

Standards and specifications



This section provides news from standardization bodies and nonprofit associations regarding CAN-related documents. Included are also recommended practices, application notes, implementation guidelines, and technical reports.

SAE J3271: Megawatt charging system for electric vehicles

SAE International, a U.S.-based nonprofit association, is developing the J3271 megawatt DC charging system specification. This approach is intended for commercial vehicles having a short time available for battery recharge with a goal to have charging time equivalent to present liquid refueling. The related J3271 committee was formed in 2021 as part of the standards making process for a standards' defining organization (SDO) to transform the CharIN MCS task group industry stakeholder requirements document into an SAE recommended practice document. The members of the CharIN MCS task group are the same members as of the J3271 committee. J3271 has 135 registered members and a 360-person distribution list making for diverse membership input to the document creation process. Theodore Bohn from the Argonne National Laboratory chairs the committee. CiA observes and supports this activity regarding the CAN communication. It is expected that the J3271 document will be released beginning of 2024. It is already in the final review process.

The J3271 document specifies a CAN-based as well as an Ethernet-based communication between battery and charger. The IP-based link is not used for safety-related communication and CAN-based communication is not applied for value-added services such as plug-and-charge. CAN-based communication backups also the analog safety signaling (e.g. as specified in IEC 61851-23-3), but not as the only method. The J3271 document proposes to use the ISO 15118-20 protocol for the higher-layer communication, regardless of the selected network technology, CAN FD/XL or 10Base-T1S (Ethernet). The CAN-based charging protocol is mapped to SAE J1939 messages (e.g. EVSE1C1 with the Parameter Group Number 5300_n).

The Parameter Groups for the Ethernet mapping option (as defined in CiA 611-1) are not yet specified. The optional Ethernet mapping over CAN FD will follow for applications that require value added services. CAN XL is expected to support a faster Ethernet mapping, when CAN SIC XL transceivers are used. Other application layers could be supported in parallel, but are not specified in J3271. For example, GB/T 27930, Chademo, and other proprietary charging control methods can be selected at run time.

The CAN-based communication is limited to the messages specified in the J3271 document, explicitly not allowing reprogramming and not allowing general access to the in-vehicle networks. Secured CAN communication is required to be compliant with SAE J2931/7 or equivalent. It is intended to protect CAN XL frames by means

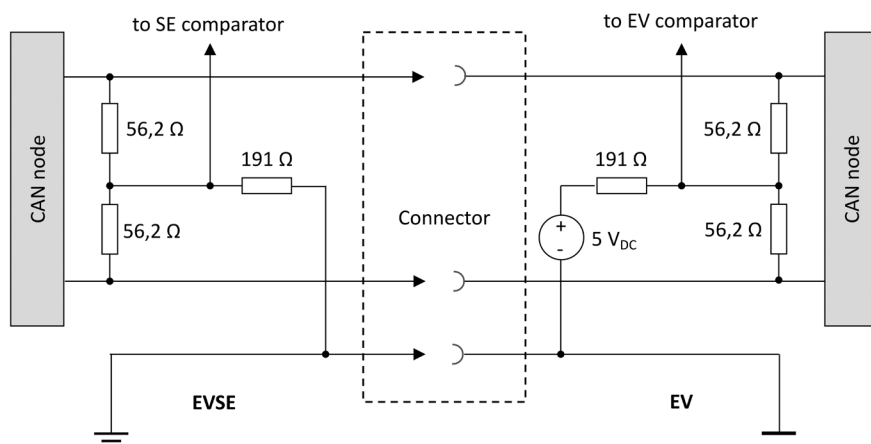


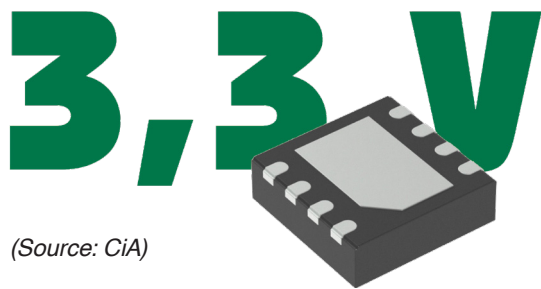
Figure 1: Basic concept for CAN connection detection (Source: SAE J3271)

of CANsec as specified in the CiA 613-2 specification (in development).

Figure 1 illustrates the basic concept for connection detection for the CAN link. While the 5-V pull-up resistor is referenced to chassis ground, the CAN transceivers are isolated in this design. Due to this, the voltage at the center-tap of the split CAN termination circuitry floats to the level set by the 191-Ω pull-up resistor in the electrical vehicle (EV) and the 191-Ω pull-down resistor in the EV supply equipment (SE). The voltages are set such that the CAN recessive state is 2,5 V, when the SE is connected to the EV. This voltage is monitored by a comparator to detect, whether the ground wire is connected and thus ready for the charging.

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CiA SIG 3,3-V transceivers established



(Source: CiA)

CiA has established the Special Interest Group (SIG) 3,3-V transceivers. Vikas Thawani (Texas Instruments) chairs the SIG. CAN transceivers supplied with 3,3 V are nothing new. There are several industrial applications using them. ECU (electronic control unit) manufacturers are selecting increasingly 3,3-V micro-controllers. In order to avoid two supply voltages, they like to use 3,3-V CAN transceivers instead of the currently dominating 5-V transceivers. The usage of 3,3-V transceivers can simplify device designs and can avoid the need of LDO (low-drop-out) regulators. To implement the 3,3-V transceivers in a network together with 5-V transceivers requires some additional specifications. Thus, the recently established SIG under the CiA Interest Group (IG) lower layers (chaired by Magnus Hell, Infineon) is going to develop such a 3,3-V transceiver specification.

The scope of the SIG 3,3-V transceivers covers the following kinds of CAN transceivers compliant with ISO 11898-2:2024: CAN HS (high speed), CAN FD (flexible data rate), CAN SIC (signal improvement capability), and CAN SIC XL (extended data field length). This includes also transceivers with low-power and selective wake-up capabilities. A related conformance test plan, an interoperability test plan submitted by the C&S Group, and an EMC specification are also in the SIG's scope. The EMC specification is a candidate to be submitted for international standardization in IEC.

The first CiA specification is intended for PMA (physical medium attachment) sublayer implementations according to the parameter set A and B as given in ISO/FDIS 11898-2:2023. The release is planned for end of 2024. All market-leading CAN transceiver chipmakers participated in the SIG's inaugural meeting.

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Brief news

- ◆ **SAE J1939-02:** [SAE](#) has updated the recommended practice for an agricultural forestry off-road machinery control and communication network. It specifies the document series within the set of SAE J1939 documents that are applicable to the agriculture industry. Based on these J1939 documents, the ISO has specified the ISO 11783 series (also known as Isobus). Unfortunately, the SAE J1939-02 document is not completely harmonized with the terminology used in the ISO documents. The requirements in both document series are sometimes given twice with the risk of inconsistencies.
- ◆ **SAE J1939-82:** SAE has published a new version of J1939 compliance tests. The purpose of these compliance procedures is to generate one or more test documents, which outline the tests needed to assure that an ECU (electronic control unit) designed to operate as a node on an SAE J1939 network, would do so correctly.
- ◆ **CiA 402-1/2/3:** [CiA](#) has released revised versions of the CiA 402 profile for drives and motion controllers. The updated parts (Part 1: General definitions, Part 2: Operation modes and application data, Part 3: PDO mapping) introduce 64-bit position values and some additional operation modes. The PDO mapping is intended for CANopen CC (classic).
- ◆ **CiA 1301:** Since the end of 2023, the version 1.1.0 of the CiA 1301 CANopen FD application layer specification is available. It provides an updated CAN FD bit timing table based on a 40-MHz clock instead of an 80-MHz clock. The document introduces an optional adjustable maximum available payload in order to use the rest payload for additional functionality (e.g. for security purposes). The handling of USDO (universal service data object) services has been simplified by clarification of the session-ID handling. Also, the handling of USDO remote services has been declared as mandatory. Further, the specification clarifies the error handling for every CANopen FD service in case a CANopen FD device receives more or less data bytes than expected. Additionally, the data object for implemented CiA specification versions and the storage behavior have been specified more precisely. The document has also been improved editorially.
- ◆ **CiA 437 series:** The CANopen application profile for grid-based photovoltaic systems has been updated. Part 1 and part 2 are already released; part 3 will follow, soon.
- ◆ **CiA 410 series:** The CiA profile for inclinometers has been completely revised. It is split into Part B (functional behavior and parameters) and application layer specific mappings. Part C specifies the mapping to CANopen CC (classic). Part F is related to CANopen FD and part J to the J1939 application layer.

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Day 1: May 14, 2024			Day 2: May 15, 2024		
9:15	icc opening	Holger Zeltwanger (CAN in Automation)	Session IV: Software Chairperson: Dr. Ken Tindell (JK Energy)		
Keynote session Chairperson: Holger Zeltwanger (CAN in Automation)			8:30	Linux CAN XL support and programming	Dr. Oliver Hartkopp (Volkswagen)
9:30	From FlexRay to CAN-XL: Migrating real-time high-performance networks into the future	Marko Moch (Cariad SE)	9:00	Scheduling of CAN frame transmission when multiple FIFOs with assigned priorities are used in RTOS drivers	Michal Lenc, Dr. Pavel Pisa (Czech Technical University)
Session I: Network design Chairperson: Reiner Zitzmann (CAN in Automation)			9:30	CAN-based bootloaders: Advantages and disadvantages of CANopen, J1939 DM17, J1939 CAM11/CAM21, and UDS bootloaders	Torsten Gedenk (emotas embedded communication)
10:30	Cable layout and CAN transceivers for higher bit rates	Kent Lennartsson (Kvaser)	Session V: System design Chairperson: Holger Zeltwanger (CAN in Automation)		
11:00	CAN XL physical layer network design	Magnus-Maria Hell (Infineon)	10:30	Relation of bandwidth and latency in CAN and PLC networks	Christoffer Mathiesen (Kvaser)
11:30	What information can eye diagrams provide for CAN?	Thomas Stueber (Teledyne LeCroy)	11:00	The power of CAN partial networking in the software-defined electrical vehicle	Mike van Haare (NXP Semiconductors)
Session II: Functional safety Chairperson: Christian Schlegel (CSC)			11:30	Dual-modular redundancy for CAN networks	Uwe Koppe (MicroControl)
13:30	Enhancing functional safety in CAN/CANopen data communication for industrial machines	Thilo Schumann (CAN in Automation)	Session VI: Application Chairperson: Christian Schlegel (CSC)		
14:00	Functional safety solutions: SAE J1939-76 (CAN) and SAE J1939-77 (CAN FD)	Travis Breitkreutz (Caterpillar)	13:30	CANopen host controller – today and tomorrow	Reiner Zitzmann (CAN in Automation)
14:30	Message end-to-end protection for small monolithic devices	Fred Rennig (STMicroelectronics)	14:00	Use-case study: Automated testing of a CANopen NMT server device	Carina Heinrich (Friedrich Lütze)
Session III: Security Chairperson: Dr. Pavel Pisa (Czech Technical University in Prague)			14:30	CAN-based body builder networks for commercial vehicles	Richard Moser (Palfinger)
15:30	Security concepts with CAN XL	Peter Decker (Vector Informatik)	Session VII: CAN XL network design Chairperson: Magnus-Maria Hell (Infineon Technologies)		
16:00	Security requirements for vehicle security gateways	Ben Gardiner (NMFTA) John Maag (Cummins) Dr. Ken Tindell (JK Energy)	15:30	CAN XL system design – about clock tolerances and margins for physical-layer effects	Dr. Arthur Mutter (Robert Bosch)
16:30	Making marine applications based on NMEA 2000 robust to cyberattacks	Dr. Chris Quigley (Warwick Control Technologies)	16:00	CAN XL in-vehicle network validation	Ayat Taleb, Christopher Walkhoff (C & S group)
			16:30	Investigation of CAN-XL EMC performance at car level	Frank Schade (Volkswagen)

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