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Earth-moving machinery — Collision warning and avoidance —

Part 2: On-board J1939 communication interface

Engins de terrassement — Avertissement et évitement de collision — Partie 2: Interface de communication embarquée

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

A list of all parts in the ISO 21815 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The increasing use of detection systems and avoidance technology has been supporting operators to safely operate machines in the field of mining and construction. At the same time, there are demands to set standards for machines and systems detecting, alerting and intervening to mitigate collision risk.

There are currently two existing standards in the field: ISO 16001 and ISO 17757. These standards provide guidance for visibility aids and object detection systems and for autonomous and semi-autonomous machines, however, there is currently no standard that describes collision risk awareness, warning signals and collision avoidance actions of the machinery operated by humans where there is a risk of collision.

Collision warning and avoidance systems are developing technologies; and the algorithms are not yet mature and well understood. This document is intended to foster innovation and accelerate the pace of improvements in new collision warning and avoidance technologies. The performance requirements of this document are technology neutral and do not specify technologies to meet the requirements.

The systems described in this document are intended to assist the operator of the machine. As current technologies are unable to achieve full collision warning/avoidance in every situation, the responsibility for safe operation of the machine remains with the operator of the machine.

This document defines a protocol for communication between a machine and a connected device to allow the connected device to command the machine to slow down, stop or to maintain a stationary state where the machine can move in a linear (i.e. forwards-backwards) direction along a travel path. Machines with rotational movements (e.g. excavators) and machines with compound movements (e.g. machines with booms) are only considered to the extent of the linear component of their travel.

The machine manufacturer may be flexible in deciding which method is most appropriate for their machine. Some applications can be delivered with basic functionality (e.g. without the use of registers). Regardless of which approach is selected, the connected device has a means to discover the capabilities of the machine.

Annex B outlines a mechanism for establishing trust between the machine and the connected device based on the exchange of certificates at the session layer as defined by the machine manufacturer. The message structure for the session layer can be different to the message structure defined in this document.

The specification of the J1939 protocol in this document does not preclude the development of other communication interfaces that can support collision warning and avoidance functionality. At the time of publishing this document, protocols have only been defined for SAE J1939 due to the general availability of CAN 2.0 interfaces on machinery and devices providing collision warning and avoidance functions.

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Part 2: On-board J1939 communication interface

1 Scope

This document describes the on-board J1939 communication interface between a connected device and mobile machines for use in earth-moving, mining and road construction applications to enable interventional collision avoidance actions defined in ISO 21815-1 based on the SAE J1939 protocol. This interface is intended for use by a collision avoidance system (CAS) device integrated independently from the original machine providing intervention signals to slow down, stop or prevent motion of the machine. The protocol defined by this document can also be used to provide input information for a collision warning system (CWS).

This document is not intended for plug-and-play implementation of CAS or CWS on the machine. Additional details not fully described in this document can be negotiated by the CAS or CWS manufacturer and the machine manufacturer to enable functionality.

This document does not preclude the possibility of the machine manufacturer or the CxD manufacturer developing alternative on-board communication interfaces.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19014-3, *Earth-moving machinery — Functional safety — Part 3: Environmental performance and test requirements of electronic and electrical components used in safety-related parts of the control system*

SAE J1939-15, *Reduced Physical Layer, 250 kbits/sec, UN-Shielded Twisted Pair (UTP)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
collision warning system
CWS
system which detects intended objects in the collision risk area, evaluates the collision risk level and provides a warning to the operator

[SOURCE: ISO 21815-1:—, 3.8]