

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**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 IEC, Geneva, Switzerland

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

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

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

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

About the IEC

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

About IEC publications

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

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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

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

A propos de l'IEC

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

A propos des publications IEC

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

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

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

IEC Just Published - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

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

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 47.020.70

ISBN 978-2-8322-6109-5

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

Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

FOREWORD.....	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 Assignment of unique system function ID (SFID)	19
4.4.3 Implementing configurable transmission groups.....	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	21
4.5.3 Datagram output requirements.....	22
4.5.4 Multi SF serial port	22
4.5.5 Handling malformed data received on serial line	22
4.6 PGN to network gateway function (PNGF) requirements	23
4.6.1 General requirements	23
4.6.2 Output buffer management from IEC 61162-450 network to IEC 61162-3 network.....	23
4.6.3 Datagram output requirements.....	23
4.6.4 PGN group number.....	24
4.7 Other network function (ONF) requirements	24
5 Low level network requirements.....	24
5.1 Electrical and mechanical requirements	24
5.2 Network protocol requirements.....	25
5.3 IP address assignment for equipment	26
5.4 Multicast address range	26
5.5 Device address for instrument networks.....	26
6 Transport layer specification.....	26
6.1 General.....	26
6.2 UDP messages	27
6.2.1 UDP multicast protocol	27
6.2.2 Use of multicast addresses and port numbers.....	27
6.2.3 UDP checksum	29
6.2.4 Datagram size	29

7	Application layer specification.....	30
7.1	Datagram header	30
7.1.1	Valid header	30
7.1.2	Error logging.....	30
7.2	General IEC 61162-1 sentence transmissions.....	30
7.2.1	Application of this protocol.....	30
7.2.2	Types of messages for which this protocol can be used.....	30
7.2.3	TAG block parameters for sentences transmitted in the datagram.....	30
7.2.4	Requirements for processing incoming datagrams	34
7.2.5	Error logging for processing incoming datagrams	34
7.3	Binary file transfer using UDP multicast – Single transmitter, multiple receivers.....	34
7.3.1	Application of this protocol.....	34
7.3.2	Binary file structure.....	35
7.3.3	61162-450 header	35
7.3.4	Binary file descriptor structure	37
7.3.5	Binary file data fragment.....	38
7.3.6	Sender process for binary file transfer	39
7.3.7	Receiver process for binary file transfer.....	42
7.3.8	Other requirements.....	44
7.3.9	Error logging.....	46
7.4	General IEC 61162-3 PGN message transmissions	46
7.4.1	Message structure	46
7.4.2	Message format.....	47
7.4.3	Address translation requirements.....	47
7.4.4	Message processing	48
7.4.5	Additional management requirements	48
7.5	System function ID resolution.....	48
7.5.1	General	48
7.5.2	Transmitter functions	49
7.6	Binary file transfer using TCP point-to-point.....	49
7.6.1	Definition	49
7.6.2	Data field structure for transfer of files.....	50
7.6.3	Structure of the transfer stream	52
7.6.4	TCP port and IP addresses.....	52
7.6.5	Implementation guidance.....	52
8	Method of test and required results.....	53
8.1	Test set-up and equipment.....	53
8.2	Basic requirements	54
8.2.1	Equipment to be connected to the network	54
8.2.2	Network infrastructure equipment	54
8.2.3	Documentation	54
8.3	Network function (NF)	54
8.3.1	Maximum data rate	54
8.3.2	Error logging function	55
8.4	System function block (SF)	55
8.4.1	General	55
8.4.2	Assignment of unique system function ID (SFI).....	55
8.4.3	Implementing configurable transmission groups.....	55

8.5	Serial to network gateway function (SNGF)	55
8.5.1	General	55
8.5.2	Serial line output buffer management	56
8.5.3	Datagram output	56
8.5.4	Datagram output multi SF serial port	56
8.5.5	Handling malformed data received on serial line	57
8.6	Other network function (ONF)	58
8.7	Low level network	59
8.7.1	Electrical and mechanical requirements	59
8.7.2	Network protocol	59
8.7.3	IP address assignment for equipment	59
8.7.4	Multicast address range	59
8.8	Transport layer	59
8.9	Application layer	60
8.9.1	Application	60
8.9.2	Datagram header	60
8.9.3	Types of messages	60
8.9.4	TAG block parameters	60
8.9.5	General authentication	61
8.10	Error logging	62
8.11	Binary file transfer using UDP multicast – Single transmitter, multiple receiver	62
8.11.1	Sender process test	62
8.11.2	Receiver process test	63
8.11.3	Binary file descriptor test	64
8.11.4	Binary file transfer error logging	64
8.11.5	Maximum outgoing rate	65
8.12	PGN to network gateway function (PNGF)	65
8.12.1	General	65
8.12.2	Output buffer management	65
8.12.3	Datagram output	65
8.12.4	PGN group	65
8.12.5	Address conflicts	65
8.13	System function ID resolution	65
8.14	Binary file transfer using TCP point-to-point	65
8.14.1	Test of transmit client	66
8.14.2	Test of receiver server	66
8.14.3	Maximum outgoing rate	67
8.14.4	TCP port and IP addresses	67
Annex A (normative) Classification of IEC 61162-1 talker identifier mnemonics and sentences		68
A.1	General	68
A.2	Talker identifier mnemonic to transmission group mapping	68
A.3	List of all sentence formatters and the sentence type	70
Annex B (normative) TAG block definitions		74
B.1	Validity	74
B.2	Valid TAG block characters	74
B.3	TAG block format	74
B.4	TAG block "hexadecimal checksum" (*hh)	75

B.5	TAG block "line"	75
B.6	TAG block parameter-code dictionary	76
Annex C	(normative) Reliable transmission of command-response pair messages	77
C.1	Purpose	77
C.2	Information exchange examples	77
C.3	Characteristics	77
C.4	Requirements	77
C.5	Data flow description	78
C.5.1	Heartbeat message	78
C.5.2	Command response pair	78
Annex D	(informative) Compatibility between IEC 61162-450 nodes based on IEC 61162-450:2011 connected to network which uses methods based on IEC 61162- 450:2018	79
D.1	General	79
D.2	Alternative methods for compatibility	79
D.2.1	Use of IGMP proxy node	79
D.2.2	Use of virtual LAN (VLAN)	79
D.2.3	Use of static multicast switch configuration	80
Annex E	(informative) Use of switch setup configuration to filter network traffic	81
Annex F	(normative) Sentence to support SFI collision detection	82
F.1	General	82
F.2	SRP – System function ID resolution protocol	82
Bibliography	83
Figure 1	– Network topology example	15
Figure 2	– Ethernet frame example for a SRP from a rate of turn sensor	27
Figure 3	– Non re-transmittable sender process	40
Figure 4	– Re-transmittable sender process	42
Figure 5	– Re-transmittable receiver process	44
Figure C.1	– Command response communications	77
Table 1	– Syslog message format	18
Table 2	– Syslog error message codes	19
Table 3	– Interfaces, connectors and cables	25
Table 4	– Destination multicast addresses and port numbers	28
Table 5	– Destination multicast addresses and port numbers for binary data transfer	29
Table 6	– Destination multicast addresses and port numbers for other services	29
Table 7	– Description of terms	35
Table 8	– Binary file structure	35
Table 9	– 61162-450 header format	36
Table 10	– Binary file descriptor format	38
Table 11	– Examples of MIME content type for DataType codes	38
Table 12	– Binary file data fragment format	38
Table 13	– Structure for PGN message	46
Table 14	– PGN message descriptor	47
Table 15	– Description of terms	49

Table 16 – Binary file structure	50
Table 17 – Header structure	50
Table 18 – Package data structure.....	51
Table A.1 – Classification of IEC 61162-1 talker identifier mnemonics	68
Table A.2 – Classification of IEC 61162-1 sentences	70
Table B.1 – Defined parameter-codes	76

Currently in preview, click buy full version

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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This bilingual version (2018-10) corresponds to the monolingual English version, published in 2018-05.

This second edition of IEC 61162-450 cancels and replaces the first edition published in 2011 and Amendment 1:2016. This edition constitutes a technical revision.

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

- a) network traffic filtering based on IGMP snooping added;

- b) network traffic balancing added;
- c) new encapsulation of IEC 61162-3 PGNs added;
- d) new alternative for binary file transfer added: TCP/IP based on Annex H of IEC 62388:2007 on radars;
- e) general authentication tag "a:" added to support managing of cyber security risk.

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

FDIS	Report on voting
80/880/FDIS	80/885/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This document has been drafted in accordance with the ISO/IEC Directive – Part 2.

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 "<http://www.store.iec.ch>" in the data related to the specific document. At this date, the document will be

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

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 (OFCS)*