



SURFACE VEHICLE RECOMMENDED PRACTICE

J1939™-02

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(R) Agricultural Forestry Off-Road Machinery
Control and Communication Network

RATIONALE

This SAE Recommended Practice was reviewed and updated as part of the SAE Five-Year Review. Updates include clarifying messaging uses ISO 11898-1 CEFF data frames, replacing abbreviations A&F and T&B with full terms throughout document, and some wordsmithing regarding the interactions between ISO 11783 and SAE J1939 for item requests and assignments. Updated Table 1 to only include applicable SAE J1939 documents.

FOREWORD

The SAE J1939 communications network is defined using a collection of individual SAE J1939 documents based upon the layers of the Open System Interconnect (OSI) model for computer communications architecture. This document, SAE J1939-02, specifies a particular set of SAE J1939 documents which define an SAE J1939 network as it applies to agricultural and forestry equipment.

The SAE J1939 communications network is a high-speed ISO 11898-1 CAN-based communications network that supports real-time closed-loop control functions, simple information exchanges, and diagnostic data exchanges between electronic control units (ECUs) physically distributed throughout the vehicle.

The SAE J1939 communications network is developed for use in heavy-duty environments and suitable for horizontally integrated vehicle industries. The SAE J1939 communications network is applicable for light-duty, medium-duty, and heavy-duty vehicles used on-road or off-road, and for appropriate stationary applications which use vehicle-derived components (e.g., generator sets). Vehicles of interest include, but are not limited to, on-highway and off-highway trucks and their trailers, construction equipment, and agricultural equipment and implements. The physical layer aspects of SAE J1939 reflect its design goal for use in heavy-duty environments. Horizontally integrated vehicles involve the integration of different combinations of loose package components, such as engines and transmissions that are sourced from many different component suppliers. The SAE J1939 common communication architecture strives to offer an open interconnect system that allows the ECUs associated with different component manufacturers to communicate with each other.

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Documents

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1. SCOPE

This SAE Recommended Practice specifies the requirements for application of SAE J1939 in agricultural and forestry equipment. This document specifies the series of documents within the set of SAE J1939 documents that are applicable to agricultural and forestry equipment and provides further requirements for this industry.

The SAE and ISO groups have cooperated to define agricultural and forestry networks in a manner to allow compatibility of ECUs and messaging protocols between agricultural and forestry ISO 11783 networks and truck and bus SAE J1939 networks.

2. REFERENCES

2.1 Related Publications

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

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 J1939	Serial Control and Communications Heavy-Duty Vehicle Network - Top-Level Document
SAE J1939DA	Digital Annex of Serial Control and Communications Heavy-Duty Vehicle Network
SAE J1939-11	Physical Layer, 250 kbps, Twisted Shielded Pair
SAE J1939-13	Off-Board Diagnostic Connector
SAE J1939-15	Physical Layer, 250 kbps, Un-Shielded Twisted Pair (UTP)
SAE J1939-21	Data Link Layer
SAE J1939-31	Network Layer
SAE J1939-71	Vehicle Application Layer
SAE J1939-73	Application Layer - Diagnostics
SAE J1939-74	Application - Configurable Messaging
SAE J1939-75	Application Layer - Generator Sets and Industrial
SAE J1939-81	Network Management
SAE J1939-82	Compliance

2.1.2 ISO Publications

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

ISO 11783-1	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 1: General standard for mobile data communication
ISO 11783-2	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 2: Physical layer
ISO 11783-3	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 3: Data link layer
ISO 11783-4	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 4: Network layer
ISO 11783-5	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 5: Network management
ISO 11783-6	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 6: Virtual terminal
ISO 11783-7	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 7: Implement messages application layer
ISO 11783-8	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 8: Powertrain messages
ISO 11783-9	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 9: Tractor ECU
ISO 11783-10	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 10: Task controller and management information system data interchange
ISO 11783-11	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 11: Mobile data element dictionary
ISO 11783-12	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 12: Diagnostics services
ISO 11783-13	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 13: File server
ISO 11783-14	Tractors and machinery for agriculture and forestry - Serial control and communications data network - Part 14: Sequence control

2.1.3 NMEA Publications

Available from National Marine Electronics Association, 7 Riggs Ave., Severna Park, MD 21146, 410-975-9425, www.nmea.org.

NMEA 2000	National Marine Electronics Association Standard for Serial-Data Networking of Marine Electronic Devices
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3. DEFINITIONS

Terms and abbreviations are defined in the SAE J1939 top-level document for use in the context of this document. Additional terms are defined below.

3.1 CLASSICAL EXTENDED FRAME FORMAT (CEFF)

An ISO 11898-1 CAN data frame with a 29-bit identifier, a single bit rate, and a maximum data field length of 8 bytes.

3.2 CONTROLLER APPLICATION (CA)

The software within an Electronic Control Unit (ECU) that performs a particular control function. More than one controller application can reside within an ECU. In ISO 11783, the term control function (CF) is synonymous with controller application.

3.3 CONFIGURABLE MESSAGES

A set of SAE J1939 PGs (messages) that can be configured to contain any desired combination of a set of parameters (SPs) that are designated to be configurable.

3.4 ELECTRONIC CONTROL UNIT (ECU)

Any of a number of electronic modules contained in a machine that communicates with other ECUs via an SAE J1939 network.

3.5 FARM MANAGEMENT INFORMATION SYSTEM (FMIS)

The office computer system for the farmer or contractor. It includes the software for farm management such as bookkeeping, payroll, resource management for machines, products, workers, field management, geographic information systems (GIS), decision support systems, and task management.

3.6 FAST PACKET

An NMEA 2000 transport protocol method employing multiple, broadcasted, and serialized data frames (packets) with no minimum separation between packets.

3.7 IMPLEMENT NETWORK

Network segment that connects agricultural implement ECUs, as well as some ECUs on a tractor, such as a virtual terminal and a tractor ECU.

3.8 ISOBUS

Standardization of the agricultural implement network defined in ISO 11783.

3.9 MANAGEMENT COMPUTER INTERFACE

The method of exchanging information between the FMIS and the vehicle task controllers using XML data format. A physical interface is not specified.

3.10 NETWORK INTERCONNECTION ECU

A device that exists primarily for interconnecting networks or sub networks. Specific implementations for "forwarding" messages include: repeater, bridge, router, and gateway.

3.11 PROCESS DATA

A message that is used for the transmission of measured data and/or set point commands to one or more controllers.

3.12 TASK CONTROLLER

An electronic unit on the mobile implement control system that is responsible for the sending, receiving, and logging of process data. A task controller can have an operator interface.

3.13 TERMINATION BIAS CIRCUIT

A circuit required at each end of a network segment that provides bias voltages for the CAN high and CAN low signals, and the common mode impedance termination for the respective conductors.

3.14 TRACTOR NETWORK

Network segment that connects mainly tractor mounted ECUs, including powertrain modules.

3.15 TRACTOR ECU

Standardized network interconnect device between tractor network and implement network.

3.16 VIRTUAL TERMINAL

An ECU, consisting of a graphical display and input functions, which provides the capability to display information to and retrieve data from an operator for a connected implement or working set.

4. ABBREVIATIONS

Abbreviations are defined in SAE J1939 for use in the context of this document.

CA	Controller Application
CEFF	Classical Extended Frame Format
ECU	Electronic Control Unit
ETP	Extended Transport Protocol
FMIS	Farm Management Information System
ISO	International Organization for Standardization
ISO/TC 23/SC 19/WG 1	International Organization for Standards, Technical Committee 23, Subcommittee 19, Working Group 1 (the group responsible for maintaining the ISOBUS protocol standard for agricultural and forestry networks)
NMEA	National Marine Electronics Association
PDU	Protocol Data Unit
PG	Parameter Group
PGN	Parameter Group Number
SLOT	Size, Length, Offset, and Transfer Function