

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Multimedia systems and equipment for vehicles – Surround view system –
Part 1: General**

**Systèmes et équipements multimédias pour véhicules – Système de vision
panoramique –
Partie 1: Généralités**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2022 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Multimedia systems and equipment for vehicles – Surround view system –
Part 1: General**

**Systèmes et équipements multimédias pour véhicules – Système de vision
panoramique –
Partie 1: Généralités**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.160.99; 43.040.15

ISBN 978-2-8322-1095-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	7
3.1 Terms and definitions.....	7
3.2 Abbreviated terms.....	7
4 System model.....	7
4.1 General.....	7
4.2 Number of cameras and camera field of view	8
4.3 Method for projecting visual image to 3D projection surface.....	9
4.4 Visualizing the projection image at free eye point.....	11
4.5 Free eye point capability	11
5 Camera configuration	11
5.1 Camera.....	11
5.2 Lens distortion data	11
5.2.1 General	11
5.2.2 Distortion data of rotationally symmetric lens.....	12
5.2.3 Distortion data of non-rotationally symmetric lens	12
5.3 Optical axis shift data	13
6 Rendering.....	14
6.1 General.....	14
6.2 Composite view data.....	14
6.2.1 3D projection surface data	14
6.2.2 Capture size	14
6.2.3 Conversion of eye point parameter	15
6.2.4 Virtual 3D image car model data	16
6.2.5 Guide line and bitmap data	16
6.2.6 Layout data and layer setting data	17
Annex A (informative) Camera mounting to the car	19
A.1 Camera mounting position	19
A.2 Camera mounting height.....	19
A.3 Camera mounting angle	19
Annex B (informative) Camera field of view.....	21
Annex C (informative) Camera calibration.....	22
Annex D (informative) Display.....	23
D.1 Display specification data	23
D.2 Composite view change mode.....	23
Annex E (informative) Time behaviour	24
E.1 Start-up time	24
E.2 Frame rate	24
E.3 Latency.....	24
Bibliography.....	25
Figure 1 – System model for surround view system.....	8

Figure 2 – Horizontal angle of view of the camera	9
Figure 3 – Vertical angles of view at the camera	9
Figure 4 – 3D projection surface	10
Figure 5 – Projecting to 3D projection surface.....	11
Figure 6 – Distortion data of a rotationally symmetric lens	12
Figure 7 – Distortion data format of rotationally symmetric lens	12
Figure 8 – Distortion data of a non-rotationally symmetric lens	12
Figure 9 – Distortion data format of a non-rotationally symmetric lens.....	13
Figure 10 – Texture normalization coordinate at the centre of each optical axis	13
Figure 11 – The format of optical shift data	14
Figure 12 – 3D projection surface data	14
Figure 13 – Capture specification data format.....	15
Figure 14 – Camera angle in conversion of eye point.....	15
Figure 15 – Camera position/scaling in conversion of eye point	15
Figure 16 – Virtual 3D image car model at original dimensions	16
Figure 17 – Virtual 3D image car model at real dimensions	16
Figure 18 – Guide line and bitmap data.....	17
Figure 19 – Camera image coordinate system	17
Figure 20 – Screen coordinate system	18
Figure 21 – Object coordinate system	18
Figure 22 – Layout data and layer setting data.....	18
Figure A.1 – Camera mounting position	19
Figure A.2 – Camera mounting height.....	19
Figure A.3 – Camera mounting angle	20
Figure C.1 – Camera calibration	22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTIMEDIA SYSTEMS AND EQUIPMENT FOR VEHICLES –
SURROUND VIEW SYSTEM –****Part 1: General****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63033-1 has been prepared by technical area 17: Multimedia systems and equipment for vehicles, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

This first edition cancels and replaces IEC TS 63033-1 published in 2017. This edition constitutes a technical revision.

The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3728/FDIS	100/3751/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 63033 series, published under the general title *Multimedia systems and equipment for vehicles – Surround view system*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The purpose of this document is to specify the model for generating the surrounding visual image of the surround view system, which provides drivers with an image of the car's surroundings. The surround view system is characterised by audio-visual monitoring and recording, which is part of the car's multimedia equipment.

When manoeuvring, the driver relies on the images provided by the rear-view monitor for parking assistance, the blind spot monitor for displaying views of the blind spots at intersections with poor visibility, and the bird's-eye view monitor. But each surround view system provides a different viewpoint to the driver. It's a heavy burden for a car driver to switch between these systems and quickly recognize the multiple fields of view. And the fields of view are limited to these camera systems, and they cannot freely change the viewpoint depending on the driving situation. Thus, the usage range of these systems is limited to such manoeuvres as parking assistance. Furthermore, on commercial vehicles such as trucks and buses, and special vehicles such as construction machinery and agricultural machinery, the usage range of these systems is even more limited. Nobody can assist drivers of large vehicles in ensuring the car's correct position.

With a surround view system, it is possible to quickly ensure the car's proper positioning in various driving situations. And not only for passenger cars, but good positioning can also be quickly ensured for commercial vehicles and special vehicles.

This document specifies the model for generating the surrounding visual image of the surround view system. IEC 63033-2 specifies the information sets that are provided by the surround view system, and recording methods for that information and visual images. IEC 63033-3 specifies the measurement methods of surrounding visual images for the surround view system.

MULTIMEDIA SYSTEMS AND EQUIPMENT FOR VEHICLES – SURROUND VIEW SYSTEM –

Part 1: General

1 Scope

This part of IEC 63033 specifies the model for generating the surrounding visual image of the surround view system.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

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:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Terms and definitions

3.1.1

car

powered wheeled vehicle of any kind

3.2 Abbreviated terms

3D	three dimensional
camera ECU	camera electronic control unit
CAN	controller area network
GUI	graphical user interface
AD	analogue-to-digital
DA	digital-to-analogue

4 System model

4.1 General

The system model of the surround view system is described in Figure 1. Cameras, which are mounted on the outside of the car, capture the visual image of the area surrounding the car and these visual data are projected onto a 3D projection surface. The visual image can then be displayed as a composite image. The images can be rendered from various viewpoints with the parameters for capture. The number of cameras required on vehicles other than automobiles can be more than four depending on the size and shape of the car. This model defines a system with four cameras for general application. The number of cameras actually used for each composite image changes depending on the viewpoint. The mounting positions and angles for the four cameras should be calibrated in accordance with the data described in 4.2 and 4.3.