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COMMENTED VERSION

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems –
Digital interfaces –
Part 1: Single talker and multiple listeners**

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ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 1: Single talker and multiple listeners

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.
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This commented version (CMV) of the official standard IEC 61162-1:2024 edition 6.0 allows the user to identify the changes made to the previous IEC 61162-1:2016 edition 5.0. Furthermore, comments from IEC TC 80 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 61162-1 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) alternative hardware is given in 5.1 which may now be as specified in this document or as specified in IEC 61162-2;
- b) the data transmission rate given in Clause 6 is now configurable. The default remains as 4 800 (bits/s) but higher rates may be provided;
- c) new identifiers have been added to Table 4;
- d) new sentences AGL, EPM, GDC, NLS, SEL, SLM, SMV and VBC have been added;
- e) revisions have been made to ABK, ABM, ACN, ALC, ALF, ARC, BBM, DDC, DTM, EPV, FIR, GBS, GFA, GLL, GNS, GRS, GSA, GST, GSV, HRM, NRX, POS, RLM, ROR, RSA, TLB, TTD, VSD and XDR;
- f) the previous Annex A, Glossary, has been deleted as being of historical interest.

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

| Draft | Report on voting |
|--------------|------------------|
| 80/1093/FDIS | 80/1097/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.

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/publications.

A list of all parts in the IEC 61162 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*, can be found on the IEC website.

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, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 IEC 61162 series consists of 5 parts which specify digital interfaces for application in marine navigation, radiocommunication and system integration, as follows:

- IEC 61162-1: Single talker and multiple listeners;
- IEC 61162-2: Single talker and multiple listeners, high speed transmission;
- IEC 61162-3: ~~Multiple talkers and multiple listeners~~ – Serial data instrument network;
- IEC 61162-450: Multiple talkers and multiple listeners – Ethernet interconnection;
- IEC 61162-460: Multiple talkers and multiple listeners – Ethernet interconnection – Safety and security

IEC technical committee 80 interface standards are developed with input from manufacturers, private and government organisations and equipment operators. The information is intended to meet the needs of users at the time of publication, but users should recognise that as applications and technology change, interface standards should change as well. Users of this document are advised to immediately inform the IEC of any perceived inadequacies therein.

The first edition of IEC 61162-1 was published in 1995. The second edition published in 2000 removed some sentences which were no longer in use, added some new sentences and included details of the ship equipment defined in IMO resolutions together with appropriate sentences for communication between them. This information was subsequently removed from the third edition when it became the practice to specify the sentence formatters in the individual standards for equipment.

The third edition published in 2007 introduced a re-arrangement of the text and new sentences particularly to support the automatic identification system and the voyage data recorder. The third edition also introduced a further type of start of sentence delimiter. The conventional delimiter "\$" was retained for the conventional sentences which are now called "parametric sentences". The new delimiter "!" identifies sentences that conform to special purpose encapsulation.

The fourth edition removed some sentences which were not in use, added some new sentences for new applications and made some corrections and additions. In particular, the sentences of relevance to satellite navigation receivers were expanded to facilitate the description of new satellite systems.

The fifth edition also removed some sentences which were no longer in use, added some new sentences for new applications and made some corrections and additions.

This sixth edition adds some new sentences for new applications and makes some corrections and additions.

~~Liaison has been maintained with NMEA and~~ This edition has been aligned where appropriate and possible with NMEA 0183 version 4.10. **1**

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 1: Single talker and multiple listeners

1 Scope

This part of IEC 61162 contains the requirements for data communication between maritime electronic instruments, navigation and radiocommunication equipment when interconnected via an appropriate system.

This document is intended to support one-way serial data transmission from a single talker to one or more listeners. These data are in printable ASCII form and ~~may~~ can include information such as position, speed, depth, frequency allocation, etc. Typical messages ~~may~~ can be from about 11 to a maximum of 79 characters in length and generally require transmission no more rapidly than one message per second.

The electrical definitions in this document are not intended to accommodate high-bandwidth applications such as radar or video imagery, or intensive database or file transfer applications. Since there is no provision for guaranteed delivery of messages and only limited error checking capability, it is important this document ~~should be~~ is used with caution in all safety applications.

For applications where a faster transmission rate is necessary, ~~reference should be made to~~ IEC 61162-2 applies.

For applications to shore based equipment of the automatic identification system (AIS) ~~reference should be made to~~ the IEC 62320 series applies.

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.

IEC 60945:2002 **2**, *Maritime navigation and radiocommunication equipment and systems – General requirements - Methods of testing and required test results*

~~IEC 61097-6, Global maritime distress and safety system (GMDSS) – Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX) **3**~~

~~IEC 61108 (all parts), Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) **3**~~

~~IEC 61162 (all parts), Maritime navigation and radiocommunication equipment and systems – Digital interface **3**~~

~~IEC 61162-2:1998, Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission **3**~~

~~IEC 61174, Maritime navigation and radiocommunication equipment and systems—Electronic chart display and information system (ECDIS)—Operational and performance requirements, methods of testing and required test results~~ **3**

~~IEC 61924-2:2012, Maritime navigation and radiocommunication equipment and systems—Integrated navigation systems—Part 2: Modular structure for INS—Operational and performance requirements, methods of testing and required test results~~ **3**

~~IEC 61996 (all parts), Maritime navigation and radiocommunication equipment and systems—Shipborne voyage data recorder (VDR)~~ **3**

~~ISO/IEC 8859 (all parts), Information technology—8-bit single-byte coded graphic character sets~~ **3**

ISO/IEC 8859-1:1998, Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1

~~ISO/IEC 10646, Information technology—Universal Coded Character Set (UCS)~~ **3**

~~ITU-R Recommendation M.493, Digital selective calling system for use in the maritime mobile service~~ **3**

~~ITU-R M.625, Direct printing telegraph equipment employing automatic identification in the maritime mobile service~~ **3**

~~ITU-R Recommendation M.821, Optional expansion of the digital selective calling system for use in the maritime mobile service~~ **3**

~~ITU-R Recommendation M.1084, Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service~~ **3**

~~ITU-R Recommendation M.1371, Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile band~~ **3**

ITU-T Recommendation X.27/V.11:1996, Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s

~~IMO GMDSS.1/Circ.18, Master plan of shore-based facilities for the global maritime distress and safety system (GMDSS master plan)~~ **3**

~~IMO, International Convention on Load Lines~~ **3**

~~IMO, International SafetyNET Manual~~ **3**

~~IMO MSC.252(83), Performance standards for integrated navigation systems (INS)~~ **3**

~~IMO MSC.302(87), Performance standards for Bridge Alert Management (BAM)~~ **3**

~~IMO Publication 951E, NAVTEX Manual~~ **3**

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Maritime navigation and radiocommunication equipment and systems – Digital interfaces –
Part 1: Single talker and multiple listeners**

**Matériels et systèmes de navigation et de radiocommunication maritimes –
Interfaces numériques –
Partie 1: Émetteur unique et récepteurs multiples**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 1: Single talker and multiple listeners

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.
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IEC 61162-1 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) alternative hardware is given in 5.1 which may now be as specified in this document or as specified in IEC 61162-2;
- b) the data transmission rate given in Clause 6 is now configurable. The default remains as 4 800 (bits/s) but higher rates may be provided;

- c) new identifiers have been added to Table 4;
- d) new sentences AGL, EPM, GDC, NLS, SEL, SLM, SMV and VBC have been added;
- e) revisions have been made to ABK, ABM, ACN, ALC, ALF, ARC, BBM, DDC, DTM, EPV, FIR, GBS, GFA, GLL, GNS, GRS, GSA, GST, GSV, HRM, NRX, POS, RLM, ROR, RSA, TLB, TTD, VSD and XDR;
- f) the previous Annex A, Glossary, has been deleted as being of historical interest.

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

| Draft | Report on voting |
|--------------|------------------|
| 80/1093/FDIS | 80/1097/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.

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/publications.

A list of all parts in the IEC 61162 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*, can be found on the IEC website.

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, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 IEC 61162 series consists of 5 parts which specify digital interfaces for application in marine navigation, radiocommunication and system integration, as follows:

IEC 61162-1: Single talker and multiple listeners;

IEC 61162-2: Single talker and multiple listeners, high speed transmission;

IEC 61162-3: Serial data instrument network;

IEC 61162-450: Multiple talkers and multiple listeners – Ethernet interconnection;

IEC 61162-460: Multiple talkers and multiple listeners – Ethernet interconnection – Safety and security

IEC technical committee 80 interface standards are developed with input from manufacturers, private and government organisations and equipment operators. The information is intended to meet the needs of users at the time of publication, but users should recognise that as applications and technology change, interface standards should change as well. Users of this document are advised to immediately inform the IEC of any perceived inadequacies therein.

The first edition of IEC 61162-1 was published in 1995. The second edition published in 2000 removed some sentences which were no longer in use, added some new sentences and included details of the ship equipment defined in IMO resolutions together with appropriate sentences for communication between them. This information was subsequently removed from the third edition when it became the practice to specify the sentence formatters in the individual standards for equipment.

The third edition published in 2007 introduced a re-arrangement of the text and new sentences particularly to support the automatic identification system and the voyage data recorder. The third edition also introduced a further type of start of sentence delimiter. The conventional delimiter "\$" was retained for the conventional sentences which are now called "parametric sentences". The new delimiter "!" identifies sentences that conform to special purpose encapsulation.

The fourth edition removed some sentences which were not in use, added some new sentences for new applications and made some corrections and additions. In particular, the sentences of relevance to satellite navigation receivers were expanded to facilitate the description of new satellite systems.

The fifth edition also removed some sentences which were no longer in use, added some new sentences for new applications and made some corrections and additions.

This sixth edition adds some new sentences for new applications and makes some corrections and additions.

This edition has been aligned where appropriate and possible with NMEA 0183 version 4.10.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 1: Single talker and multiple listeners

1 Scope

This part of IEC 61162 contains the requirements for data communication between maritime electronic instruments, navigation and radiocommunication equipment when interconnected via an appropriate system.

This document is intended to support one-way serial data transmission from a single talker to one or more listeners. These data are in printable ASCII form and can include information such as position, speed, depth, frequency allocation, etc. Typical messages can be from about 11 to a maximum of 79 characters in length and generally require transmission no more rapidly than one message per second.

The electrical definitions in this document are not intended to accommodate high-bandwidth applications such as radar or video imagery, or intensive database or file transfer applications. Since there is no provision for guaranteed delivery of messages and only limited error checking capability, it is important this document is used with caution in all safety applications.

For applications where a faster transmission rate is necessary, IEC 61162-2 applies.

For applications to shore based equipment of the automatic identification system (AIS) the IEC 62320 series applies.

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.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements - Methods of testing and required test results*

ISO/IEC 8859-1:1998, *Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1*

ITU-T Recommendation X.27/V.11:1996, *Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

MATÉRIELS ET SYSTÈMES DE NAVIGATION ET DE RADIOCOMMUNICATION MARITIMES – INTERFACES NUMÉRIQUES –

Partie 1: Émetteur unique et récepteurs multiples

AVANT-PROPOS

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L'IEC 61162-1 a été établie par le comité d'études 80 de l'IEC: Matériels et systèmes de navigation et de radiocommunication maritimes. Il s'agit d'une Norme internationale.

Cette sixième édition annule et remplace la cinquième édition parue en 2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) deux options sont données en 5.1 pour le matériel, qui peut désormais être conforme au présent document ou à l'IEC 61162-2;
- b) le débit d'émission de données indiqué à l'Article 6 est désormais configurable. La valeur par défaut reste 4 800 (bits/s), mais des débits supérieurs peuvent être prévus;
- c) de nouveaux identificateurs ont été ajoutés dans le Tableau 4;
- d) de nouvelles sentences AGL, EPM, GDC, NLS, SEL, SLM, SMV et VBC ont été ajoutées;
- e) des révisions ont été apportées aux sentences ABK, ABM, ACN, ALC, ALF, ARC, BBM, DDC, DTM, EPV, FIR, GBS, GFA, GLL, GNS, GRS, GSA, GST, GSV, HRM, NRX, POS, RLM, ROR, RSA, TLB, TTD, VSD et XDR;
- f) l'ancienne Annexe A, Glossaire, a été supprimée, son intérêt étant historique.

Le texte de cette Norme internationale est issu des documents suivants:

| Projet | Rapport de vote |
|--------------|-----------------|
| 80/1093/FDIS | 80/1097/RVD |

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La version française de cette norme n'a pas été soumise au vote.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

Une liste de toutes les parties de la série IEC 61162, publiées sous le titre général *Matériels et systèmes de navigation et de radiocommunication maritimes – Interfaces numériques*, se trouve sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé, ou
- révisé.

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INTRODUCTION

La série IEC 61162 est composée de 5 parties qui spécifient les interfaces numériques pour une application en navigation maritime, en radiocommunication et en intégration système, dont voici les titres:

- IEC 61162-1: Émetteur unique et récepteurs multiples;
- IEC 61162-2: Émetteur unique et récepteurs multiples, transfert rapide de données;
- IEC 61162-3: Réseau par liaison de données série d'instruments;
- IEC 61162-450: Émetteurs multiples et récepteurs multiples – Interconnexion Ethernet;
- IEC 61162-460: Émetteurs multiples et récepteurs multiples – Interconnexion Ethernet – Sûreté et sécurité.

Les normes d'interface du comité d'études 80 de l'IEC sont développées à partir de contributions des fabricants, des organismes privés et gouvernementaux et des opérateurs de matériels. Les informations sont destinées à satisfaire aux besoins des utilisateurs au moment de la publication, mais il convient que les utilisateurs reconnaissent que, dans la mesure où les applications et la technologie évoluent, il convient que les normes d'interface évoluent aussi. Les utilisateurs du présent sont invités à informer immédiatement l'IEC de toute insuffisance éventuelle.

La première édition de l'IEC 61162-1 a été publiée en 1995. La deuxième édition publiée en 2000 a supprimé certaines sentences qui n'étaient plus utilisées, a ajouté quelques nouvelles sentences et a inclus des détails sur le matériel navire défini dans les résolutions de l'OMI avec des sentences appropriées pour la communication entre eux. Ces informations ont ensuite été retirées de la troisième édition lorsque la pratique établit de spécifier les données de formatage des sentences dans les différentes normes de matériels.

La troisième édition publiée en 2007 a introduit une nouvelle disposition du texte et de nouvelles sentences, en particulier pour prendre en charge le système d'identification automatique et l'enregistreur de données de navigation. La troisième édition a également introduit un autre type de délimiteur de début de sentence. Le délimiteur traditionnel "\$" a été conservé pour les sentences conventionnelles qui sont désormais désignées par le terme "sentences paramétriques". Le nouveau délimiteur "!" identifie les sentences qui sont conformes à une encapsulation à usage spécifique.

La quatrième édition a supprimé certaines sentences qui n'étaient plus utilisées, ajouté quelques nouvelles sentences pour de nouvelles applications et apporté quelques corrections et ajouts. En particulier, les sentences pertinentes par rapport aux récepteurs de navigation par satellite ont été élargies pour faciliter la description de nouveaux systèmes satellites.

La cinquième édition a également supprimé certaines sentences qui n'étaient plus utilisées, ajouté quelques nouvelles sentences pour de nouvelles applications et apporté quelques corrections et ajouts.

La présente sixième édition ajoute de nouvelles sentences pour de nouvelles applications et apporte des corrections et des ajouts.

La présente édition a été alignée, le cas échéant et dans la mesure du possible, sur la NMEA 0183 version 4.10.

MATÉRIELS ET SYSTÈMES DE NAVIGATION ET DE RADIOCOMMUNICATION MARITIMES – INTERFACES NUMÉRIQUES –

Partie 1: Émetteur unique et récepteurs multiples

1 Domaine d'application

La présente partie de l'IEC 61162 contient les exigences pour la communication des données entre les instruments maritimes électroniques, les matériels de navigation et de radiocommunications lorsqu'ils sont interconnectés par l'intermédiaire d'un système approprié.

Le présent document est destiné à prendre en charge l'émission unidirectionnelle de données série entre un seul émetteur et un ou plusieurs récepteurs. Ces données sont au format ASCII imprimable et peuvent inclure des informations telles que la position, la vitesse, la profondeur, l'allocation de fréquences, etc. Les messages types peuvent être de longueur comprise entre environ 11 et 79 caractères au maximum et nécessitent généralement une émission pas plus rapide qu'un seul message par seconde.

Les définitions électriques du présent document ne sont pas destinées à gérer les applications à large bande passante comme les radars ou l'imagerie vidéo, ou encore les bases de données intensives et les applications de transfert de fichiers. En l'absence de disposition assurant l'émission des messages et compte tenu de la capacité limitée de vérification des erreurs, il est important d'utiliser le présent document avec précaution dans toutes les applications de sécurité.

Pour les applications dans lesquelles un débit d'émission plus rapide est nécessaire, l'IEC 61162-2 s'applique.

Pour les applications relatives aux matériels côtiers du système d'identification automatique (SIA), la série IEC 62320 s'applique.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60945, *Matériels et systèmes de navigation et de radiocommunication maritimes – Spécifications générales – Méthodes d'essai et résultats exigibles*

ISO/IEC 8859-1:1998, *Technologies de l'information – Jeux de caractères graphiques codés sur un seul octet – Partie 1: Alphabet latin n° 1*

Recommandation UIT-T X.27/V.11:1996, *Caractéristiques électriques des circuits de jonction symétriques à double courant fonctionnant à des débits binaires jusqu'à 10 Mbits/s*