

This signal represents the charger is at the limit of its source capability (saturation). The charger becomes saturated when either the charger limits are achieved or the vehicle limits from handshaking have been achieved. It's used by the PEV control to compensate for reaching the limit. This would allow the vehicle to refrain from setting a fault when the charger is providing power to the limit of the present operating conditions.

Table 48 - EVSE power limit achieved

Element/Attribute Name	Type	Semantics
EVSEPowerLimitAchieved	simpleType boolean	If set to TRUE, the EVSE has reached its power limit.

4.2.50 EVSE Present Current (EVSEPresentCurrent)

*Source: SECC**Destination: EVCC*

This signal represents the measured high-voltage DC current at the output of the DC supply through the charge coupler.

Table 49 - EVSE present current

Element/Attribute Name	Type	Semantics
EVSEPresentCurrent	complexType PhysicalValueType	Present output current of the EVSE.

NOTE: The range allows for negative current measurements in the event that the energy is flowing out of the vehicle's charge receptacle.

4.2.51 EVSE Present Voltage (EVSEPresentVoltage)

*Source: SECC**Destination: EVCC*

This signal represents the measured high-voltage DC voltage at the output of the DC supply. It's used by the PEV during charging for diagnosis of on board sensors. It may be opportunistically used by the vehicle during charge as a redundant check to diagnose on-board sensors.

Table 50 - EVSE present voltage

Element/Attribute Name	Type	Semantics
EVSEPresentVoltage	complexType PhysicalValueType	Present voltage of EVSE.

4.2.52 EVSE Processing (EVSEProcessing)

Source: SECC

Destination: EVCC

Table 51 - EVSE processing

Element/Attribute Name	Type	Semantics
EVSEProcessing	simpleType: EVSEProcessingType enumeration	Parameter indicating that the EVSE has finished the processing that was initiated after the ContractAuthenticationReq or that the EVSE is still processing at the time the response message was sent.

NOTE: By using the EVSEProcessing parameter, the EVSE can indicate to the EVCC that the processing has not finished but a response message has to be sent to fulfill the timeout and performance requirements defined in 5.6.2. This allows a delay to the V2G communication session while fulfilling the performance and timeout requirements.

4.2.53 EVSE Status Code (EVSEStatusCode)

Source: SECC

Destination: EVCC

Table 52 - EVSE status code

Element/Attribute Name	Type	Semantics
EVSEStatusCode	simpleType: DC_EVSEStatusCodeType enumeration	Indicates the internal state of the EVSE.

This signal indicates the charger internal charging sequence state. That could be charger malfunction, utility interrupt event, charger ready, pre-charge, charger standby, etc.

In situations where a charger might have more than one state from the list below, the charger will determine the highest priority item to send to the vehicle for display.

This signal may contain any value defined by the enumerated type DC_EVSEStatusCodeType. The value and meaning of each enumeration is described in the table below.

[V2G-DC-347] The EVCC shall use the EVSEStatusCode in Table 53.

Table 53 - Semantics and type definition for EVSEStatusCodeType

Element Name	Semantics
EVSE_NotReady	Not authorized, StandBy, on maintenance, etc.
EVSE_Ready	Standard value used during normal operation.
EVSE_Shutdown	Charger shutdown, customer initiated shutdown.
EVSE_UtilityInterruptEvent	Utility interrupt event, utility or equipment operator has requested a temporary reduction in load.
EVSE_IsolationMonitoringActive	After the charging station has confirmed HV isolation internally, it will remain in this state until the cable isolation integrity is checked.
EVSE_EmergencyShutdown	Charging system incompatibility, emergency shutdown, or "E-stop" button pressed at charging station.
EVSE_Malfunction	A non-recoverable charger fault has occurred (isolation failure, etc.).
Reserved 8-C	Reserved by ISO/IEC for future use.

- [V2G-DC-637]** All EVSEStatusCodes in Table 53 for which there are no explicit requirements in this document are for information purpose only. They shall not influence the EV charging process.
- [V2G-DC-638]** EVSEStatusCode equal to “EVSE_Ready” shall be used unless a different value shall be used according to another requirement in this document.

NOTE: “EVSE_Shutdown” is used by the SECC to trigger a termination of the charging process in situations other than an emergency shutdown. “EVSE_EmergencyShutdown” may be used by the SECC to inform the EVCC that the EVSE is in the process of, or has just executed, an emergency shutdown. However, to force the EV to participate in the emergency shutdown, the SECC does not use this value, but instead uses the control pilot line (CPL) in accordance with SAE J1772. In all other cases, the expected value for EVSEStatusCode is “EVSE_Ready” or “EVSE_IsolationMonitoringActive.”

4.2.54 EVSE Voltage Limit Achieved (EVSEVoltageLimitAchieved)

Source: SECC

Destination: EVCC

This signal indicates that the charger is at the limit of its source capability (saturation). The charger becomes saturated when either the charger limits are achieved or the vehicle limits from handshaking have been achieved. It's used by the PEV control to compensate for reaching the limit. This would allow vehicle to refrain from setting a fault when the charger is providing voltage to the limit of the present operating conditions.

Table 54 - EVSE voltage limit achieved

Element/Attribute Name	Type	Semantics
EVSEVoltageLimitAchieved	simpleType boolean	If set to TRUE, the EVSE has reached its voltage limit.

4.2.55 External Payment (ExternalPayment)

Source: EVCC

Destination: SECC

Not used for DC charging. See 4.2.85.

4.2.56 Free Service (FreeService)

Source: SECC

Destination: EVCC

Table 55 - External payment

Element/Attribute Name	Type	Semantics
FreeService	simpleType: boolean	This element is used by the SECC to indicate if a service can be used by the EVCC free of charge or not. If FreeService is equal to true, the EV can use the offered service without payment. If FreeService is equal to false the service, if used by the EV, will be billed using the payment method negotiated using the payment option message element.

4.2.57 Full SOC (FullSOC)

*Source: EVCC**Destination: SECC*

This signal defines the SOC where the vehicle considers the RESS is full. It is defined by each vehicle OEM and allows the charger to display the full charge status.

Table 56 - Full SOC

Element/Attribute Name	Type	Semantics
FullSOC	simpleType: percentValueType byte (range: 0-100)	Optional Element: SOC at which the EV considers the battery to be fully charged.

4.2.58 General Challenge (GeneralChallenge)

*Source: EVCC**Destination: SECC***Table 57 - General challenge**

Element/Attribute Name	Type	Semantics
GenChallenge	simpleType genChallengeType string	Optional Element: This optional element shall not be used.

Not used for DC charging.

4.2.59 ID (Identification)

*Source: EVCC**Destination: SECC***Table 58 - ID**

Element/Attribute Name	Type	Semantics
Id	simpleType IDREF	Optional Element. this optional element shall not be used.

Not used for DC charging.

4.2.60 Multiplier (Multiplier)

*Source: SECC**Destination: EVCC***Table 59 - Multiplier**

Element/Attribute Name	Type	Semantics
Multiplier	simpleType: unitMultiplierType byte (range: -3..+3)	The Multiplier defines the exponent to base 10 (dec). The final physical value is determined by: Value * 10 ^ Multiplier [Unit].

See 4.2.69.

4.2.61 Notification Max Delay (NotificationMaxDelay)

Source: SECC

Destination: EVCC

Table 60 - Notification max delay

Element/Attribute Name	Type	Semantics
NotificationMaxDelay	simpleType unsignedInt	The SECC uses the NotificationMaxDelay element in the EVSEStatus to indicate the time until it expects the EVCC to react on the action request indicated in EVSENotification. If the target time is not in the future, the EVCC is expected to perform the action immediately.

[V2G-DC-636] For DC charging the EVCC shall ignore the value of the parameter NotificationMaxDelay in the EVSEStatus.

4.2.62 P Max (PMax)

Source: SECC

Destination: EVCC

Table 61 - P max

Element/Attribute Name	Type	Semantics
PMax	simpleType: PMaxType short	Defines maximum amount of power to be drawn from the EVSE outlet the vehicle is connected to.

[V2G-DC-333] The PMax element shall define the maximum amount of power to be drawn from the EVSE outlet when the element of type PMaxScheduleEntryType is active.

4.2.63 P Max Schedule (PMaxSchedule)

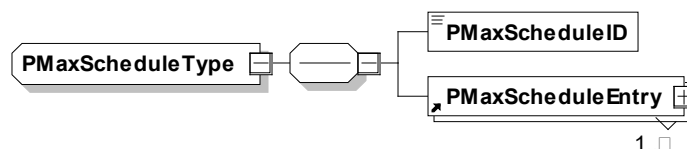
Source: SECC

Destination: EVCC

[V2G-DC-324] The SECC shall provide a PMaxSchedule element based upon the limits of the local installation if no secondary actor provides a grid schedule.

[V2G-DC-559] Since for DC charging, the EVCC is not able to provide a planned departure time, SAScheduleList shall provide PMaxSchedule covering at least 24 hours.

[V2G-DC-326] The SECC and the EVCC shall implement this type as defined in Figure 9.

**Figure 9 - Schema diagram—PMaxScheduleType**

4.2.64 P Max Schedule Entry (PMaxScheduleEntry)

Source: SECC

Destination: EVCC

Table 62 - P max schedule entry

Element/Attribute Name	Type	Semantics
PMaxScheduleEntry	complexType: PMaxScheduleEntryType	List of PMaxScheduleEntry elements

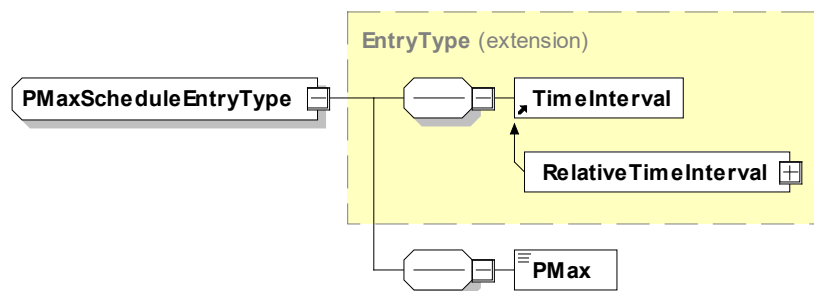
[V2G-DC-329] The number of PMaxScheduleEntry elements in the PMaxScheduleType shall be limited to twelve.

4.2.65 P Max Schedule Entry Type (PMaxScheduleEntryType)

Source: SECC

Destination: EVCC

[V2G-DC-330] The SECC and the EVCC shall implement this type as defined in Figure 10.

**Figure 10 - Schema diagram—PMaxScheduleEntryType**

[V2G-DC-331] The message element shall be used as defined in RelativeTimeInterval and PMax.

4.2.66 P Max Schedule ID (PMaxScheduleID)

Source: SECC

Destination: EVCC

Table 63 - P max schedule ID

Element/Attribute Name	Type	Semantics
PMaxScheduleID	simpleType: SAIDType short	Unique identifier for an element of type PMaxScheduleType across a charging session.

[V2G-DC-328] The value of the PMaxScheduleID element shall uniquely identify an element of type PMaxScheduleType during the entire charging session.

4.2.67 Parameter Set ID (ParameterSetID)

Source: EVCC

Destination: SECC

Table 64 - Parameter set ID

Element/Attribute Name	Type	Semantics
ParameterSetID	--	Optional Element: NOTE: This optional element shall not be used.

[V2G-DC-555] The element “ParameterSetID” shall not be used for DC charging.

4.2.68 Payment Options (PaymentOptions)

Source: SECC

Destination: EVCC

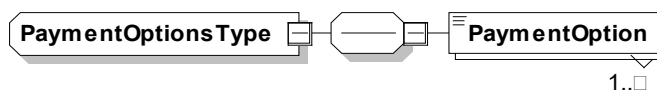
This signal includes the list of payment options an EVSE offers to the vehicle indicating what method could be chosen to pay for the services. The vehicle can only select one payment method for all services used.

NOTE: Only the payment option “external payment” shall be used, since detailed payment options are not yet defined.

Table 65 - Payment options

Element/Attribute Name	Type	Semantics
PaymentOptions	complexType: paymentOptionsType	Not used with DC charging. Indicates that external payment methods are being used to enable the charge process. This element includes the list of payment options an SECC offers to the EVCC indicating what method could be chosen to pay for the services. The EVCC can only select one payment method for all services used by the EVCC.

[V2G-DC-301] The EVCC and the SECC shall implement this type as defined in Figure 11.

**Figure 11 - Schema diagram—PaymentOptionsType**

[V2G-DC-633] Only the PaymentOption “ExternalPayment” shall be used.

[V2G-DC-634] The number of PaymentOption elements in the PaymentOptionsType shall be limited to 2.

4.2.69 Physical Value Type (PhysicalValueType)

Source: SECC

Destination: EVCC

[V2G-DC-297] The SECC and the EVCC shall implement this type as defined in Figure 12.

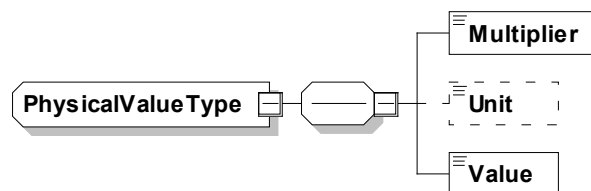


Figure 12 - Schema diagram—PhysicalValueType

[V2G-DC-298] The message element shall be used as defined in Table 66.

Table 66 - Semantics and type definition for PhysicalValueType

Element Name	Type	Semantics
Multiplier	simpleType: unitMultiplierType byte (range: -3..+3)	The Multiplier defines the exponent to base 10 (dec). The final physical value is determined by: Value * 10 ^ Multiplier [Unit].
Unit	simpleType: unitSymbolType enumeration	Optional Element: Unit of the value.
Value	simpleType short	Value which has to be multiplied.

4.2.70 Priority (Priority)

Source: EVCC

Destination: SECC

This signal is used by the vehicle for indicating the protocol priority of a specific protocol allowing the EVSE to select a protocol based on priorities.

Table 67 - Priority

Element/Attribute Name	Type	Semantics
Priority	simpleType: priorityType unsignedByte (range 1..20)	This message element is used by the EVCC for indicating the protocol priority of a specific protocol allowing the SECC to select a protocol based on priorities.

4.2.71 Profile Entry (ProfileEntry)

Source: EVCC

Destination: SECC

Table 68 - Profile entry

Element/Attribute Name	Type	Semantics
ProfileEntry	complexType: ProfileEntryType	Element used for encapsulating an individual charging profile entry of the charge schedule

4.2.72 Profile Entry Type (ProfileEntryType)

Source: SECC
Destination: EVCC

- [V2G-DC-307] The number of ProfileEntry elements in the ChargingProfileType shall be limited to 24.
- [V2G-DC-308] The SECC and the EVCC shall implement this type as defined in Figure 13.

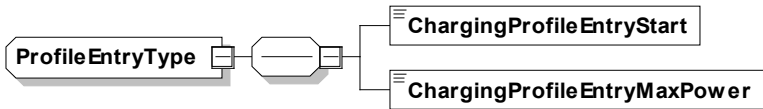


Figure 13 - Schema diagram—ProfileEntryType

4.2.73 Protocol Namespace (ProtocolNamespace)

Source: EVCC
Destination: SECC

This signal is used by the vehicle to uniquely identify the Namespace URI of a specific protocol supported by the vehicle; i.e., this is the protocol name of the related protocol.

Table 69 - Protocol namespace

Element/Attribute Name	Type	Semantics
ProtocolNamespace	simpleType: protocolNamespaceType string (max length: 100)	This message element is used by the EVCC to uniquely identify the Namespace URI of a specific protocol supported by the EVCC; i.e., this is the protocol name of the related protocol.

4.2.74 Ready to Charge State (ReadyToChargeState)

Source: EVCC
Destination: SECC

This signal tells the EVSE that the vehicle is ready for full energy transfer (i.e., any contactors are closed and Pre-charge is complete) and the EVSE can enable its full high voltage output regulation. Any circuits related to inrush current limiting and HV bus pre-charging can be disabled in the EVSE to allow regulated control of the output power. This commands the DC supply to switch on the high-power conversion circuit.

During shutdown, this signal tells the EVSE that the vehicle has completed charging, and that the EVSE should discharge the HV output bus.

4.2.75 Relative Time Interval (RelativeTimeInterval)

Source: SECC

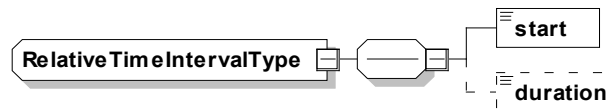
Destination: EVCC

Table 70 - Relative Time Interval

Element/Attribute Name	Type	Semantics
RelativeTimeInterval	complexType: RelativeTimeInterval substitutes abstract element TimeInterval.	Extends the TimeIntervalType and defines the time interval the PMaxScheduleEntry is valid for based upon relative times.

[V2G-DC-332] Any extension of the TimeInterval element shall define the active period of time for the respective parent element of type PMaxScheduleEntryType.

[V2G-DC-334] The SECC and the EVCC shall implement this type as defined in Figure 14.

**Figure 14 - Schema diagram—RelativeTimeIntervalType**

4.2.76 Remaining Time to Bulk SOC (RemainingTimetoBulkSOC)

Source: EVCC

Destination: SECC

This signal from the vehicle allows the charging station to display a time remaining count. This value is the Remaining time to charge PEV up to the bulk SOC. The time represents how much time it will take to get from the actual SOC to the bulk SOC. The DC supply may optionally use this periodic signal from the vehicle in order to display information to the user. The DC supply will not stop the charging session based on this time; the vehicle always controls the charging session stop time. OEM will decide bulk level (80% for example).

Table 71 - Remaining time to bulk SOC

Element/Attribute Name	Type	Semantics
RemainingTimeToBulkSOC	complexType PhysicalValueType	Optional Element: Estimated or calculated time until bulk charge (approximately 80% SOC) is complete.

4.2.77 Remaining Time to Full SOC (RemainingTimetoFullSOC)

Source: EVCC

Destination: SECC

This signal represents remaining time to charge PEV to full SOC; that is, the interval in time when no more energy is needed to charge the RESS. Display time to charge from actual SOC to full SOC. The DC supply may optionally use this periodic signal from the vehicle in order to display information to the user. The DC supply will not stop the charging session based on this time; the vehicle always controls the charging session stop time.

Table 72 - Remaining time to full SOC

Element/Attribute Name	Type	Semantics
RemainingTimeToFullSOC	complexType PhysicalValueType	Optional Element: Estimated or calculated time until full charge (100% SOC) is complete.

4.2.78 Response Code (ResponseCode)

*Source: SECC**Destination: EVCC*

This response code is included in all response messages except session setup (see below).

Table 73 - Response code

Element Name	Type	Semantics
ResponseCode	simpleType: responseCodeType enumeration	Response Code indicating the acknowledgment status of any of the V2G messages received by the SECC. This message element is used by the SECC for indicating whether the list of protocols received from the EVCC includes at least one protocol matching with the protocols supported by the SECC. Signals a response code with the following meaning: - OK_SuccessfulNegotiation: successful negotiation of a application protocol. - OK_SuccessfulNegotiationWithMinorDeviation: successful negotiation of a protocol, with minor deviation. - Failed_NoNegotiation: failed negotiation of protocols.

This enumerated state encoded signal indicates how the charge station has responded to a specific request message from the vehicle. Depending on the value in the response code the vehicle decides if it can proceed with the charge process or if it has to handle an error. This signal may contain any value defined by the enumerated type responseCodeType. The value and meaning of each enumeration is described in the table below.

Any value starting with “FAILED” indicates an negative response. Detailed information may be provided by FAILED_<additional info>. This information may be used to differentiate the reaction on the negative response.

Any value starting with “OK” indicates a positive response. Detailed information may be provided by OK_<additional info>. This information may be used to differentiate the reaction on the positive response.

Table 74 - Response code values

XML Response Code Enumeration	Comments/Description
OK	Indicates if the processing of the request message was successful and no specific ResponseCodeType is defined for the current state.
OK_NewSessionEstablished	Indicates processing of the SessionSetupReq message was successful and a different SessionID is contained in the response message than the SessionID in the request message.
OK_OldSessionJoined	Indicates processing of the SessionSetupReq message was successful and the same SessionID as used in the request message is contained in the response message.
OK_CertificateExpiresSoon	Not used for DC charging.
FAILED	Indicates the processing of the request message was not successful and no specific "responseCodeType" is defined for the current error case.
FAILED_SequenceError	Indicates the EVSE has received an unexpected request message.
FAILED_ServiceIDInvalid	Not used for DC charging.
FAILED_UnknownSession	Indicates the SessionID in the request message does not fit to the EVSE provided SessionID during SessionSetupRes.
FAILED_ServiceSelectionInvalid	Indicates the SelectedServiceList contained in the ServicePaymentSelectionReq message contains a ServiceID which was not contained in the offered ServiceList of ServiceDiscoveryRes.
FAILED_PaymentSelectionInvalid	Indicates the SelectedPaymentOption contained in the ServicePaymentSelectionReq message was not part of the offered PaymentOptions of ServiceDiscoveryRes.
FAILED_CertificateExpired	Not used for DC charging.
FAILED_SignatureError	Indicates the validation of the Security element in the message header failed.
FAILED_NoCertificateAvailable	Not used for DC charging.
FAILED_CertChainError	Not used for DC charging.
FAILED_ChallengeInvalid	Not used for DC charging.
FAILED_ContractCanceled	Not used for DC charging.
FAILED_WrongChargeParameter	Indicates if the contents of ChargeParameterDiscoveryReq message is not valid, e.g., wrong parameter set is provided, one or multiple parameters cannot be interpreted.
FAILED_PowerDeliveryNotApplied	Indicates the EVSE is not able to deliver energy
FAILED_TariffSelectionInvalid	Indicates the charging profile in the PowerDeliveryReq message contains a SATupleID which was not contained in the "SASchedules" attribute provided in "ChargeParameterDiscoveryRes."
FAILED_ChargingProfileInvalid	Indicates the charging profile in the PowerDeliveryReq message violates a power limitation provided in "ChargeParameterDiscoveryRes."
FAILED_EVSEPresentVoltageTooLow	Not used for DC charging.
FAILED_MeteringSignatureNotValid	Not used for DC charging.
FAILED_WrongEnergyTransferType	The vehicle requested energy transfer does not match what the DC supply is able to deliver.

4.2.79 SA Schedule List (SAScheduleList)

Source: SECC

Destination: EVCC

Table 75 - SA schedule list

Element/Attribute Name	Type	Semantics
SAScheduleList	complexType: SAScheduleListType substitutes abstract type SASchedulesType	Includes several tuples of schedules from secondary actors.

[V2G-DC-559] Since for DC charging, the EVCC is not able to provide a planned departure time, SAScheduleList shall provide PMaxSchedule covering at least 24 hours.