



IEC 61162-450

Edition 3.0 2024-04
COMMENTED VERSION

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems –
Digital interfaces –
Part 450: Multiple talkers and multiple listeners – Ethernet interconnection**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 47.020.70

ISBN 978-2-8322-8714-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

| | |
|--|----|
| FOREWORD | 7 |
| 1 Scope | 9 |
| 2 Normative references | 9 |
| 3 Terms and definitions | 10 |
| 4 General network and equipment requirements | 14 |
| 4.1 Network topology example | 14 |
| 4.2 Basic requirements | 15 |
| 4.2.1 Requirements for equipment to be connected to the network..... | 15 |
| 4.2.2 Additional requirements for network infrastructure equipment..... | 16 |
| 4.3 Network function (NF) requirements | 16 |
| 4.3.1 General requirements | 16 |
| 4.3.2 Maximum data rate requirements | 16 |
| 4.3.3 Error logging function | 17 |
| 4.3.4 Provisions for network traffic filtering – IGMP | 19 |
| 4.4 System function block (SF) requirements..... | 19 |
| 4.4.1 General requirements | 19 |
| 4.4.2 Implementing configurable transmission groups..... | 19 |
| 4.4.3 Assignment of unique system function ID (SFI)..... | 20 |
| 4.5 Serial to network gateway function (SNGF) requirements..... | 20 |
| 4.5.1 General requirements | 20 |
| 4.5.2 Serial line output buffer management | 22 |
| 4.5.3 Datagram output requirements | 23 |
| 4.5.4 Multi SF serial port | 23 |
| 4.5.5 Handling malformed data received on serial line | 24 |
| 4.6 PGN to network gateway function (PNGF) requirements | 24 |
| 4.6.1 General requirements | 24 |
| 4.6.2 Output buffer management from IEC 61162-450 network to IEC 61162-3 network..... | 24 |
| 4.6.3 Datagram output requirements | 25 |
| 4.6.4 PGN group number..... | 25 |
| 4.7 Other network function (ONF) requirements..... | 25 |
| 5 Low level network requirements..... | 25 |
| 5.1 Electrical and mechanical requirements..... | 25 |
| 5.2 Network protocol requirements..... | 26 |
| 5.3 IP address assignment for equipment..... | 27 |
| 5.4 Multicast address range | 27 |
| 5.5 Device address for instrument networks | 28 |
| 6 Transport layer specification..... | 28 |
| 6.1 General | 28 |
| 6.2 UDP messages..... | 29 |
| 6.2.1 UDP multicast protocol | 29 |
| 6.2.2 Use of multicast addresses and port numbers..... | 29 |
| 6.2.3 UDP checksum..... | 31 |
| 6.2.4 Datagram size | 32 |
| 7 Application layer specification | 32 |
| 7.1 Datagram header..... | 32 |

| | | |
|-------|---|----|
| 7.1.1 | Valid header..... | 32 |
| 7.1.2 | Error logging | 32 |
| 7.2 | General IEC 61162-1 sentence transmissions..... | 32 |
| 7.2.1 | Application of this protocol..... | 32 |
| 7.2.2 | Types of messages for which this protocol can be used | 32 |
| 7.2.3 | TAG block parameters for sentences transmitted in the datagram | 33 |
| 7.2.4 | Requirements for processing incoming datagrams | 39 |
| 7.2.5 | Error logging for processing incoming datagrams..... | 39 |
| 7.3 | Binary file transfer using UDP multicast – Single transmitter, multiple receivers | 40 |
| 7.3.1 | Application of this protocol..... | 40 |
| 7.3.2 | Binary file structure | 40 |
| 7.3.3 | 61162-450 header | 41 |
| 7.3.4 | Binary file descriptor structure | 43 |
| 7.3.5 | Binary file data fragment..... | 43 |
| 7.3.6 | Sender process for binary file transfer..... | 44 |
| 7.3.7 | Receiver process for binary file transfer | 47 |
| 7.3.8 | Other requirements..... | 49 |
| 7.3.9 | Error logging | 51 |
| 7.4 | General IEC 61162-3 PGN message transmissions..... | 51 |
| 7.4.1 | Message structure | 51 |
| 7.4.2 | Message format..... | 52 |
| 7.4.3 | Address translation requirements | 52 |
| 7.4.4 | Message processing | 53 |
| 7.4.5 | Additional management requirements..... | 53 |
| 7.5 | System function ID resolution..... | 53 |
| 7.5.1 | General..... | 54 |
| 7.5.2 | Transmitter functions | 54 |
| 7.6 | Binary file transfer using TCP point-to-point..... | 54 |
| 7.6.1 | Definition..... | 54 |
| 7.6.2 | Data field structure for transfer of files | 55 |
| 7.6.3 | Structure of the transfer stream..... | 57 |
| 7.6.4 | TCP port and IP addresses..... | 58 |
| 7.6.5 | Implementation guidance | 58 |
| 8 | Methods of test and required results | 59 |
| 8.1 | Test set-up and equipment..... | 59 |
| 8.2 | Basic requirements | 60 |
| 8.2.1 | Equipment to be connected to the network | 60 |
| 8.2.2 | Network infrastructure equipment..... | 60 |
| 8.2.3 | Documentation | 60 |
| 8.3 | Network function (NF)..... | 60 |
| 8.3.1 | Maximum data rate | 60 |
| 8.3.2 | Error logging function | 60 |
| 8.4 | System function block (SF) | 61 |
| 8.4.1 | General..... | 61 |
| 8.4.2 | Assignment of unique system function ID (SFI)..... | 61 |
| 8.4.3 | Implementing configurable transmission groups..... | 61 |
| 8.5 | Serial to network gateway function (SNGF)..... | 61 |
| 8.5.1 | General..... | 61 |

| | | |
|--|---|----|
| 8.5.2 | Serial line output buffer management..... | 62 |
| 8.5.3 | Datagram output..... | 62 |
| 8.5.4 | Datagram output Multi SF serial port..... | 62 |
| 8.5.5 | Handling malformed data received on serial line..... | 63 |
| 8.6 | Other network function (ONF)..... | 66 |
| 8.7 | Low level network..... | 66 |
| 8.7.1 | Electrical and mechanical requirements..... | 66 |
| 8.7.2 | Network protocol..... | 66 |
| 8.7.3 | IP address assignment for equipment..... | 66 |
| 8.7.4 | Multicast address range..... | 67 |
| 8.8 | Transport layer..... | 67 |
| 8.9 | Application layer..... | 67 |
| 8.9.1 | Application..... | 67 |
| 8.9.2 | Datagram header..... | 67 |
| 8.9.3 | Types of messages..... | 68 |
| 8.9.4 | TAG block parameters..... | 68 |
| 8.9.5 | General authentication..... | 69 |
| 8.10 | Error logging..... | 69 |
| 8.11 | Binary file transfer using UDP multicast – Single transmitter, multiple receiver..... | 70 |
| 8.11.1 | Sender process test..... | 70 |
| 8.11.2 | Receiver process test..... | 71 |
| 8.11.3 | Binary file descriptor test..... | 72 |
| 8.11.4 | Binary file transfer error logging..... | 72 |
| 8.11.5 | Maximum outgoing rate..... | 72 |
| 8.12 | PGN to network gateway function (PNGF)..... | 72 |
| 8.12.1 | General..... | 72 |
| 8.12.2 | Output buffer management..... | 72 |
| 8.12.3 | Datagram output..... | 73 |
| 8.12.4 | PGN group..... | 73 |
| 8.12.5 | Address conflicts..... | 73 |
| 8.13 | System function ID resolution..... | 73 |
| 8.14 | Binary file transfer using TCP point-to-point..... | 73 |
| 8.14.1 | Test of transmit client..... | 73 |
| 8.14.2 | Test of receiver server..... | 74 |
| 8.14.3 | Maximum outgoing rate..... | 75 |
| 8.14.4 | TCP port and IP addresses..... | 75 |
| Annex A (normative) Classification of IEC 61162-1 talker identifier mnemonics and sentences..... | | 76 |
| A.1 | General..... | 76 |
| A.2 | Talker identifier mnemonic to transmission group mapping..... | 76 |
| A.3 | List of all sentence formatters and the sentence type..... | 78 |
| Annex B (normative) TAG block definitions..... | | 83 |
| B.1 | Validity..... | 83 |
| B.2 | Valid TAG block characters..... | 83 |
| B.3 | TAG block format..... | 83 |
| B.4 | TAG block "hexadecimal checksum" (*hh)..... | 84 |
| B.5 | TAG block "line"..... | 84 |
| B.6 | TAG block parameter-code dictionary..... | 85 |

| | |
|--|-----|
| Annex C (normative) Reliable transmission of command-response pair messages..... | 86 |
| C.1 Purpose | 86 |
| C.2 Information exchange examples..... | 86 |
| C.3 Characteristics | 86 |
| C.4 Requirements | 86 |
| C.5 Data flow description | 87 |
| C.5.1 Heartbeat message | 87 |
| C.5.2 Command response pair..... | 87 |
| Annex D (informative) Compatibility between IEC 61162-450 nodes based on IEC 61162-450:2011 connected to a network which uses methods based on later editions of IEC 61162-450: 2018 | 88 |
| D.1 General..... | 88 |
| D.2 Alternative methods for compatibility | 88 |
| D.2.1 Use of IGMP proxy node..... | 88 |
| D.2.2 Use of virtual LAN (VLAN) | 88 |
| D.2.3 Use of static multicast switch configuration..... | 89 |
| Annex E (informative) Use of switch setup configuration to filter network traffic | 90 |
| Annex F (normative) Sentence to support SFI collision detection | 91 |
| F.1 General..... | 91 |
| F.2 SRP – System function ID resolution protocol..... | 91 |
| Annex G (informative) Examples for SRP sentences and SFI collision detection..... | 92 |
| G.1 SFI collision detection..... | 92 |
| G.2 Examples for SRP sentences | 92 |
| G.2.1 Redundancy on network level only | 92 |
| G.2.2 Examples for redundancy on network and serial (to network) level | 96 |
| G.3 Other uses of SRP sentence | 98 |
| Annex H (normative) Reserved cluster identifiers | 99 |
| Bibliography..... | 100 |
| List of comments..... | 102 |
| | |
| Figure 1 – Network topology example | 15 |
| Figure 2 – SNGF examples..... | 21 |
| Figure 3 – SNGF example, multi SF serial port..... | 21 |
| Figure 4 – Ethernet frame example for a SBM from a rate of turn sensor..... | 28 |
| Figure 5 – Non re-transmittable sender process | 45 |
| Figure 6 – Re-transmittable sender process | 47 |
| Figure 7 – Re-transmittable receive process | 49 |
| Figure C.1 – Command response communications | 86 |
| Figure G.1 – Two separate network interfaces connected to the same single network..... | 92 |
| Figure G.2 – An example of two equipment..... | 93 |
| Figure G.3 – Two separate networks interfaces connected to the same single network, but only one of the network interfaces is sending at any one time | 94 |
| Figure G.4 – An example of two equipment..... | 94 |
| Figure G.5 – Two separate network interfaces connected to the same single network but a network switch makes the equipment to be seen as one | 95 |
| Figure G.6 – An example of two equipment..... | 96 |

| | |
|--|----|
| Figure G.7 – One equipment with two separate serial interfaces connected through separate SNGFs to the network | 97 |
| Table 1 – Syslog message format | 18 |
| Table 2 – Syslog error message codes | 19 |
| Table 3 – Interfaces, connectors and cables | 26 |
| Table 4 – Destination multicast addresses and port numbers..... | 30 |
| Table 5 – Destination multicast addresses and port numbers for binary data transfer | 31 |
| Table 6 – Destination multicast addresses and port numbers for other services..... | 31 |
| Table 7 – Description of terms | 40 |
| Table 8 – Binary file structure | 40 |
| Table 9 – 61162-450 header format | 41 |
| Table 10 – Binary file descriptor format..... | 43 |
| Table 11 – Examples of MIME content type for DataType codes | 43 |
| Table 12 – Binary file data fragment format..... | 44 |
| Table 13 – Structure for PGN message | 51 |
| Table 14 – PGN message descriptor..... | 52 |
| Table 15 – Description of terms | 55 |
| Table 16 – Binary file structure | 55 |
| Table 17 – Header structure | 56 |
| Table 18 – Package data structure..... | 57 |
| Table A.1 – Classification of IEC 61162-1 talker identifier mnemonics..... | 76 |
| Table A.2 – Classification of IEC 61162-1 sentences..... | 78 |
| Table B.1 – Defined parameter-codes..... | 85 |
| Table H.1 – List of reserved cluster identifiers..... | 99 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This commented version (CMV) of the official standard IEC 61162-450:2024 edition 3.0 allows the user to identify the changes made to the previous IEC 61162-450:2018 edition 2.0. 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 61162-450 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This third edition cancels and replaces the second edition published in 2018. This edition constitutes a technical revision.

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

- a) clarification of serial to network gateway function (SNGF) in 4.5 with the addition of two new figures;
- b) addition of further destination multicast addresses and port numbers in 6.2;
- c) clarification of TAG block parameters in 7.2 together with Annex B, a new Annex H and associated tests in 8.9.4;
- d) clarification of the sender process for binary files in 7.3.6 and the receiver process for binary files in 7.3.7 with updated Figure 6 and Figure 7;
- e) clarifications of SFI collision detection and use of SRP sentence in 7.5 together with a new Annex G;
- f) revision of tests for handling malformed data received on the serial line in 8.5.5.

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

| Draft | Report on voting |
|--------------|------------------|
| 80/1094/FDIS | 80/1098/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.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

1 Scope

This part of IEC 61162 specifies interface requirements and methods of test for high speed communication between shipboard navigation and radiocommunication equipment as well as between such systems and other ship systems that need to communicate with navigation and radio-communication equipment. This document is based on the application of an appropriate suite of existing international standards to provide a framework for implementing data transfer between devices on a shipboard Ethernet network.

This document specifies an Ethernet based bus type network where any listener can receive messages from any sender with the following properties.

- This document includes provisions for multicast distribution of information formatted according to IEC 61162-1, for example position fixes and other measurements, as well as provisions for transmission of general data blocks (binary file), for example between radar and VDR, and also includes provisions for multicast distribution of information formatted according to IEC 61162-3, for example position fixes and other measurements.
- This document is limited to protocols for equipment (network nodes) connected to a single Ethernet network consisting only of OSI level one or two devices and cables (network infrastructure).
- This document provides requirements only for equipment interfaces. By specifying protocols for transmission of IEC 61162-1 sentences, IEC 61162-3 PGN messages and general binary file data, these requirements will guarantee interoperability between equipment implementing this document as well as a certain level of safe behaviour of the equipment itself.
- This document permits equipment using other protocols than those specified in this document to share a network infrastructure, provided that it is supplied with interfaces which satisfy the requirements described for ONF.
- This document includes provisions for filtering of the network traffic in order to limit the amount of traffic to manageable level for each individual equipment.

This document does not contain any system requirements other than the ones that can be inferred from the sum of individual equipment requirements. An associated standard, IEC 61162-460, further addresses system requirements.

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 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCSs)*

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

IEC 61162-1:~~2016~~, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners* **1**

IEC 61162-3:~~2008~~, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 3: Serial data instrument network* **1**

IEEE Std 802.3-~~2015~~2022, *IEEE Standard for Ethernet* **2**

ISOC RFC 768, *User Datagram Protocol, Standard STD0006*

ISOC RFC 791, *Internet Protocol (IP), Standard STD0005 (and updates)*

~~ISOC RFC 792, Internet Control Message Protocol (ICMP), Standard STD0005 (and updates)~~ **3**

~~RFC 793:1981, Transmission Control Protocol (TCP)~~ **3**

ISOC RFC 826, *An ethernet Address Resolution Protocol*

ISOC RFC 1112, *Host Extensions for IP Multicasting, Standard STD0005 (and updates), (include IGMP version 1)*

ISOC RFC 1918, *Address Allocation for Private Internets, Best Current Practice BCP0005*

ISOC RFC 2236, *Internet Group Management Protocol, Version 2*

ISOC RFC 2474, *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*

ISOC RFC 3376, *Internet Group Management Protocol, Version 3*

ISOC RFC 5000, *Internet Official Protocol Standards, Standard 0001*

ISOC RFC 5227, *IPv4 Address Conflict Detection*

ISOC RFC 5424, *The Syslog Protocol*

~~NMEA 0183:2008, Standard for interfacing marine electronic devices, Version 4.00~~ **3**

NOTE The standards of the Internet Society (ISOC) are available on the IETF websites <http://www.ietf.org>. Later updates can be tracked at <http://www.rfc-editor.org/rfcsearch.html>.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Maritime navigation and radiocommunication equipment and systems – Digital interfaces –
Part 450: Multiple talkers and multiple listeners – Ethernet interconnection**

**Matériels et systèmes de navigation et de radiocommunication maritimes –
Interfaces numériques –
Partie 450: Émetteurs multiples et récepteurs multiples – Interconnexion
Ethernet**

CONTENTS

| | |
|---|----|
| FOREWORD..... | 7 |
| 1 Scope..... | 9 |
| 2 Normative references | 9 |
| 3 Terms and definitions | 10 |
| 4 General network and equipment requirements..... | 14 |
| 4.1 Network topology example | 14 |
| 4.2 Basic requirements | 15 |
| 4.2.1 Requirements for equipment to be connected to the network | 15 |
| 4.2.2 Additional requirements for network infrastructure equipment | 16 |
| 4.3 Network function (NF) requirements..... | 16 |
| 4.3.1 General requirements | 16 |
| 4.3.2 Maximum data rate requirements | 16 |
| 4.3.3 Error logging function | 17 |
| 4.3.4 Provisions for network traffic filtering – IGMP | 19 |
| 4.4 System function block (SF) requirements | 19 |
| 4.4.1 General requirements | 19 |
| 4.4.2 Implementing configurable transmission groups..... | 19 |
| 4.4.3 Assignment of unique system function ID (SFI)..... | 20 |
| 4.5 Serial to network gateway function (SNGF) requirements..... | 20 |
| 4.5.1 General requirements | 20 |
| 4.5.2 Serial line output buffer management | 22 |
| 4.5.3 Datagram output requirements..... | 23 |
| 4.5.4 Multi SF serial port | 23 |
| 4.5.5 Handling malformed data received on serial line | 24 |
| 4.6 PGN to network gateway function (PNGF) requirements | 24 |
| 4.6.1 General requirements | 24 |
| 4.6.2 Output buffer management from IEC 61162-450 network to IEC 61162-3 network..... | 24 |
| 4.6.3 Datagram output requirements..... | 24 |
| 4.6.4 PGN group number | 25 |
| 4.7 Other network function (ONF) requirements | 25 |
| 5 Low level network requirements..... | 25 |
| 5.1 Electrical and mechanical requirements | 25 |
| 5.2 Network protocol requirements..... | 26 |
| 5.3 IP address assignment for equipment | 27 |
| 5.4 Multicast address range | 27 |
| 5.5 Device address for instrument networks..... | 27 |
| 6 Transport layer specification..... | 28 |
| 6.1 General..... | 28 |
| 6.2 UDP messages | 29 |
| 6.2.1 UDP multicast protocol | 29 |
| 6.2.2 Use of multicast addresses and port numbers..... | 29 |
| 6.2.3 UDP checksum | 31 |
| 6.2.4 Datagram size | 31 |
| 7 Application layer specification..... | 31 |
| 7.1 Datagram header | 31 |

| | | |
|-------|--|----|
| 7.1.1 | Valid header | 31 |
| 7.1.2 | Error logging..... | 32 |
| 7.2 | General IEC 61162-1 sentence transmissions..... | 32 |
| 7.2.1 | Application of this protocol..... | 32 |
| 7.2.2 | Types of messages for which this protocol can be used..... | 32 |
| 7.2.3 | TAG block parameters for sentences transmitted in the datagram..... | 32 |
| 7.2.4 | Requirements for processing incoming datagrams | 38 |
| 7.2.5 | Error logging for processing incoming datagrams | 38 |
| 7.3 | Binary file transfer using UDP multicast – Single transmitter, multiple receivers..... | 39 |
| 7.3.1 | Application of this protocol..... | 39 |
| 7.3.2 | Binary file structure..... | 39 |
| 7.3.3 | 61162-450 header | 40 |
| 7.3.4 | Binary file descriptor structure | 42 |
| 7.3.5 | Binary file data fragment..... | 43 |
| 7.3.6 | Sender process for binary file transfer | 44 |
| 7.3.7 | Receiver process for binary file transfer..... | 47 |
| 7.3.8 | Other requirements..... | 49 |
| 7.3.9 | Error logging..... | 51 |
| 7.4 | General IEC 61162-3 PGN message transmissions..... | 51 |
| 7.4.1 | Message structure | 51 |
| 7.4.2 | Message format..... | 52 |
| 7.4.3 | Address translation requirements..... | 52 |
| 7.4.4 | Message processing | 53 |
| 7.4.5 | Additional management requirements | 53 |
| 7.5 | System function ID resolution..... | 53 |
| 7.5.1 | General | 54 |
| 7.5.2 | Transmitter functions | 54 |
| 7.6 | Binary file transfer using TCP point-to-point..... | 54 |
| 7.6.1 | Definition | 54 |
| 7.6.2 | Data field structure for transfer of files..... | 55 |
| 7.6.3 | Structure of the transfer stream | 57 |
| 7.6.4 | TCP port and IP addresses..... | 58 |
| 7.6.5 | Implementation guidance | 58 |
| 8 | Methods of test and required results..... | 59 |
| 8.1 | Test set-up and equipment..... | 59 |
| 8.2 | Basic requirements | 60 |
| 8.2.1 | Equipment to be connected to the network | 60 |
| 8.2.2 | Network infrastructure equipment | 60 |
| 8.2.3 | Documentation | 60 |
| 8.3 | Network function (NF)..... | 60 |
| 8.3.1 | Maximum data rate | 60 |
| 8.3.2 | Error logging function | 60 |
| 8.4 | System function block (SF) | 61 |
| 8.4.1 | General | 61 |
| 8.4.2 | Assignment of unique system function ID (SFI)..... | 61 |
| 8.4.3 | Implementing configurable transmission groups..... | 61 |
| 8.5 | Serial to network gateway function (SNGF)..... | 61 |
| 8.5.1 | General | 61 |

| | | |
|---|--|----|
| 8.5.2 | Serial line output buffer management | 62 |
| 8.5.3 | Datagram output..... | 62 |
| 8.5.4 | Multi SF serial port | 62 |
| 8.5.5 | Handling malformed data received on serial line | 63 |
| 8.6 | Other network function (ONF) | 66 |
| 8.7 | Low level network | 66 |
| 8.7.1 | Electrical and mechanical requirements | 66 |
| 8.7.2 | Network protocol..... | 66 |
| 8.7.3 | IP address assignment for equipment | 66 |
| 8.7.4 | Multicast address range..... | 67 |
| 8.8 | Transport layer | 67 |
| 8.9 | Application layer | 67 |
| 8.9.1 | Application..... | 67 |
| 8.9.2 | Datagram header..... | 67 |
| 8.9.3 | Types of messages..... | 68 |
| 8.9.4 | TAG block parameters | 68 |
| 8.9.5 | General authentication..... | 69 |
| 8.10 | Error logging..... | 69 |
| 8.11 | Binary file transfer using UDP multicast – Single transmitter, multiple receiver | 70 |
| 8.11.1 | Sender process test..... | 70 |
| 8.11.2 | Receiver process test | 71 |
| 8.11.3 | Binary file descriptor test | 72 |
| 8.11.4 | Binary file transfer error logging..... | 72 |
| 8.11.5 | Maximum outgoing rate | 72 |
| 8.12 | PGN to network gateway function (PNGF)..... | 72 |
| 8.12.1 | General | 72 |
| 8.12.2 | Output buffer management | 72 |
| 8.12.3 | Datagram output..... | 73 |
| 8.12.4 | PGN group | 73 |
| 8.12.5 | Address conflicts | 73 |
| 8.13 | System function ID resolution..... | 73 |
| 8.14 | Binary file transfer using TCP point-to-point..... | 73 |
| 8.14.1 | Test of transmit client | 73 |
| 8.14.2 | Test of receiver server..... | 74 |
| 8.14.3 | Maximum outgoing rate | 75 |
| 8.14.4 | TCP port and IP addresses..... | 75 |
| Annex A (normative) Classification of IEC 61162-1 talker identifier mnemonics and sentences | | 76 |
| A.1 | General..... | 76 |
| A.2 | Talker identifier mnemonic to transmission group mapping | 76 |
| A.3 | List of all sentence formatters and the sentence type | 78 |
| Annex B (normative) TAG block definitions | | 82 |
| B.1 | Validity..... | 82 |
| B.2 | Valid TAG block characters..... | 82 |
| B.3 | TAG block format..... | 82 |
| B.4 | TAG block "hexadecimal checksum" (*hh)..... | 83 |
| B.5 | TAG block "line" | 83 |
| B.6 | TAG block parameter-code dictionary | 84 |

| | |
|---|----|
| Annex C (normative) Reliable transmission of command-response pair messages | 85 |
| C.1 Purpose | 85 |
| C.2 Information exchange examples | 85 |
| C.3 Characteristics | 85 |
| C.4 Requirements | 85 |
| C.5 Data flow description | 86 |
| C.5.1 Heartbeat message | 86 |
| C.5.2 Command response pair | 86 |
| Annex D (informative) Compatibility between nodes based on IEC 61162-450:2011 connected to a network which uses methods based on later editions of IEC 61162-450 | 87 |
| D.1 General | 87 |
| D.2 Alternative methods for compatibility | 87 |
| D.2.1 Use of IGMP proxy node | 87 |
| D.2.2 Use of virtual LAN (VLAN) | 87 |
| D.2.3 Use of static multicast switch configuration | 88 |
| Annex E (informative) Use of switch setup configuration to filter network traffic | 89 |
| Annex F (normative) Sentence to support SFI collision detection | 90 |
| F.1 General | 90 |
| F.2 SRP – System function ID resolution protocol | 90 |
| Annex G (informative) Examples for SRP sentences and SFI collision detection | 91 |
| G.1 SFI collision detection | 91 |
| G.2 Examples for SRP sentences | 91 |
| G.2.1 Redundancy on network level only | 91 |
| G.2.2 Examples for redundancy on network and serial (to network) level | 95 |
| G.3 Other uses of SRP sentence | 97 |
| Annex H (normative) Reserved cluster identifiers | 98 |
| Bibliography | 99 |
| | |
| Figure 1 – Network topology example | 15 |
| Figure 2 – SNGF examples | 21 |
| Figure 3 – SNGF example, multi SF serial port | 21 |
| Figure 4 – Ethernet frame example for a SBM from a rate of turn sensor | 28 |
| Figure 5 – Non re-transmittable sender process | 45 |
| Figure 6 – Re-transmittable sender process | 47 |
| Figure 7 – Re-transmittable receive process | 49 |
| Figure C.1 – Command response communications | 85 |
| Figure G.1 – Two separate network interfaces connected to the same single network | 91 |
| Figure G.2 – An example of two equipment | 92 |
| Figure G.3 – Two separate networks interfaces connected to the same single network, but only one of the network interfaces is sending at any one time | 93 |
| Figure G.4 – An example of two equipment | 93 |
| Figure G.5 – Two separate network interfaces connected to the same single network but a network switch makes the equipment to be seen as one | 94 |
| Figure G.6 – An example of two equipment | 95 |
| Figure G.7 – One equipment with two separate serial interfaces connected through separate SNGFs to the network | 96 |

| | |
|--|----|
| Table 1 – Syslog message format | 18 |
| Table 2 – Syslog error message codes | 19 |
| Table 3 – Interfaces, connectors and cables | 26 |
| Table 4 – Destination multicast addresses and port numbers | 29 |
| Table 5 – Destination multicast addresses and port numbers for binary data transfer..... | 30 |
| Table 6 – Destination multicast addresses and port numbers for other services | 31 |
| Table 7 – Description of terms | 39 |
| Table 8 – Binary file structure | 40 |
| Table 9 – 61162-450 header format | 41 |
| Table 10 – Binary file descriptor format..... | 43 |
| Table 11 – Examples of MIME content type for DataType codes | 43 |
| Table 12 – Binary file data fragment format..... | 43 |
| Table 13 – Structure for PGN message..... | 51 |
| Table 14 – PGN message descriptor | 52 |
| Table 15 – Description of terms | 55 |
| Table 16 – Binary file structure | 55 |
| Table 17 – Header structure | 56 |
| Table 18 – Package data structure..... | 57 |
| Table A.1 – Classification of IEC 61162-1 talker identifier mnemonics | 76 |
| Table A.2 – Classification of IEC 61162-1 sentences | 78 |
| Table B.1 – Defined parameter-codes | 84 |
| Table H.1 – List of reserved cluster identifiers | 98 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –
DIGITAL INTERFACES –****Part 450: Multiple talkers and multiple listeners –
Ethernet interconnection**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61162-450 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This third edition cancels and replaces the second edition published in 2018. This edition constitutes a technical revision.

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

- a) clarification of serial to network gateway function (SNGF) in 4.5 with the addition of two new figures;

- b) addition of further destination multicast addresses and port numbers in 6.2;
- c) clarification of TAG block parameters in 7.2 together with Annex B, a new Annex H and associated tests in 8.9.4;
- d) clarification of the sender process for binary files in 7.3.6 and the receiver process for binary files in 7.3.7 with updated Figure 6 and Figure 7;
- e) clarifications of SFI collision detection and use of SRP sentence in 7.5 together with a new Annex G;
- f) revision of tests for handling malformed data received on the serial line in 8.5.5.

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

| Draft | Report on voting |
|--------------|------------------|
| 80/1094/FDIS | 80/1098/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.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

1 Scope

This part of IEC 61162 specifies interface requirements and methods of test for high speed communication between shipboard navigation and radiocommunication equipment as well as between such systems and other ship systems that need to communicate with navigation and radio-communication equipment. This document is based on the application of an appropriate suite of existing international standards to provide a framework for implementing data transfer between devices on a shipboard Ethernet network.

This document specifies an Ethernet based bus type network where any listener can receive messages from any sender with the following properties.

- This document includes provisions for multicast distribution of information formatted according to IEC 61162-1, for example position fixes and other measurements, as well as provisions for transmission of general data blocks (binary file), for example between radar and VDR, and also includes provisions for multicast distribution of information formatted according to IEC 61162-3, for example position fixes and other measurements.
- This document is limited to protocols for equipment (network nodes) connected to a single Ethernet network consisting only of OSI level one or two devices and cables (network infrastructure).
- This document provides requirements only for equipment interfaces. By specifying protocols for transmission of IEC 61162-1 sentences, IEC 61162-3 PGN messages and general binary file data, these requirements will guarantee interoperability between equipment implementing this document as well as a certain level of safe behaviour of the equipment itself.
- This document permits equipment using other protocols than those specified in this document to share a network infrastructure, provided that it is supplied with interfaces which satisfy the requirements described for ONF.
- This document includes provisions for filtering of the network traffic in order to limit the amount of traffic to manageable level for each individual equipment.

This document does not contain any system requirements other than the ones that can be inferred from the sum of individual equipment requirements. An associated standard, IEC 61162-460, further addresses system requirements.

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 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCSs)*

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

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61162-3, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 3: Serial data instrument network*

IEEE Std 802.3-2022, *IEEE Standard for Ethernet*

ISOC RFC 768, *User Datagram Protocol, Standard STD0006*

ISOC RFC 791, *Internet Protocol (IP), Standard STD0005 (and updates)*

ISOC RFC 826, *An ethernet Address Resolution Protocol*

ISOC RFC 1112, *Host Extensions for IP Multicasting, Standard STD0005 (and updates), (include IGMP version 1)*

ISOC RFC 1918, *Address Allocation for Private Internets, Best Current Practice BCP0005*

ISOC RFC 2236, *Internet Group Management Protocol, Version 2*

ISOC RFC 2474, *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*

ISOC RFC 3376, *Internet Group Management Protocol, Version 3*

ISOC RFC 5000, *Internet Official Protocol Standards, Standard 0001*

ISOC RFC 5227, *IPv4 Address Conflict Detection*

ISOC RFC 5424, *The Syslog Protocol*

NOTE The standards of the Internet Society (ISOC) are available on the IETF websites <http://www.ietf.org>. Later updates can be tracked at <http://www.rfc-editor.org/rfcsearch.html>.

SOMMAIRE

| | |
|---|-----|
| AVANT-PROPOS | 107 |
| 1 Domaine d'application | 109 |
| 2 Références normatives | 109 |
| 3 Termes et définitions | 110 |
| 4 Exigences générales relatives au réseau et au matériel..... | 115 |
| 4.1 Exemple de topologie de réseau | 115 |
| 4.2 Exigences fondamentales | 116 |
| 4.2.1 Exigences relatives aux matériels à connecter au réseau | 116 |
| 4.2.2 Exigences supplémentaires relatives aux matériels d'infrastructure réseau | 116 |
| 4.3 Exigences de fonction de réseau (NF) | 117 |
| 4.3.1 Exigences générales | 117 |
| 4.3.2 Exigences de débit maximal des données..... | 117 |
| 4.3.3 Fonction de consignation des erreurs | 118 |
| 4.3.4 Dispositions en matière de filtrage du trafic réseau – IGMP | 120 |
| 4.4 Exigences relatives au bloc fonctionnel de système (SF) | 120 |
| 4.4.1 Exigences générales | 120 |
| 4.4.2 Mise en œuvre de groupes de transmission configurables | 120 |
| 4.4.3 Attribution d'un ID de fonction système (SFI) unique..... | 121 |
| 4.5 Exigences de bloc fonctionnel de passerelle série/réseau (SNGF) | 121 |
| 4.5.1 Exigences générales | 121 |
| 4.5.2 Gestion de la mémoire tampon de sortie de la ligne série | 123 |
| 4.5.3 Exigences relatives à la sortie de datagramme | 124 |
| 4.5.4 Accès série multi-SF | 125 |
| 4.5.5 Traitement des données mal formées reçues sur la ligne série | 125 |
| 4.6 Exigences de bloc fonctionnel de passerelle PGN/réseau (PNGF) | 125 |
| 4.6.1 Exigences générales | 125 |
| 4.6.2 Gestion de la mémoire tampon de sortie entre un réseau IEC 61162-450 et un réseau IEC 61162-3..... | 126 |
| 4.6.3 Exigences relatives à la sortie de datagramme | 126 |
| 4.6.4 Numéro de groupe PGN..... | 126 |
| 4.7 Exigences relatives à l'autre fonction de réseau (ONF) | 126 |
| 5 Exigences relatives au réseau de bas niveau | 127 |
| 5.1 Exigences électriques et mécaniques | 127 |
| 5.2 Exigences de protocole de réseau | 128 |
| 5.3 Attribution d'adresse IP pour le matériel..... | 129 |
| 5.4 Plage d'adresses de multidiffusion | 129 |
| 5.5 Adresse de dispositif pour les réseaux d'instruments | 129 |
| 6 Spécification de la couche de transport | 129 |
| 6.1 Généralités | 129 |
| 6.2 Messages UDP | 130 |
| 6.2.1 Protocole multidiffusion UDP | 130 |
| 6.2.2 Utilisation des adresses de multidiffusion et des numéros d'accès..... | 131 |
| 6.2.3 Somme de contrôle UDP | 133 |
| 6.2.4 Taille des datagrammes..... | 133 |
| 7 Spécification de la couche d'application..... | 133 |
| 7.1 En-tête de datagramme..... | 133 |

| | | |
|-------|--|-----|
| 7.1.1 | En-tête valide | 133 |
| 7.1.2 | Consignation des erreurs..... | 134 |
| 7.2 | Transmissions de sentences IEC 61162-1 générales | 134 |
| 7.2.1 | Application de ce protocole..... | 134 |
| 7.2.2 | Types de messages pour lesquels ce protocole peut être utilisé | 134 |
| 7.2.3 | Paramètres de bloc TAG pour les sentences émises dans le datagramme | 134 |
| 7.2.4 | Exigences de traitement des datagrammes entrants | 141 |
| 7.2.5 | Consignation des erreurs pour le traitement des datagrammes entrants | 141 |
| 7.3 | Transfert de fichier binaire par multidiffusion UDP – Un seul émetteur, plusieurs récepteurs | 141 |
| 7.3.1 | Application de ce protocole..... | 141 |
| 7.3.2 | Structure de fichier binaire..... | 142 |
| 7.3.3 | En-tête 61162-450 | 143 |
| 7.3.4 | Structure du descripteur de fichier binaire..... | 145 |
| 7.3.5 | Fragment de données de fichier binaire | 146 |
| 7.3.6 | Processus d'envoi pour le transfert de fichier binaire | 146 |
| 7.3.7 | Processus de réception pour le transfert de fichier binaire | 149 |
| 7.3.8 | Autres exigences | 152 |
| 7.3.9 | Consignation des erreurs..... | 153 |
| 7.4 | Transmissions de message PGN IEC 61162-3 générales..... | 154 |
| 7.4.1 | Structure des messages | 154 |
| 7.4.2 | Format de message | 154 |
| 7.4.3 | Exigences de traduction d'adresse | 154 |
| 7.4.4 | Traitement des messages..... | 155 |
| 7.4.5 | Exigences de gestion supplémentaires | 156 |
| 7.5 | Résolution d'ID de fonction système | 156 |
| 7.5.1 | Généralités | 156 |
| 7.5.2 | Fonctions de l'émetteur | 156 |
| 7.6 | Transfert de fichier binaire à l'aide de TCP point à point | 156 |
| 7.6.1 | Définition | 156 |
| 7.6.2 | Structure de champ de données pour le transfert de fichiers..... | 157 |
| 7.6.3 | Structure du flux de transfert | 160 |
| 7.6.4 | Accès TCP et adresses IP | 160 |
| 7.6.5 | Recommandations relatives à la mise en œuvre | 161 |
| 8 | Méthodes d'essai et résultats exigés | 162 |
| 8.1 | Montage et matériel d'essai | 162 |
| 8.2 | Exigences fondamentales | 162 |
| 8.2.1 | Matériels à connecter au réseau..... | 162 |
| 8.2.2 | Matériel d'infrastructure réseau | 163 |
| 8.2.3 | Documentation | 163 |
| 8.3 | Fonction de réseau (NF) | 163 |
| 8.3.1 | Débit maximal des données | 163 |
| 8.3.2 | Fonction de consignation des erreurs | 163 |
| 8.4 | Bloc fonctionnel de système (SF)..... | 164 |
| 8.4.1 | Généralités | 164 |
| 8.4.2 | Attribution d'un ID de fonction système (SFI) unique..... | 164 |
| 8.4.3 | Mise en œuvre de groupes de transmission configurables | 164 |
| 8.5 | Fonction de passerelle série-réseau (SNGF)..... | 164 |

| | | |
|--|---|-----|
| 8.5.1 | Généralités | 164 |
| 8.5.2 | Gestion de la mémoire tampon de sortie de la ligne série | 165 |
| 8.5.3 | Sortie de datagramme | 165 |
| 8.5.4 | Accès série multi-SF | 165 |
| 8.5.5 | Traitement des données mal formées reçues sur la ligne série | 167 |
| 8.6 | Autre fonction de réseau (ONF) | 169 |
| 8.7 | Réseau de bas niveau | 169 |
| 8.7.1 | Exigences électriques et mécaniques | 169 |
| 8.7.2 | Protocole de réseau | 169 |
| 8.7.3 | Attribution d'adresse IP pour le matériel | 170 |
| 8.7.4 | Plage d'adresses de multidiffusion | 170 |
| 8.8 | Couche de transport | 170 |
| 8.9 | Couche application | 170 |
| 8.9.1 | Application | 170 |
| 8.9.2 | En-tête de datagramme | 170 |
| 8.9.3 | Types de messages | 171 |
| 8.9.4 | Paramètres du bloc TAG | 171 |
| 8.9.5 | Authentification générale | 172 |
| 8.10 | Consignation des erreurs | 173 |
| 8.11 | Transfert de fichier binaire par multidiffusion UDP – Un seul émetteur, plusieurs récepteurs | 173 |
| 8.11.1 | Essai du processus d'envoi | 173 |
| 8.11.2 | Essai du processus de réception | 174 |
| 8.11.3 | Essai du descripteur de fichier binaire | 175 |
| 8.11.4 | Consignation des erreurs de transfert de fichier binaire | 176 |
| 8.11.5 | Débit de sortie maximal | 176 |
| 8.12 | Fonction de passerelle série/réseau (PNGF) | 176 |
| 8.12.1 | Généralités | 176 |
| 8.12.2 | Gestion de la mémoire tampon de sortie | 176 |
| 8.12.3 | Sortie de datagramme | 176 |
| 8.12.4 | Groupe PGN | 176 |
| 8.12.5 | Conflits d'adresses | 177 |
| 8.13 | Résolution d'ID de fonction système | 177 |
| 8.14 | Transfert de fichier binaire à l'aide de TCP point à point | 177 |
| 8.14.1 | Essai du client de transmission | 177 |
| 8.14.2 | Essai du serveur destinataire | 178 |
| 8.14.3 | Débit de sortie maximal | 179 |
| 8.14.4 | Accès TCP et adresses IP | 179 |
| Annexe A (normative) Classification des codes mnémoniques d'identificateurs d'émetteur et des sentences IEC 61162-1 | | 180 |
| A.1 | Généralités | 180 |
| A.2 | Mapping du code mnémonique d'identificateur d'émetteur avec le groupe de transmission | 180 |
| A.3 | Liste de toutes les données de formatage de sentences et de tous les types de sentences | 182 |
| Annexe B (normative) Définitions de bloc TAG | | 187 |
| B.1 | Validité | 187 |
| B.2 | Caractères de bloc TAG valides | 187 |
| B.3 | Format du bloc TAG | 187 |
| B.4 | "Somme de contrôle hexadécimale" (*hh) du bloc TAG | 188 |

| | | |
|---|--|-----|
| B.5 | "Ligne" de bloc TAG..... | 189 |
| B.6 | Dictionnaire de codes de paramètre de bloc TAG..... | 189 |
| Annexe C (normative) Transmission fiable des messages de la paire commande-réponse | | 190 |
| C.1 | Objectif | 190 |
| C.2 | Exemples d'échanges d'informations..... | 190 |
| C.3 | Caractéristiques..... | 190 |
| C.4 | Exigences | 190 |
| C.5 | Description du flux de données | 191 |
| C.5.1 | Message "heartbeat" | 191 |
| C.5.2 | Paire commande-réponse | 191 |
| Annexe D (informative) Compatibilité entre les nœuds fondés sur l'IEC 61162-450:2011 connectés au réseau qui utilise des méthodes reposant sur des éditions ultérieures de l'IEC 61162-450..... | | 192 |
| D.1 | Généralités | 192 |
| D.2 | Autres méthodes de compatibilité | 192 |
| D.2.1 | Utilisation du nœud de proxy IGMP..... | 192 |
| D.2.2 | Utilisation du réseau LAN virtuel (VLAN)..... | 192 |
| D.2.3 | Utilisation d'une configuration à commutateur de multidiffusion statique | 193 |
| Annexe E (informative) Utilisation de la configuration du montage de commutateurs pour filtrer le trafic réseau..... | | 194 |
| Annexe F (normative) Sentence pour la prise en charge de la détection de collision du SFI..... | | 195 |
| F.1 | Généralités | 195 |
| F.2 | SRP – Protocole de résolution d'ID de fonction système | 195 |
| Annexe G (informative) Exemples de sentences SRP et détection de collision du SFI..... | | 196 |
| G.1 | Détection de collision du SFI..... | 196 |
| G.2 | Exemples de sentences SRP | 196 |
| G.2.1 | Redondance au niveau réseau uniquement | 196 |
| G.2.2 | Exemples de redondances au niveau réseau et série(-réseau) | 200 |
| G.3 | Autres utilisations de la sentence SRP..... | 202 |
| Annexe H (normative) Identificateurs de paquet réservés | | 203 |
| Bibliographie..... | | 204 |
| Figure 1 – Exemple de topologie de réseau | | 115 |
| Figure 2 – Exemples de SNGF..... | | 122 |
| Figure 3 – Exemple de SNGF, accès série multi-SF | | 122 |
| Figure 4 – Exemple de trame Ethernet pour un SBM provenant d'un capteur de vitesse angulaire | | 130 |
| Figure 5 – Processus d'envoi non retransmissible..... | | 147 |
| Figure 6 – Processus d'envoi retransmissible..... | | 149 |
| Figure 7 – Processus de réception retransmissible | | 151 |
| Figure C.1 – Communications de réponse à la commande | | 190 |
| Figure G.1 – Deux interfaces réseau distinctes connectées à un seul et même réseau | | 196 |
| Figure G.2 – Exemple de deux matériels..... | | 197 |
| Figure G.3 – Deux interfaces réseau distinctes connectées à un seul et même réseau, mais une seule des interfaces réseau effectue les envois, à un moment donné | | 198 |
| Figure G.4 – Exemple de deux matériels..... | | 198 |

| | |
|--|-----|
| Figure G.5 – Deux interfaces réseau distinctes connectées à un seul et même réseau, mais un commutateur réseau permet de percevoir le matériel comme une seule interface | 199 |
| Figure G.6 – Exemple de deux matériels..... | 200 |
| Figure G.7 – Un matériel avec deux interfaces série distinctes connectées au réseau par des SNGF distincts | 201 |
| Tableau 1 – Format de message syslog | 119 |
| Tableau 2 – Codes de message d'erreur syslog | 120 |
| Tableau 3 – Interfaces, connecteurs et câbles | 127 |
| Tableau 4 – Adresses de multidiffusion de destination et numéros d'accès | 131 |
| Tableau 5 – Adresses de multidiffusion de destination et numéros d'accès pour le transfert de données binaires..... | 132 |
| Tableau 6 – Adresses de multidiffusion de destination et numéros d'accès pour d'autres services..... | 133 |
| Tableau 7 – Description des termes | 142 |
| Tableau 8 – Structure de fichier binaire | 142 |
| Tableau 9 – Format de l'en-tête 61162-450..... | 143 |
| Tableau 10 – Format du descripteur de fichier binaire..... | 145 |
| Tableau 11 – Exemples de types de contenus MIME pour les codes DataType | 145 |
| Tableau 12 – Format de fragment de données de fichier binaire | 146 |
| Tableau 13 – Structure des messages PGN..... | 154 |
| Tableau 14 – Descripteur de message PGN..... | 154 |
| Tableau 15 – Description des termes | 157 |
| Tableau 16 – Structure de fichier binaire..... | 157 |
| Tableau 17 – Structure d'en-tête | 158 |
| Tableau 18 – Structure des données du paquet | 160 |
| Tableau A.1 – Classification des codes mnémoniques d'identificateurs d'émetteur IEC 61162-1 | 181 |
| Tableau A.2 – Classification des sentences IEC 61162-1 | 182 |
| Tableau B.1 – Codes de paramètre définis | 189 |
| Tableau H.1 – Liste des identificateurs de paquet réservés..... | 203 |

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**MATÉRIELS ET SYSTÈMES DE NAVIGATION ET
DE RADIOCOMMUNICATION MARITIMES –
INTERFACES NUMÉRIQUES –****Partie 450: Émetteurs multiples et récepteurs multiples –
Interconnexion Ethernet**

AVANT-PROPOS

- 1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'IEC attire l'attention sur le fait que la mise en application du présent document peut entraîner l'utilisation d'un ou de plusieurs brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à l'applicabilité de tout droit de brevet revendiqué à cet égard. À la date de publication du présent document, l'IEC n'avait pas reçu notification qu'un ou plusieurs brevets pouvaient être nécessaires à sa mise en application. Toutefois, il y a lieu d'avertir les responsables de la mise en application du présent document que des informations plus récentes sont susceptibles de figurer dans la base de données de brevets, disponible à l'adresse <https://patents.iec.ch>. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 61162-450 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 troisième édition annule et remplace la deuxième édition parue en 2018. Cette édition constitue une révision technique.

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

- a) clarification de la fonction de passerelle série-réseau (SNGF) au 4.5 avec l'ajout de deux nouvelles figures;
- b) ajout d'adresses de multidiffusion de destination et de numéros d'accès supplémentaires au 6.2;
- c) clarification des paramètres du bloc TAG au 7.2 ainsi qu'à l'Annexe B, dans une nouvelle Annexe H et dans les essais associés au 8.9.4;
- d) clarification du processus d'envoi des fichiers binaires au 7.3.6 et du processus de réception des fichiers binaires au 7.3.7 avec mise à jour de la Figure 6 et de la Figure 7;
- e) clarification de la détection de collision du SFI et de l'utilisation de la sentence SRP au 7.5 ainsi que dans une nouvelle Annexe G;
- f) révision des essais de traitement des données mal formées reçues sur la ligne série au 8.5.5.

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

| Projet | Rapport de vote |
|--------------|-----------------|
| 80/1094/FDIS | 80/1098/RVD |

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

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

Le présent 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.

IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de ce document indique qu'il contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer ce document en utilisant une imprimante couleur.

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

Partie 450: Émetteurs multiples et récepteurs multiples – Interconnexion Ethernet

1 Domaine d'application

La présente partie de l'IEC 61162 spécifie les exigences d'interface et les méthodes d'essai de la communication à grande vitesse entre les matériels de navigation et de radiocommunication embarqués, et entre ce type de système et d'autres systèmes de navigation qui nécessitent de communiquer avec les matériels de navigation et de radiocommunication. Le présent document repose sur l'application d'une série appropriée de Normes internationales existantes visant à définir le cadre de mise en œuvre du transfert de données entre les dispositifs sur un réseau Ethernet embarqué.

Le présent document spécifie un réseau de type bus Ethernet dans lequel un récepteur peut recevoir des messages d'un émetteur avec les propriétés suivantes.

- Le présent document comporte les dispositions en matière de distribution de multidiffusion des informations mises en forme selon l'IEC 61162-1 (relevés de position et autres mesurages, par exemple) et en matière de transmission de blocs de données générales (fichier binaire) entre un radar et un VDR, par exemple. Enfin, il contient les dispositions relatives à la distribution de multidiffusion des informations mises en forme selon l'IEC 61162-3 (relevés de position et autres mesurages, par exemple).
- Le présent document se limite aux protocoles pour les matériels (nœuds de réseau) connectés à un seul réseau Ethernet composé uniquement d'un ou de deux dispositifs et câbles de niveau OSI (Infrastructure de réseau).
- Le présent document fournit les exigences relatives aux interfaces de matériel uniquement. En spécifiant les protocoles de transmission des sentences IEC 61162-1, des messages PGN IEC 61162-3 et des données générales de fichier binaire, ces exigences assurent l'interopérabilité entre le matériel mettant en œuvre le présent document, ainsi qu'un certain niveau de comportement sûr du matériel lui-même.
- Le présent document permet au matériel utilisant d'autres protocoles que ceux qu'il spécifie de partager une infrastructure de réseau comportant des interfaces conformes aux exigences décrites pour l'ONF.
- Le présent document comporte les dispositions en matière de filtrage du trafic réseau afin de limiter la quantité de trafic à un niveau gérable par chaque matériel.

Le présent document ne comporte aucune exigence système autre que celles qui peuvent être déduites à partir de la somme des exigences relatives au matériel seul. La norme connexe IEC 61162-460 traite davantage des exigences système.

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 60825-2, *Sécurité des appareils à laser – Partie 2: Sécurité des systèmes de télécommunication par fibres optiques (STFO)*

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

IEC 61162-1, *Matériels et systèmes de navigation et de radiocommunication maritimes – Interfaces numériques – Partie 1: Émetteur unique et récepteurs multiples*

IEC 61162-3, *Matériels et systèmes de navigation et de radiocommunication maritimes – Interfaces numériques – Partie 3: Réseau par liaison de données série d'instruments*

IEEE Std 802.3-2022, *IEEE Standard for Ethernet*

ISOC RFC 768, *User Datagram Protocol, Standard STD0006*

ISOC RFC 791, *Internet Protocol (IP), Standard STD0005 (and updates)*

ISOC RFC 826, *An ethernet Address Resolution Protocol*

ISOC RFC 1112, *Host Extensions for IP Multicasting, Standard STD0005 (and updates)* (inclut IGMP version 1)

ISOC RFC 1918, *Address Allocation for Private Internets, Best Current Practice BCP0005*

ISOC RFC 2236, *Internet Group Management Protocol, Version 2*

ISOC RFC 2474, *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*

ISOC RFC 3376, *Internet Group Management Protocol, Version 3*

ISOC RFC 5000, *Internet Official Protocol Standards, Standard 0001*

ISOC RFC 5227, *IPv4 Address Conflict Detection*

ISOC RFC 5424, *The Syslog Protocol*

NOTE Les normes de l'Internet Society (ISOC) sont disponibles sur les sites web de l'IETF à l'adresse <http://www.ietf.org>. Les dernières mises à jour peuvent être consultées à l'adresse <http://www.rfc-editor.org/rfcsearch.html>.