



SURFACE VEHICLE TECHNICAL INFORMATION REPORT

J3068/2

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Control of Bidirectional Power for AC Conductive Charging

RATIONALE

SAE J3068/2 adds a new Protocol Version (definitions of signals and the associated logical rules) to SAE J3068 to add support for bidirectional and four-quadrant power transfer conforming to SAE J3072 and IEEE 1547. Capabilities include (depending on authorization) control of real and reactive AC power while charging or discharging to support either site electrical limitations or for power grid management.

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Documents

Document Sharing Hub

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1. SCOPE

This document extends SAE J3068 and SAE J3068/1 to include multiple ways to control charging and discharging to an EPS, managed charging, and other related capabilities. Capabilities are designed to support both site electrical limits and power grid management.

2. REFERENCES

2.1 General

This technical information report adds additional functionality to SAE J3068 and will, where possible, refer to that document to reduce the potential for conflicting information. However, for completeness, all documents referenced by SAE J3068 are listed here.

All requirements are given level-four section numbers and appear in the text. [APPENDIX B](#) summarizes only the requirements (with links to explanatory text in context) to assist verification planning.

2.2 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.

2.2.1 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 J1939	Serial Control and Communications Heavy Duty Vehicle Network - Top-Level Document
SAE J1939DA	J1939 Digital Annex
SAE J3068	Electric Vehicle Power Transfer System Using a Three-Phase Capable Coupler
SAE J3068/1	Identification of Vehicles and Supply Equipment for Conductive AC Charging
SAE J3072	Interconnection Requirements for Onboard, Grid Support Inverter Systems

2.2.2 CSA Publications

Available from CSA International, 178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3, Tel: 416-747-4000, www.csa-international.org.

CSA C22.1	Canadian Electrical Code Part 1, Section 86
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2.2.3 IEC Publications

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

IEC 62196-2	Plugs, Socket-Outlets, Vehicle Connectors and Vehicle Inlets - Conductive Charging of Electric Vehicles - Part 2: Dimensional Compatibility and Interchangeability Requirements for AC Pin and Contact-Tube Accessories
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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 100 CD	Standards Dictionary: Glossary of Terms and Definitions
IEEE 1547	IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
IEEE 1547.1	IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces

2.2.5 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voe-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 3779	Road vehicles - Vehicle identification number (VIN) - Content and structure
ISO 5474	Electrically propelled road vehicles - Functional requirements and safety requirements for power transfer - Part 1: General requirements for conductive power transfer.
ISO 15118	Road vehicles - Vehicle to grid communication interface
ISO 17987-1	Road Vehicles - Local Interconnect Network (LIN) - Part 1: General Information and Use Case Definition
ISO 17987-2	Road vehicles - Local Interconnect Network (LIN) - Part 2: Transport protocol and network layer services
ISO 17987-3	Road vehicles - Local Interconnect Network (LIN) - Part 3: Protocol and specification
ISO 17987-4	Road vehicles - Local Interconnect Network (LIN) - Part 4: Electrical physical layer (EPL) specification 12 V/24 V
ISO/TR 17987-5	Road vehicles - Local Interconnect Network (LIN) - Part 5: Application programmers interface (API)
ISO 17987-6	Road vehicles - Local Interconnect Network (LIN) - Part 6: Protocol conformance test specification
ISO 17987-7	Road vehicles - Local Interconnect Network (LIN) – Part 7: Electrical Physical Layer (EPL) conformance test specification
ISO/IEC 29341-16-11	Information technology - UPnP Device Architecture - Part 16-11: Low Power Device Control Protocol - Low Power Service

2.2.6 NFPA Publications

Available from National Fire Protection Agency, 1 Batterymarch Park, Quincy, MA 02169-7471, Tel: 617-770-3000, www.nfpa.org.

NFPA 70 National Electric Code

2.2.7 Normas Mexicanas Publications

Available from Sistema Integral de Normas y Evaluación de la Conformidad (SINEC), Insurgentes Sur 1735, Col. Guadalupe Inn., Delegación Alvaro Obregón, México, D.F. C.P. 01020, Tel: (01)-(55)-2000-3000, www.sinec.gob.mx.

NOM-001-SEDE Instalaciones Electricas (Utilización) Artículo 625

2.2.8 UL Publications

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

UL 1008 Transfer Switch Equipment

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

UL 2231 Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits

UL 2251 Plugs, Receptacles, and Couplers for Electric Vehicles

UL 2594 Electric Vehicle Supply Equipment

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

2.3 Related Publications

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

2.3.1 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 J3400 NACS Electric Vehicle Coupler

2.3.2 IEEE Publications

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

IEEE 1547.9 IEEE Guide for Using IEEE Std 1547 for Interconnection of Energy Storage Distributed Energy Resources with Electric Power Systems

3. DEFINITIONS

3.1 AFFILIATION

The process whereby *EV* and *SE* share identifying information (such as EMAID, EVCCID, VIN, EVSEID, and SECCID) so the *devices* and any associated remote management system (RMS) know what is connected and where.

3.2 AREA ELECTRIC POWER SYSTEM (AREA EPS)

An *EPS* that serves a *local EPS*.

NOTE: Typically, an *area EPS* has primary access to public rights-of-way, priority crossing of property boundaries, etc., and is subject to regulatory oversight.

3.3 ASCII7

Seven-bit *ASCII*, equivalent to the Basic Latin (single byte) code page of UTF-8. Control codes are not included in *ASCII7* for the purposes of this document. A collection of these values is a string.

3.4 CCID

Charging circuit interruption device. A mechanism to interrupt the charging circuit when *residual current* exceeds a threshold, normally 20 mA of sinusoidal AC current.

3.5 (SAE J3072) CERTIFICATION

A group of requirements defined in SAE J3072 for the interconnection of a *DER* with the *area EPS*.

3.6 CONDUCTOR

A body, usually in the form of a wire, cable, or bus bar, suitable for carrying an electric current. Refer to IEEE 100 CD.

3.7 CONNECTION SESSION

A *connection session* starts when the *connector* is inserted into the *inlet* and ends when the *connector* is removed from the *inlet*. A normal *connection session* may contain one or more periods of charging.

3.8 CONNECTOR

A hand-held conductive device at the end of a flexible cable from the *SE*, which is inserted into the *EV inlet* to charge the battery.

3.9 CONTACTOR

A switching device capable of repeatedly interrupting normal load currents, but not necessarily rated to interrupt short circuit current as a circuit breaker would. A *contactor* is similar in concept to a relay, but generally has higher power capacity. *Contactors* may also refer to a high-power (and silent) solid state relay.

3.10 CP LEVEL

Control pilot level refers to the nominal high-level voltage of the control pilot waveform (during *LIN-CP*). This voltage is a function of the *EV* being plugged in or unplugged and of the *EV* closing or opening the switch *S2*. *CP level* is denoted as 12, 9, 6, etc.

CP level is similar to "State" in SAE J1772, but not identical. The negative amplitude differs (-12 V for *PWM-CP* and approximately 0 V for *LIN-CP*). The analog control function of *S2* is supplemented by digital signals.

3.11 CYCLIC REDUNDANCY CHECK (CRC)

A *cyclic redundancy check* is an error-detecting code used to detect accidental changes to raw data.

3.12 CYCLE

A complete transmission of all *multiplexed* data within a *stage*, beginning with the control *page* and ending with the *CRC page* if *CRCs* are being transmitted.

3.13 DEVICE

Either an *EV* or *SE* capable of SAE J3068/1.

- a. Local device - Within a LIN-CP session, whichever device is running the application program being discussed.
- b. Remote device - Within a LIN-CP session, whichever device is connected to the local device.

EXAMPLE: In a section describing *SE* functions, the *SE* is the *local device*, and the *EV* is the *remote device*.

3.14 DISTRIBUTED ENERGY RESOURCE (DER)

A source of electric power that is not directly connected to a bulk power system. *DER* includes both generators and energy storage technologies capable of exporting active power to an *EPS*. The *DER* is comprised of the *SE* and attached *EV*.

3.15 ELECTRIC POWER SYSTEM (EPS)

Facilities that deliver electric power to a load.

3.16 ELECTRIC VEHICLE (EV)

A vehicle designed to receive energy from *SE*. This term is used to cover *electric vehicles* and plug-in hybrid *electric vehicles*. This includes on-road *electric vehicles*, off-road *electric vehicles*, airport ground support equipment, etc.

3.17 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

A *device* responsible for safely providing power to the *EV* through the use of certain control functions which are defined in this recommended practice. It may be permanently wired or connected via a cord to the premises wiring. To supply the *EV*, it may have a permanently attached *connector*, or an *SE socket-outlet* (see [3.51](#)) which accepts a *plug* (see [3.40](#)). Contrast this with *SE*, which does not encompass the connection method (see [3.49](#)).

3.18 EPS ISOLATION SWITCH

A *switch* intended for isolating the *local EPS* from the *area EPS*. It may have no interrupting rating. The *EPS isolation switch* performs a function similar to that of an automatic transfer switch (ATS) and may be an ATS in some installations. The *switch* monitors the conditions on the *area EPS* even when it is open, and communicates these conditions, as well as its state (open or closed) to the *supply equipment*.

3.19 EV CABLE ACCESSORY

Something that connects to an *EV's inlet*, inclusive of, but not limited to, *EV cable assemblies*.

3.20 EV CABLE ASSEMBLY

A portable *cable assembly* consisting of a length of *EV cable*, a vehicle *connector* on one end, and an *EV plug* on the other.

3.21 FIELD

Like a *signal*, but communicated via one or more *signals* in a *paged frame* as determined by the *page number*.

3.22 FORM, LOCAL EPS

The act of providing a voltage reference and a frequency standard to the *local EPS* when separate from the *area EPS*. Typically, this includes providing power to the *local EPS*. Refer to IEEE 100 CD.

3.23 FRAME

A *LIN* communication entity consisting of a header and response. All *frames* in the SAE J3068 series have 8-byte payloads.

3.24 GRID CODE

A set of functional and communication requirements for interconnection of a *DER* with the *area EPS* in a particular regulatory jurisdiction.

3.25 GRID SERVICES

Any of a number of schemes whereby a *DER* provides value to the *area EPS*.

3.26 GROUND CONDUCTOR (GROUNDING CONDUCTOR or GROUND)

A *conductor* which does not carry current under normal operating conditions but is capable of carrying sufficient fault current to trip a circuit protection device such as a fuse or circuit breaker. Also known as “Protective Earth” outside of North America.

3.27 HIGH-VOLTAGE ENERGY STORAGE SYSTEM (HVESS)

The group of components comprising the vehicle’s stored energy source used primarily for propulsion and primary operation, including but not limited to lithium-ion batteries, contactors, and battery management systems.

3.28 INLET

The component on the *EV* into which the *connector* mates.

3.29 LIN

Local Interconnect Network; refer to ISO 17987.

3.30 LIN-CP

The control method using *LIN signals* and *CP levels*, as described in SAE J3068.

3.31 LINE CONDUCTOR (LINE)

A *conductor* that is not connected to the *neutral* point of a system that is intended to carry current under normal conditions.

3.32 LOCAL ELECTRIC POWER SYSTEM (LOCAL EPS)

An *EPS* contained entirely within a single premises or group of premises. See [3.2](#).

3.33 LOCAL ELECTRICAL CODES

Refers to the regulations governing electrical installations in their corresponding jurisdictions: NFPA 70, CSA C22.1, or NOM-001-SEDE, and/or any applicable local regulations.

3.34 MODE

The rules and control scheme under which the system of *EV* and *SE* are currently operating. The *SE* chooses a *mode* that is appropriate to conditions within those advertised by the *EV* as currently available. The system defaults to the *Normal Charging mode* where operation is identical to that defined in SAE J3068/1.

3.35 MULTIPLEXING

In this document, a system where *signals* within a *LIN frame* hold different data on subsequent *LIN* transfers depending on the value of an index variable, referred to as a *page*. See [3.12](#), [3.21](#), [3.38](#), and [3.52](#).

3.36 NOT AVAILABLE

A special value for a *signal* or *field* that means that a value for this *signal* or *field* is *Not Available* or invalid and should not be used in calculations or decisions. See *valid value* in [3.57](#).

3.37 NEUTRAL CONDUCTOR (NEUTRAL)

The *conductor* connected to the *neutral* point of a system that is intended to carry current under normal conditions. Refer to NFPA 70, Article 100.

3.38 PAGE

A group of data, stored in a *paged frame*, indexed by a *page* number.

3.39 PARAMETER GROUP NUMBER (PGN)

CAN message identifier in SAE J1939. The meaning of a particular *PGN* is defined in SAE J1939DA.

3.40 PLUG

A hand-held conductive component at one end of an *EV cable assembly*, which mates into the *socket-outlet*: present in case B and case A, not present in case C.

3.41 PLUG AND CHARGE

A system defined in ISO 15118 allowing a vehicle owner to be billed for public charging without having to interact with the *EVSE* outside of connecting the vehicle.

3.42 PROTOCOL VERSION

The particular communications format in use. This document defines *Protocol Version 252*₁₀, which are supersets of *Protocol Version 103*₁₀ defined in SAE J3068. Future editions and/or companion documents may define additional *Protocol Versions*.

3.43 PROXIMITY DETECTION (PROXIMITY or PROX)

A method whereby the *EV* can ascertain whether a *connector* is plugged into the *inlet*, without requiring active elements in the *connector* or cable. *Proximity detection* may also provide additional functionality. This function is also used between the *plug* and the *socket-outlet*.

3.44 PUBLISHER

A *LIN* node which has been assigned to provide the response for a specific *frame*. Each *frame* can have only one *publisher*.

3.45 RESIDUAL CURRENT

The vector sum of the currents in all *conductors* intended to carry current (i.e., excluding the *ground conductor*). Refer to IEEE 100 CD.

3.46 RESTART

An event within a *connection session* where *LIN-CP* communication begins again in a new control sequence.

3.47 S2

A means for the *EV* to change the *control pilot level* between *levels* 9 and 6.

3.48 SCHEDULE

The *schedule* describes the *frames* and the timing of the *frames* transmitted on the data link. Refer to ISO 17987-3.

3.49 SUPPLY EQUIPMENT (SE)

Supply equipment (also “Se...” in *signal*, *field*, and *frame* names). In this recommended practice, *supply equipment* does not encompass the connection method, which has distinct voltage and current ratings that are not necessarily reflected in the *SE* rating *signals*. Contrast this with *EVSE* (see [3.17](#)), which does encompass the connection method ratings in addition to the control box ratings.

3.50 SIGNAL

A datum communicated over the *LIN* data link. One or more *signals* are packaged in an 8-byte *frame*. In this recommended practice, most *signals* contain a minimum of two bits so that even a binary *signal* with normal values such as *Incomplete* and *Complete* can also indicate the values of *Error* and *Not Available* for exceptions. Parametric *signals* typically encode a range of data (for example, with 8 bits) with the maximum value encoding *Not Available*.

In the SAE J3068 series of documents, *signals* are typeset in monospace font, and groups of *signals* are denoted by an appended x, where the x replaces whatever differentiates the different *signals* in the group.

3.51 SOCKET-OUTLET

The component on the *EVSE* into which the *plug* of an *EV cable assembly* is inserted. The *SE socket-outlet* only exists in case B applications. The *SE* may instead have a permanently attached cable; see case C. These components are not general-purpose (e.g., NEMA) receptacles, but are instead specifically for *EVs*. These components are not used to provide a connection between the premises wiring and the *supply equipment*, but instead connect the *EV cable assembly* to the *supply equipment*.

3.52 STAGE

A section of the information exchange protocol described in SAE J3068/1 and this document.

3.53 START VALUE

A value stored internally in a *LIN* node (usually referring to a *signal* from the other node) at the start of a *control sequence* before an actual *signal* is received from the other *LIN* node. *Start values* are sometimes defined to set safe start conditions or to set values that can be distinguished from *valid* received *values* (making it clear from the variable value when nothing has yet been received from the other side of the network).

3.54 SUSPECT PARAMETER NUMBER (SPN)

CAN *signal* identifier in SAE J1939. The meaning of a particular *SPN* is defined in the SAE J1939DA.

3.55 SUBSCRIBER

A *LIN* node which has been assigned to receive the response for a specific *frame*. Each *frame* can have zero, one, or several *subscribers*.

3.56 SUNSPEC MODBUS

A group of information models defined by the SunSpec Alliance intended for the control of *distributed energy resources* via *Modbus*: a data communications protocol originally designed for use with programmable logic controllers using predefined 16-bit registers.

3.57 VALID VALUE

A *signal* or *field* value that is not set to *Not Available* (binary value of all ones) and not set to *Error*. In other words, a usable value that does not need to be ignored.

3.58 VEHICLE-TO-GRID (V2G)

A system in which *electric vehicles* sell *grid services* to the *area EPS*.

3.59 VEHICLE-TO-HOME (V2H)

Use of an *electric vehicle* to provide back-up power during a power outage or to displace energy from the *area EPS* with energy from renewable sources. *Vehicle-to-home* is a special case of *vehicle-to-load*.

3.60 VEHICLE-TO-LOAD (V2L)

Where an *EV* provides power for a load independent of the grid. The *EV* forms the *local EPS*.

3.61 VEHICLE-TO-VEHICLE (V2V)

Use of a (donor) *electric vehicle* to provide power to charge another (recipient) *electric vehicle*, normally in an emergency situation where the recipient is stranded at very low state-of-charge. *Vehicle-to-vehicle* is a special case of *vehicle-to-load*.

3.62 VEHICLE-TO-X (V2X)

Any of *vehicle-to-grid* (V2G), *vehicle-to-home* (V2H), *vehicle-to-load* (V2L), or *vehicle-to-vehicle* (V2V).

4. DOCUMENT OVERVIEW

4.1 Document Overview

This technical information report provides an overview of proposed additional functionality for the three-phase capable AC charging system defined in SAE J3068 and SAE J3068/1. Support for various forms of unidirectional and bidirectional power management are included. The changes are added under an experimental *Protocol Version 252*. This document, in its current form, may not completely define a working system. It is intended that a future edition of SAE J3068/2 will provide a recommended practice under a non-experimental *Protocol Version*.

4.2 Protocol Version 252 Overview

The basic functionality of *Protocol Version 252* is largely unchanged from the *Protocol Version* defined in (the appendix of) SAE J3068/1. SAE J3068/2 is a strict superset of SAE J3068/1.

Protocol Version 252 adds support for unidirectional and bidirectional active power management, with and without reactive power management. Regulatory requirements are satisfied according to SAE J3072 where applicable. SAE J3068/2 is designed to define a minimum of new *frames*, to facilitate future extensions, and to have minimal effect on *LIN* bus timing. Much of the added functionality uses the same mechanism defined in SAE J3068/1, as either new *pages* and *fields* added to the *frames* defined in that standard, or in another pair of similar *frames*. Three additional *frames* are defined for latency-sensitive data.

4.3 Communications Domains

The SAE J3068 series of documents discuss several communications protocols and purposes. However, only the communications between the *EV* and *EVSE*, specifically over *LIN-CP*, are defined here. Other communications discussed, such as SAE J1939, are for reference only. See [Figure 1](#).

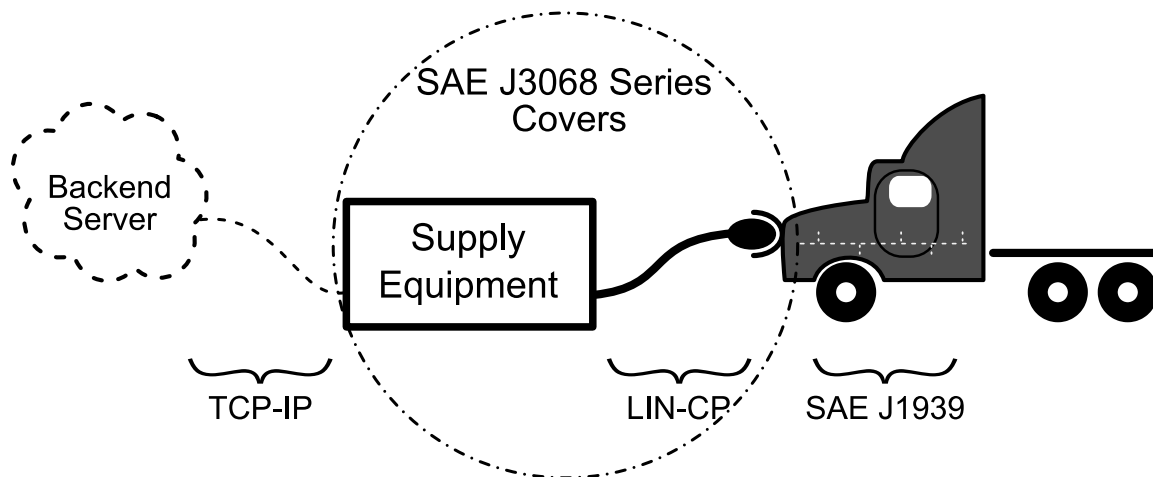


Figure 1 - SAE J3068 series communications domains (informative)

5. GENERAL REQUIREMENTS

5.1 EVSE Requirements

5.1.1 EVSE General Requirements

- 5.1.1.1 A *device* supporting SAE J3068/2 shall fulfill all applicable requirements from SAE J3068 and SAE J3068/1.
- 5.1.1.2 *EVSE* which support *vehicle-to-grid* shall be installed such that they may not be moved without tools and be permanently connected to the premises wiring (i.e., not be connected via a NEMA receptacle).
- 5.1.1.3 The *installation* of the *EVSE* shall be done in accordance with *local electrical codes*. Grid-following requirements are listed in Section 702 of NFPA 70. Grid-forming requirements are listed in Section 705 of NFPA 70.

EVSE will disconnect an *EV* that energizes the *area EPS* without authorization from the *EVSE*. See [9.5.1.5](#).

It is recommended that *EVSE* which are installed as described in [5.1.1.2](#) should not be installed on a circuit with a GFCI (Class A 5mA). This may cause upstream nuisance tripping, may interfere with the *EVSE* automatic reset function if present, and could interfere with the ability to provide a reliable power feed.

Table 1 - System classification (informative)

Line	Operating Mode	Bidirectional Capability	Applicable Standards
1	<i>Area EPS</i> following (under SAE J3072)	An on-board inverter sourcing and/or sinking power synchronized to an <i>area EPS</i>. <i>EVSE</i> provides <i>area EPS</i> settings and protective functions and is listed to UL 1741 SC. <i>EV</i> is fully compliant to IEEE 1547 and IEEE 1547.1. <i>EVSE</i> and <i>EV</i> can be tested separately and are designed to be interoperable between different makes and models. <i>EV</i> and <i>EVSE</i> communicate with each other using one of the three IEEE 1547 protocols as specified by the SAE J3072 system type. <i>EVSE</i> supports one of the three IEEE 1547 protocols in order to be configured with the latest <i>grid code</i> settings from the <i>area EPS</i> operator.	NFPA 70 Article 705 UL 1741 SC (<i>EVSE</i>) SAE J3072 (<i>EV</i> + <i>EVSE</i>) IEEE 1547 (<i>EV</i>)
2	<i>Area EPS</i> following (under UL 9741)	An on-board inverter sourcing and/or sinking power synchronized to an <i>area EPS</i>. The system of the <i>EVSE</i>, <i>EV</i>, and any ancillary equipment is compliant to IEEE 1547 and IEEE 1547.1 and supports one of the three IEEE 1547 protocols. The <i>EVSE</i>, <i>EV</i>, and any ancillary equipment are designed together, and the system only operates with certain combinations of makes and models. Because this approach is vendor specific, this document does not give specific requirements for this configuration. The <i>EV</i> and <i>EVSE</i> may communicate using proprietary methods.	NFPA 70 Article 705 UL 1741 SB (<i>EV</i> + <i>EVSE</i>) UL 9741 IEEE 1547
2	<i>Local EPS</i> following	An on-board inverter sourcing and/or sinking power synchronized to a <i>local EPS</i>. <i>EVSE</i> provides <i>local EPS</i> settings. <i>EV</i> is required to operate within those limits.	NFPA 70 Article 702 IEEE 1547 ⁽¹⁾
3	<i>Local EPS forming</i>	An on-board inverter sourcing (optionally sinking) power provides a voltage and frequency reference. <i>EVSE</i> provides <i>local EPS</i> settings. <i>EPS isolation switch</i> ensures the isolation of the <i>local EPS</i> from the <i>area EPS</i>.	NFPA 70 Article 702 UL 1008
4	Baseline	These requirements apply to all <i>EVSE</i> .	ANSI/UL 2594, 2231, 2251 NFPA 70 Article 625

Note 1: IEEE 1547 is the operating framework but, as the *local EPS* is isolated from the *area EPS*, wider frequency, voltage, etc., settings that are defined in that standard may be appropriate.

5.1.2 Area EPS Following Requirements (Under SAE J3072/UL 1741 SC)

5.1.2.1 The *EVSE* shall meet all applicable requirements of SAE J3072 for its system type.

5.1.2.2 These *EVSE* shall meet and be listed to the general product requirements specified in UL 1741 SC.

The *EVSE* confirms that the *EV* has correctly configured the *grid code* prior to giving authorization to energize the *area EPS*. See [9.5.1.3](#).

5.1.3 Area EPS Following Requirements (Under UL 9741)

Because this approach is vendor specific, this document does not give specific requirements for this configuration. The *EV* and *EVSE* may communicate using proprietary methods.

5.1.4 Local EPS Following Requirement

The *EVSE* confirms the *EV* has correctly configured the *grid code* prior to giving authorization to energize the *local EPS*. See [9.5.1.3](#).

5.1.5 Local EPS Forming Requirements

5.1.5.1 The system of the *EVSE* and any ancillary equipment (excluding the *EV*) shall meet and be listed according to UL 1008.

The *EVSE* ensures the *local EPS* is isolated from the *area EPS* prior to entering and while operating in the *local EPS forming mode*. See [10.2.2.6](#) and [10.2.2.7](#).

5.1.5.2 The *EPS isolation switch* shall confirm the *local EPS* is no longer energized (via communication and voltage measurement) prior to reconnection of the *local EPS* to the *area EPS*. See [10.3.1.2](#).

NOTE: These requirements in this section can be fulfilled by a listed combination of *EVSE* and separate *EPS isolation switch* or a single listed off-board *device*.

5.2 EV Requirements

5.2.1 General EV Requirements for Discharge into an EPS

The following requirements apply to vehicles while discharging AC power via the vehicle *inlet* and an *EVSE* into the *area EPS*.

The *EV* provides (supplemental) overcurrent protection to protect the *conductors* between the *inlet* and the *EVSE*. See [10.2.2.6](#).

5.2.1.1 The *EV* shall not bond the *neutral conductor* (if present/provided) to chassis *ground*.

5.2.1.2 The *EV* shall be designed such that if disconnected from the *EPS*, the *line/neutral conductors* in the *inlet* are insulated from the chassis *ground* by at least 500 Ω/V (i.e., when *EVSE contactor* is open, no unsafe *residual current* can flow).

NOTE: An *EV cable accessory* designed for *local EPS forming* may bond the *neutral* and *ground conductors* if appropriate *residual current* protection is provided.

5.2.1.3 The *EV* shall be designed to limit the available fault current to 5000 A (symmetrical RMS).

5.2.1.4 The *EV* continuously monitors the control pilot during operation to ensure *ground* continuity between the *EVSE* and *EV* and shall cease to energize if it determines that continuity is lost by reading *CP level 0* for 100 ms.

5.2.2 Area EPS Following Requirements (Under SAE J3072)

The following requirements apply to vehicles operating under SAE J3072.

5.2.2.1 The *EV* shall meet the requirements of SAE J3072 applicable to its system type and inverter system model number.

5.2.2.2 The *EV* shall meet the requirements of IEEE 1547 and be tested to conform to IEEE 1547.1.

NOTE: *EV* and *EVSE* operating according to IEEE 1547-2003/2014a can comply with SAE J3072 (201505) instead of the latest version.

5.2.3 Local EPS Forming Requirements

The *EV* substantiates that the *local EPS* is isolated from the *area EPS* (via communication and voltage measurement) prior to *forming* the *local EPS*. See [10.2.1.6](#). These are supplemental non-critical functional safety checks.

5.2.3.1 While *forming* the *local EPS*, the *EV* shall indicate its up and down power capability via *EvCurWattDischarge* and *EvCurWattCharge*.

5.3 General Requirements for Devices Supporting SAE J3068/2

5.3.1.1 A *device* supporting SAE J3068/2 shall include *Protocol Version 252*₁₀ as defined herein in an *EvSupportedVersionX/SeSupportedVersionX* entry.

5.3.1.2 A *device* supporting SAE J3068/2 shall support SAE J3068/1 and the *Protocol Versions* required in Appendix A of SAE J3068/1 (202312).

5.3.1.3 When operating in *Protocol Version 252*₁₀, a *device* supporting SAE J3068/2 shall fulfill all applicable requirements from SAE J3068 and SAE J3068/1.

EXCEPTION: An *SE* designed to provide only *local EPS forming* (i.e., not capable of connection to the *area EPS* or of providing power to the *EV*) need not, and should not, include *Protocol Versions 2*₁₀ and *3*₁₀ (or *103*₁₀) in *EvSupportedVersionX/SeSupportedVersionX* entries.

6. DIGITAL COMMUNICATION PROTOCOL

6.1 LIN Signals

This section defines new *signals* to be used with the *Protocol Version* (252) defined in SAE J3068/2. Refer to the similarly named sections in SAE J3068 and SAE J3068/1 for definitions of existing *signals*.

All *signal* names are shown in monospace font, and *signal* values are shown in *italic* font.

All *signal* names have a prefix indicating its *publisher*, as follows:

Ca: *Cable Assembly* (CA)

Ev: *Electric Vehicle* (EV)

Se: *Supply Equipment* (SE)

Start values are defined for all *signals*.

6.1.1 EvGridCodeStatus

EvGridCodeStatus (in conjunction with EvGridCodeStatusMod) is used to communicate the status of the *grid codes* and functional behavior configured by SeGridCodeRequest. See [6.1.2](#) and [6.1.9](#).

Signal	Bits	Values	Description	Schedule
EvGridCodeStatus	15	0000 ₁₆	Requested <i>grid code</i> not supported	Op252
		0001 ₁₆	Basic V2G settings A configured	
		0002 ₁₆	Basic V2X settings B configured	
		0003 ₁₆	UL 1741-SA defaults configured	
		0004 ₁₆	IEEE 1547-2018/UL 1741-SB defaults configured	
		7000 to 7FFA ₁₆	Manufacturer-defined settings configured	
		7FFE ₁₆	<i>Error</i>	
		7FFF ₁₆	Unconfigured (<i>start value</i>)	

6.1.2 EvGridCodeStatusMod

EvGridCodeStatusMod (in conjunction with EvGridCodeStatus) is used to communicate the status of the *grid codes* configured by SeGridCodeRequest. See [6.1.1](#) and [6.1.9](#).

Signal	Bits	Values	Description	Schedule
EvGridCodeStatusMod	1	0 ₂	<i>Grid code</i> modified after configuration	Op252
		1 ₂	<i>Grid code</i> unmodified or not configured (<i>start value</i>)	

6.1.3 EvInverterState

This *signal* allows the *EV* to report the state of its inverter. A *valid value* in this *signal* is highly desirable if power management is to be performed. An *EV* that only has one inverter sleep *mode* reports *Deep Sleep Online* when in this *mode*. (Sleep states per ISO/IEC 29341-16-11.) Inverter states, in order from *Active*, *Light Sleep*, *Deep Sleep Online*, *Deep Sleep Offline*, to *Off*, are progressively lower standby power but may require progressively longer times to become active. If the inverter is unresponsive to remote *signals*, the *signal* may be either *Disconnected/Off* or *Deep Sleep Offline*, but conversely, if the *EV* is in either of these states, it is not required to be unresponsive to remote requests. See [6.1.10](#).

Signal	Bits	Values	Description	Schedule
EvInverterState	4	0 ₁₀	Disconnected/Off	Op252
		1 ₁₀	Deep Sleep Offline	
		2 ₁₀	Deep Sleep Online	
		3 ₁₀	Light/Transparent Sleep	
		4 ₁₀	Active/On	
		5 ₁₀	In transition	
		E ₁₆	Error	
		F ₁₆	Not Available (SE start value)	
		All Others	Reserved	

6.1.4 EvJ3072ByteX

EvJ3072 refers to a group of seven *signals* the *EV* may use to facilitate SAE J3072 *certification*. All information required for SAE J3072 *certification* under IEEE 1547-2003/2014a, except for reference voltage, is communicated via EvJ3072. All information required for SAE J3072 *certification* under IEEE 1547-2018, except for the Inverter ID string, will be communicated via the *SunSpec* tunnel once fully defined. The information these *signals* can contain, and the encoding thereof is described in [Section 7](#).

Signal	Bits	Values	Description	Schedule
EvJ3072ByteA EvJ3072ByteB EvJ3072ByteC EvJ3072ByteD EvJ3072ByteE EvJ3072ByteF EvJ3072ByteG	8	00 ₁₆ to FF ₁₆	Information required for SAE J3072 <i>certification</i> determined by EvJ3072Page as described in Section 8	Op252
		FF ₁₆	<i>Not Available</i> ; also a <i>valid value</i> in some positions	

6.1.5 EvJ3072Page

The *EV* denotes the information contained in EvJ3072 via this *signal*. The meaning of the defined values is described in [Section 7](#). An *EV* does not use the reserved values and an *SE* ignores EvJ3072 when these values are received.

Signal	Bits	Values	Description	Schedule
EvJ3072Page	8	0 ₁₀ to 7 ₁₀	Page number	Op252
		8 ₁₀ to 253 ₁₀	Reserved	
		FF ₁₆	Not Available (SE start value)	

6.1.6 EvPwrCtrlModesAvail

If the *EV* is willing to allow one or more of the power control *modes* described in [9.4](#), it advertises those *modes* via this *signal*. See [6.1.7](#), [6.1.10](#), and [7.3.13](#).

Signal	Bits	Values	Description	Schedule
EvPwrCtrlModesAvail	16	0000 1000 0000 0000 ₂	Controlled Charging Limit w/ Improved Response (CCL) supported	Op252
		0000 0100 0000 0000 ₂	Target Consumption (TC; P-) supported	
		0000 0010 0000 0000 ₂	Target Generation and Consumption (TGC; P±) supported	
		0000 0001 0000 0000 ₂	Target Consumption w/ Reactive Control (TC+R; II&III) (V2L)	
		0000 0000 1000 0000 ₂	Target Generation and Consumption w/ Reactive Control (TGC+R; I,II,III,&IV) supported	
		0000 0000 0000 1000 ₂	Autonomous and/or External Control (e.g., Curves and Telematics) supported	
		0000 0000 0000 0010 ₂	Local EPS Forming (V2L/H) supported	
		Any bitwise “or” of the above	The control <i>modes</i> represented by the above values and are all supported by this <i>EV</i> at this time	
		0000 ₁₆	No <i>SE</i> control of power is supported (charging controlled by <i>EV</i>) [<i>SE start value</i>]	
		All Others	Reserved (for new <i>modes</i>)	

Note: The bit-positions in this *signal* correspond to the high-nibble of the *mode* enumeration values defined in [6.1.7](#) and [6.1.10](#).

6.1.7 EvPwrCtrlModeAck

This *signal* allows the *EV* to acknowledge the *SE*'s request in *SePwrCtrlMode*. The *valid values* of this *signal* are hamming codes with a hamming distance of four. Hamming codes help to ensure a potentially risky *mode* is not entered inadvertently. The use of this *signal* is discussed in detail in [9.4](#). See [6.1.6](#) and [6.1.10](#).

Signal	Bits	Values	Description	Schedule
EvPwrCtrlModeAck	8	FF ₁₆	Normal Charging (EV start value)	Op252
		B4 ₁₆	Controlled Charging Limit w/ Improved Response (CCL)	
		A3 ₁₆	Target Consumption (TC; P-)	
		9A ₁₆	Target Generation and Consumption (TGC; P±)	
		8D ₁₆	Target Consumption w/ Reactive Control (TC+R; II & III)	
		72 ₁₆	Target Generation and Consumption w/ Reactive Control (TGC+R; I, II, III & IV)	
		39 ₁₆	Autonomous and/or External Control (e.g., Curves and Telematics)	
		17 ₁₆	Local EPS Forming (V2L/H)	
		00 ₁₆	Processing	
		E8 ₁₆ , D1 ₁₆ , C6 ₁₆ , 65 ₁₆ , 5C ₁₆ , 2E ₁₆	Reserved; reception of a reserved code is treated as a serious error and causes the system to operate in <i>Normal Charge mode</i> for the rest of the session.	
		All Others	Invalid; SE ignores and waits for next LIN transfer	

Note 1: The high-nibble of these enumeration values correspond to the bit-positions in [6.1.6](#).

Note 2: The enumeration value 4B₁₆ is *valid*, but it is best avoided to remove any possibility of confusion with B4₁₆.