
**Earth-moving machinery —
Functional safety —**

**Part 4:
Design and evaluation of software and
data transmission for safety-related
parts of the control system**

Engins de terrassement — Sécurité fonctionnelle —

*Partie 4: Conception et évaluation du logiciel et de la transmission
des données pour les parties relatives à la sécurité du système de
commande*

[ISO 19014-4:2020](https://standards.iteh.ai/catalog/standards/iso/31260104-f3b4-477b-b5e9-8cd5a59204c1/iso-19014-4-2020)

<https://standards.iteh.ai/catalog/standards/iso/31260104-f3b4-477b-b5e9-8cd5a59204c1/iso-19014-4-2020>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO 19014-4:2020](https://standards.iteh.ai/catalog/standards/iso/31260104-f3b4-477b-b5e9-8cd5a59204c1/iso-19014-4-2020)

<https://standards.iteh.ai/catalog/standards/iso/31260104-f3b4-477b-b5e9-8cd5a59204c1/iso-19014-4-2020>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Software development	4
4.1 General.....	4
4.2 Planning.....	5
4.3 Artifacts.....	6
4.4 Software safety requirements specification.....	7
4.5 Software architecture design.....	8
4.6 Software module design and coding.....	8
4.7 Language and tool selection.....	9
4.8 Software module testing.....	10
4.9 Software module integration and testing.....	11
4.10 Software validation.....	12
5 Software-based parameterization	12
5.1 General.....	12
5.2 Data integrity.....	13
5.3 Software-based parameterization verification.....	13
6 Transmission protection of safety-related messages on bus systems	13
7 Independence by software partitioning	14
7.1 General.....	14
7.2 Several partitions within a single microcontroller.....	15
7.3 Several partitions within the scope of an ECU network.....	16
8 Information for use	17
8.1 General.....	17
8.2 Instruction handbook.....	17
Annex A (informative) Description of software methods/measures	18
Annex B (normative) Software validation test environments	31
Annex C (informative) Data integrity assurance calculation	34
Annex D (informative) Methods and measures for transmission protection	36
Annex E (informative) Methods and measures for data protection internal to microcontroller	38
Bibliography	40

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 151, *Construction equipment and building material machines - Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 19014-4, together with other parts in the ISO 19014 series, cancels and replaces ISO 15998:2008 and ISO/TS 15998-2:2012, which have been technically revised.

The main changes compared to the previous documents are as follows:

- additional requirements for software development,
- requirements for software-based parametrization development,
- requirements for transmission of safety related messages on a communication bus, and
- requirements for software validation and verification of machine performance levels.

A list of all parts in the ISO 19014 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

This document addresses systems comprising any combination of electrical, electronic, and programmable electronic components [electrical/electronic/programmable electronic systems (E/E/PES)] used for functional safety in earth-moving machinery.

The structure of safety standards in the field of machinery is as follows.

Type-A standards (basis standards) give basic concepts, principles for design, and general aspects that can be applied to machinery.

Type-B standards (generic safety standards) deal with one or more safety aspect(s), or one or more type(s) of safeguards that can be used across a wide range of machinery:

- type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);
- type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards).

Type-C standards (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

This document is a type-C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium, and large enterprises);
- health and safety bodies (regulators, accident prevention organisations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium, and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e. g. for maintenance (small, medium, and large enterprises);

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations, or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

