

BS EN 61162-450:2011+A1:2016



BSI Standards Publication

Maritime navigation and radiocommunication equipment and systems — Digital interfaces

Part 450: Multiple talkers and multiple
listeners — Ethernet interconnection
(IEC 61162-450:2011)

bsi.

AVA Documents
Document Sharing Hub

National foreword

This British Standard is the UK implementation of EN 61162-450:2011+A1:2016. It is identical to IEC 61162-450:2011, incorporating amendment 1:2016. It supersedes BS EN 61162-450:2011 which will be withdrawn on 5 May 2019.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee EPL/80, Maritime navigation and radiocommunication equipment and systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016.

Published by BSI Standards Limited 2016

ISBN 978 0 580 90208 6

ICS 47.020.70

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2011.

Amendments/corrigenda issued since publication

Date	Text affected
30 June 2016	Implementation of IEC amendment 1:2016 with CENELEC endorsement A1:2016. Annex ZA modified

**Maritime navigation and radiocommunication equipment and systems -
Digital interfaces -
Part 450: Multiple talkers and multiple listeners -
Ethernet interconnection
(IEC 61162-450:2011)**

Matériels et systèmes de navigation et de
radiocommunication maritimes -
Interfaces numériques -
Partie 450: Émetteurs multiples et
récepteurs multiples -
Interconnexion Ethernet
(CEI 61162-450:2011)

Navigations- und
Funkkommunikationsgeräte und -systeme
für die Seeschifffahrt -
Digitale Schnittstellen -
Teil 450: Mehrere Datensenden und
mehrere Datenempfänger -
Leichte Schiffssystemzusammenschaltung
(IEC 61162-450:2011)

This European Standard was approved by CENELEC on 2011-07-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 80/615/FDIS, future edition 1 of IEC 61162-450, prepared by IEC TC 80, Maritime navigation and radiocommunication equipment and systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61162-450 on 2011-07-15.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2012-04-15
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-07-15

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61162-450:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60603-7	NOTE	Harmonized as EN 60603-7.
IEC 60603-7-3	NOTE	Harmonized as EN 60603-7-3.
IEC 60603-7-7	NOTE	Harmonized as EN 60603-7-7.
IEC 61076-2-101	NOTE	Harmonized as EN 61076-2-101.
IEC 61162-2	NOTE	Harmonized as EN 61162-2.
IEC 61162-3	NOTE	Harmonized as EN 61162-3.
IEC 61754-20	NOTE	Harmonized as EN 61754-20.
IEC 61996-1	NOTE	Harmonized as EN 61996-1.
IEC 62388	NOTE	Harmonized as EN 62388.

Foreword to amendment A1

The text of document 80/795/FDIS, future IEC 61162-450:2011/A1, prepared by IEC/TC 80 "Maritime navigation and radiocommunication equipment and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61162-450:2011/A1:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-02-05
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-05-05

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61162-450:2011/A1:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

Addition:

IEC 61174	NOTE	Harmonized as EN 61174.
-----------	------	-------------------------

Delete

IEC 61996-1	NOTE	Harmonized as EN 61996-1
-------------	------	--------------------------

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60825-2	-	Safety of laser products - Part 2: Safety of optical fibre communication systems (OFCS)	EN 60825-2	-
IEC 60945	-	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results	EN 60945	-
IEC 61162-1	-	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners	EN 61162-1	-
IEC 61996-1	-	Maritime navigation and radiocommunication equipment and systems - Shipborne voyage data recorder (VDR) -- Part 1: Performance requirements, methods of testing and required test results	EN 61996-1	-
IEEE 802.3	-	IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications	-	-
ISOC RFC 768	-	User Datagram Protocol	-	-
ISOC RFC 791	-	Internet Protocol - DARPA Internet Program Protocol Specification	-	-
ISOC RFC 792	-	Internet Control Message Protocol	-	-
ISOC RFC 826	-	Ethernet Address Resolution Protocol	-	-
ISOC RFC 1918	-	Address Allocation for Private Internets	-	-
ISOC RFC 2474	-	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers	-	-
ISOC RFC 5000	-	Internet Official Protocol Standards	-	-
ISOC RFC 5227	-	IPv4 Address Conflict Detection	-	-
ISOC RFC 5424	-	The Syslog Protocol	-	-
NMEA 0183	2008	Standard for interfacing marine electronic devices	-	-

CONTENTS

1	Scope.....	8
2	Normative references	8
3	Terms and definitions	9
4	General network and equipment requirements	12
4.1	Network topology example	12
4.2	Basic requirements.....	13
4.2.1	Requirements for equipment to be connected to the network	13
4.2.2	Additional requirements for network infrastructure equipment	13
4.3	Network function (NF) requirements	14
4.3.1	General requirements	14
4.3.2	Maximum data rate requirements	14
4.3.3	Error logging function	14
4.4	System function (SF) requirements.....	16
4.4.1	General requirements	16
4.4.2	Assignment of unique system function ID (SFI).....	16
4.4.3	Implementing configurable transmission groups.....	16
4.5	Serial to network gateway function (SNGF) requirements	17
4.5.1	General requirements	17
4.5.2	Serial line output buffer management	17
4.5.3	Datagram output requirements	18
4.6	Other network function (ONF) requirements	18
5	Low level network requirements.....	18
5.1	Electrical and mechanical requirements.....	18
5.2	Network protocol requirements	20
5.3	IP Address assignment for equipment	20
5.4	Multicast address range	20
6	Transport layer specification.....	20
6.1	General.....	20
6.2	UDP messages.....	21
6.2.1	UDP multicast protocol	21
6.2.2	Use of multicast addresses and port numbers.....	21
6.2.3	UDP checksum	22
6.2.4	Datagram size	23
7	Application layer specification	23
7.1	Datagram header	23
7.1.1	Valid header	23
7.1.2	Error logging.....	23
7.2	General IEC 61162-1 sentence transmissions	23
7.2.1	Application of this protocol	23
7.2.2	Types of messages for which this protocol can be used.....	23
7.2.3	TAG block parameters for sentences transmitted in the datagram	23
7.2.4	Requirements for processing incoming datagrams	25
7.2.5	Error logging.....	25
7.3	Binary image transfer using UDP multicast.....	25
7.3.1	Application of this protocol	25

7.3.2	Binary image structure.....	26
7.3.3	Header	26
7.3.4	Binary image descriptor structure	28
7.3.5	Binary image data fragment.....	29
7.3.6	Sender process for binary image transfer	29
7.3.7	Receiver process for binary image transfer.....	31
7.3.8	Other requirements.....	32
7.3.9	Error logging.....	33
8	Methods of test and required results.....	33
8.1	Test set-up and equipment	33
8.2	Basic requirements.....	34
8.2.1	Equipment to be connected to the network	34
8.2.2	Network infrastructure equipment	34
8.3	Network function (NF)	34
8.3.1	Maximum data rate	34
8.3.2	Error logging function	34
8.4	System function (SF).....	34
8.4.1	General	34
8.4.2	Assignment of unique system function ID (SFI).....	35
8.4.3	Implementing configurable transmission groups.....	35
8.5	Serial to network gateway function (SNGF)	35
8.5.1	General	35
8.5.2	Serial line output buffer management	35
8.5.3	Datagram output.....	35
8.6	Other network function (ONF).....	36
8.7	Low level network.....	36
8.7.1	Electrical and mechanical requirements.....	36
8.7.2	Network protocol	36
8.7.3	IP address assignment for equipment.....	36
8.7.4	Multicast address range.....	36
8.8	Transport layer	37
8.9	Application layer.....	37
8.9.1	Application	37
8.9.2	Datagram header.....	37
8.9.3	Types of messages.....	37
8.9.4	TAG block parameters	37
8.10	Error logging	38
8.11	Binary image transfer using UDP multicast.....	39
8.11.1	Sender process test.....	39
8.11.2	Receiver process test	40
8.11.3	Image descriptor test.....	40
8.11.4	Image transfer error logging	40
Annex A	(normative) Classification of IEC 61162-1 talker identifier mnemonics and sentences	41
Annex B	(informative) TAG block example	47
Annex C	(normative) Reliable transmission of command-response pair messages.....	49
Annex D	(informative) Network and system design guidance	54
Bibliography		62

Figure 1 – Network topology example	13
Figure 2 – Ethernet frame example for a SBM from a rate of turn sensor	21
Figure C.1 – Command response communications	49
Figure C.2 – State diagram	51
Figure D.1 – General system design architecture	54
Figure D.2 – Example of ship-shore communication architecture	55
Figure D.3 – Security infrastructure	56
Figure D.4 – Decoupled system	58
Figure D.5 – Loosely coupled system	58
Figure D.6 – Strongly coupled system	59
Table 1 – Syslog message format	15
Table 2 – Syslog error message codes	15
Table 3 – Interfaces, connectors and cables	19
Table 4 – Destination multicast addresses and port numbers	22
 Table 5 – Destination multicast addresses and port numbers for binary data transfer 	22
Table 6 – Destination multicast addresses and port numbers for other services	22
Table 7 – Description of terms	26
Table 8 – Binary image structure	26
Table 9 – Header format	27
Table 10 – Binary image descriptor format	28
Table 11 – Examples of MIME content type for DataType codes	29
Table 12 – Binary image data fragment format	29
Table A.1 – Classification of IEC 61162-1 talker identifier mnemonics	41
Table A.2 – Classification of IEC 61162-1 sentences	43
Table B.1 – Defined parameter-codes	48
Table D.1 – Overview of possible security functions	57
Table D.2 – Network failure propagation possibilities	60

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 part of IEC 61162 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 standard provides a higher speed and higher capacity alternative to the IEC 61162-1 and IEC 61162-2 standards while retaining these standards' basic data format. This standard provides a higher data capacity than IEC 61162-3.

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

- This standard 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 image), for example between radar and VDR.
- This standard 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 standard provides requirements only for equipment interfaces. By specifying protocols for transmission of IEC 61162-1 sentences and general binary image data these requirements will guarantee interoperability between equipment implementing this standard as well as a certain level of safe behaviour of the equipment itself.
- This standard permits equipment using other protocols than those specified in this standard to share a network infrastructure provided that it is supplied with interfaces which satisfy the requirements described for ONF (see 4.6).
- This standard does not contain any system requirements other than the ones that can be inferred from the sum of individual equipment requirements. Thus, to ascertain system properties that cannot be derived from equipment requirements alone, additional analysis or standards will be required. In particular, this applies to requirements to maintain system functionality in the face of a single point failure in equipment or networks. Informative Annex D contains guidance on how to address such issues.

2 Normative references

The following referenced documents are indispensable for the application 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)*

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 61996-1, *Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR) – Part 1: Performance requirements, methods of testing and required test results* 

IEEE 802.3, *IEEE Standards for Local Area Networks: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications*

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)*

ISOC RFC 826, *An ethernet Address Resolution Protocol*

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

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

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*

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>

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

ASCII

printable 7 bit character encoded in one byte

3.2

binary image

data block without formatting known to this protocol, i.e., non IEC 61162-1 formatted data, that can be transmitted with the protocol defined in 7.3.

NOTE The term “binary image” is used to differentiate the general data transfer protocol (which may or may not be in ordinary text format) from the transmission of sentences that is always in 7 bit ASCII format.

3.3

byte

group of 8 bits treated as one unit; this corresponds to what is also sometimes called an octet.

3.4 command-response pair CRP

messages exchanged between parties that synchronize state changes on both sides through the exchange

NOTE 1 CRP are defined in Annex A.

NOTE 2 Both the command and the reply message may also be used as a sensor broadcast message in some cases. Thus, the implementation of the semantics of the message exchange is somewhat different between different users of the exchange.

3.5 datagram

one atomic UDP transmission unit on the Ethernet as defined in ISOC RFC 768 and as constrained elsewhere in this standard

3.6 Ethernet

a carrier sense, multiple access collision detect (CSMA/CD) local area network protocol standard as defined in IEEE 802.3 and later revisions and additions to IEEE 802

NOTE The types of Ethernet media that can be used for implementation of this standard are defined in Clause 5.

3.7 function block

specified functionality implemented by equipment

NOTE Equipment normally implements multiple function blocks. Requirements to equipment are the sum of requirements to the function blocks it implements. Function blocks are defined in Clause 4. Types of function blocks are System Function Block (SF), Other Network Function Block (ONF), Network Function Block (NF) and Serial to Network Gateway Function Block (SNGF).

3.8 internet assigned number authority IANA

global coordination of the Domain Name Server (DNS) Root, IP addressing, and other Internet protocol resources, including UDP and TCP port numbers

NOTE The currently assigned numbers are listed in <http://www.iana.org/assignments/port-numbers>.

3.9 internet protocol IP

used and defined in ISOC RFC 791 (and updates)

3.10 message

collection of one or more sentences that are grouped by mechanisms internal to the sentence, for instance by sequence numbers as in the TXT sentence, i.e. a stand alone sentence is a message

3.11 message type

classification of IEC 61162-1 sentence formatters into $\boxed{A_1}$ SBM $\boxed{A_1}$, MSM and CRP types

NOTE 1 $\boxed{A_1}$ SBM $\boxed{A_1}$, MSM and CRP types are defined in Annex A.

NOTE 2 This standard defines different requirements to the transmission of different message types.

3.12

multi-sentence messages

MSM

logical group of messages and/or sentences where the full meaning of the group is dependent on the receiver reading the full group

NOTE 1 Multi-sentence messages that are grouped together with a TAG construct is also a sentence group.

NOTE 2 MSM are defined in Annex A.

3.13

network

one physical Ethernet network with one Internet address space, consisting only of the network nodes, switches, cables and supporting equipment such as power supply units

3.14

network function block

NF

function block responsible for physical connectivity to the network and connectivity to the transport layer as described in 4.3

3.15

network infrastructure

the part of the Network that provides a transmission path between network nodes

NOTE The network nodes are not part of the network infrastructure.

3.16

network node

physical device connected to the network and which have an Internet address (also called an Internet host)

NOTE A network node will normally correspond to equipment as the latter term is used in this standard.

3.17

other network function block

ONF

function block that interfaces to the network, but which is not using the protocol definition in Clauses 5, 6 and 7 of this standard (for example real time streaming of Radar and CCTV image transfer, VDR sound transfer, etc.)

NOTE Requirements as defined in 4.6 ensure that an ONF can co-reside with SF network nodes and function blocks that make use of this standard's protocol.

3.18

sensor broadcast message

SBM

messages consisting of only one sentence

NOTE 1 SBM type messages are sent with a sufficiently high update rate to ensure that the receiver can maintain the correct status even in environments where some messages may be lost.

NOTE 2 SBM are defined in Annex A.

3.19

sentence

standard information carrying unit as defined in IEC 61162-1

3.20

sentence group

logical group of sentences (which may consist of only one) that need to be processed together to give full meaning to the information contained in the sentence(s)

NOTE 1 The grouping of sentences into sentence group is done by TAG block mechanisms. The sentences in a sentence group may or may not have the same formatter. A multi sentence message grouped by this mechanism is also a sentence group.

NOTE 2 This standard allows the explicit grouping of sentences by using coding in a datagram. This standard does not enforce any relationship between datagram and sentence group. Thus a datagram may contain more than one sentence group or a sentence group may be split over two or more datagrams.

3.21

serial to network gateway function block

SNGF

function block that enables transfer of sentences between the network and devices that are compliant with the IEC 61162-1 and IEC 61162-2 serial line interface

3.22

system function block

SF

function block, identified by a unique system function ID (SFI), that is the only function block that can send information in a datagram format as defined in clause 7

3.23

system function ID

SFI

parameter string as defined in 4.4.2

3.24

transmission group

a pair of a multicast address and a port number that are used by an SF to transmit sentences

NOTE The transmission groups are defined in Table 4 and Annex A defines default transmission groups for the SF.

3.25

transport annotate and group

TAG

formatted block of data, defined in NMEA 0183, that adds parameters to IEC 61162-1 sentences

NOTE Informative Annex B gives an overview of the TAG blocks used in this standard.

3.26

user datagram protocol

UDP

connection-less datagram protocol defined by ISOC RFC 768; it makes no provision for transport-layer acknowledgement of packets received

4 General network and equipment requirements

4.1 Network topology example

Figure 1 shows a possible IEC 61162-450 network topology consisting of one IP Local Area Network (LAN) and a number of different network nodes, each containing different function blocks. This diagram is informal and does not imply any requirements other than the ones defined in the following subclauses.

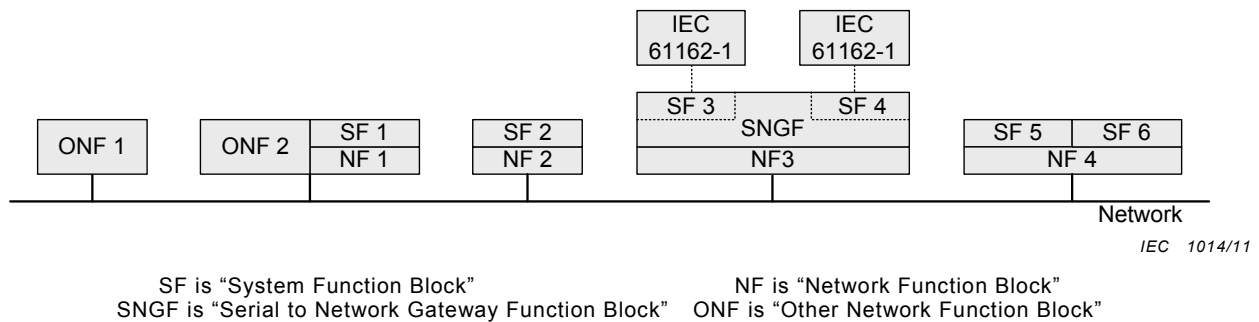


Figure 1 – Network topology example

Some examples of network nodes are (see Figure 1):

- a sensor, for example a GNSS receiver that is also a network node (SF2 and NF2).
- a device that sends or receives IEC 61162-450 compliant data (sentences and/or binary image) as well as other types of information onto the network, for example an ECDIS that can also load chart data from another device (SF1, ONF2 and NF1).
- two independent functions, such as a gyrocompass also approved as a rate of turn sensor that are implemented in one network node (SF5, SF6 and NF4).
- a system device function block represented by an IEC 61162-1 compliant equipment connected to a serial to network gateway function (SNGF). In this case, the SNGF will format outgoing sentences according to requirements in this standard (SF3, SF4, SNGF and NF3)
- a device that does not send or receive IEC 61162-450 compliant data (sentences and/or binary image), but which satisfies minimum requirements for compatible use of the same network (ONF1).

4.2 Basic requirements

4.2.1 Requirements for equipment to be connected to the network

(see 8.2.1)

The requirements for equipment connected to the network are as follows.

- All equipment connected to the network including network infrastructure equipment, shall satisfy the relevant physical and electrical requirements defined in 5.1.
- All equipment that implements one or more of SF and/or SNGF shall implement the NF. This equipment shall satisfy the requirements to the function blocks they implement as defined in 4.3 (NF), 4.4 (SF) and 4.5 (SNGF).
- All other equipment that is not network infrastructure equipment and that shares the network infrastructure shall comply with requirements to an ONF as defined in 4.6.
- Network infrastructure equipment, i.e., switches, shall satisfy requirements in 4.2.2.
- All equipment connected to a network shall satisfy the requirements of IEC 60945.

Any other equipment is not allowed to be connected to the network.

4.2.2 Additional requirements for network infrastructure equipment

(see 8.2.2)

The following requirements are included to avoid potential problems with certain network infrastructure equipment:

- routers and repeater hubs shall not be used to interconnect components of an IEC 61162-450 network;

- switches that are used to interconnect equipment compliant with IEC 61162-450 shall not implement multicast filtering techniques, such as IGMP snooping or CGMP.

NOTE 1 IGMP is Internet Group Management Protocol and CGMP is Cisco Group Management Protocol. If switches are capable of implementing multicast filtering techniques, then this functionality should be disabled.

NOTE 2 Routers are network infrastructure devices that can forward datagrams between networks. Repeater hubs are network infrastructure devices without internal storage that repeat incoming datagrams onto all outgoing connections. Switches are network infrastructure devices that based on forwarding tables can process, and forward datagrams between nodes on the same network, using intermediate storage in the switch before retransmission.

A) NOTE 3 Although multicast filtering techniques, such as IGMP snooping or CGMP, are not allowed to be activated, it is acceptable to manually configure individual ports of the switches to block unnecessary traffic flow (for example to isolate simple sensors from ECDIS and radar). **A)**

4.3 Network function (NF) requirements

4.3.1 General requirements

All equipment that implements a NF shall satisfy the requirements in Clauses 5 and 6.

4.3.2 Maximum data rate requirements

(see 8.3.1)

The manufacturer shall specify the maximum input rate under which the equipment can still perform all functions required by its performance standards.

Maximum input rate shall be specified as:

- a) maximum number of datagrams per second received, intended for and processed by the equipment;
- b) maximum number of datagrams per second received by but not intended for the equipment;
- c) maximum number of datagrams per second received by, but not intended for, the equipment at 50 % of the maximum load for item a).

NOTE "Received by" means datagrams that are received on a transmission group that the equipment listens to. "Intended for" are datagrams that are processed by the equipment as part of its specified function.

The maximum data rates shall be the mean rate over a 10 s measurement period.

4.3.3 Error logging function

(see 8.3.2)

4.3.3.1 Internal logging

Means shall be provided in each NF to record errors that occur in the NF itself as well as SF and SNGF using it. Subclauses 4.5.2, 7.1.2, 7.2.5 and 7.3.9 give minimum requirements as to what shall be logged.

As a minimum, the manufacturer shall provide mechanisms by which error logs can be inspected by a human operator. It is allowed that the inspection is done through a simple network mechanism such as a terminal emulator, a datagram as defined in this standard or any other reasonable method.

The minimum requirements for the log are to count the number of each occurrence. The counter may reset itself by a manufacturer specified method.

4.3.3.2 External logging

A NF may be configured to support external logging, where non-trivial information is sent to a logging server. In this case a "syslog" message, as defined in ISOC RFC 5424, shall be used.

Syslog messages shall be formatted as ASCII text messages and sent as UDP packets on port 514 and the multicast address defined in Table 6. Error messages defined in this standard shall be reported through a simplified message as described in Table 1, where italicised words are place-holders for data explained in the right hand column. Other characters shall be transmitted as shown, including spaces.

Table 1 – Syslog message format

Element	Description
<pri>	The combined priority and facility code (number from 0 to 199 inclusive) enclosed in pointed brackets. For the errors defined in this standard, the value 131 shall be used (facility "local use 0" and priority "error condition").
Version	The version code. The code 1 (one) shall be used for messages from this version of the standard.
Space	One space character.
Timestamp	Timestamp, containing date and time and optional UTC offset, in a valid format, for example 1985-04-12T23:20:50-03:00. The example shows date, followed by upper case "T", then local time and finally offset from UTC (3 hours west – negative, east offsets shall be prefixed by a '+'. UTC offset can be abbreviated to a single upper case "Z", without leading '-' or '+'). Alternatively, the timestamp field may be nil ('-', a single dash character).
Space	One space character
Hostname	The host name of the network node, represented as the IP address in dotted decimal notation. Alternatively, this field may be nil ('-', a single dash character).
Space	A space character
Appname	The application name. This shall be the string "450-" followed by the configured SFI code if the error originates in the SF or SNGF, "NF" if the error originates from the network function block or "ONF" if it originates in the ONF function block.
Space	A space character
Procid	Normally, this field should be nil ('-', a single dash character). Other values as defined in the Syslog standard may be used.
Space	A space character
Msgid	For errors defined in this standard, this field shall be the error code as defined in Table 2.
Space	A space character
Structured	This field can be nil ('-', a single dash character) or contain information as defined in ISOC RFC 5424.
Space	A space character
Msg	A free format message in ASCII format.

A "syslog" packet shall not exceed 480 bytes and shall be sent as a single UDP datagram.

NOTE This standard does not specify requirements for equipment receiving syslog messages. This type of equipment would fall into the category of ONF. As the above specification is a subset of the full ISOC RFC 5424 specification, implementers of such equipment should refer to ISOC RFC 5424 and make sure that syslog messages from other ONF can be received and processed without problems.

To facilitate the use of the syslog protocol, the errors defined in this standard have been assigned a message identity as defined in Table 2.

Table 2 – Syslog error message codes

Message identity	Description	Sub-clause
101	SNGF buffer overflow	4.5.2
102	Datagram header error	7.1.2
103	TAG or sentence format error	7.2.5
104	Binary image error	7.3.9



Additional information can be given in the “Msg” field, if available.

4.4 System function (SF) requirements

4.4.1 General requirements

(see 8.4.1)

Equipment that implements an SF shall satisfy the following requirements:

- requirements in 6.2 shall be satisfied for all equipment implementing SF;
- requirements in 7.2 shall be satisfied for all equipment implementing IEC 61162-1 sentence transmitting or receiving function blocks;

NOTE This also includes function blocks with the ability to send heartbeat (HBT) sentences.

- requirements in 7.3 shall be satisfied for equipment that implements an SF that can transmit or receive binary image data.

4.4.2 Assignment of unique system function ID (SFI)

(see 8.4.2)

The format of the SFI parameter string shall be “ccxxxx” where “cc” is two valid characters as defined in IEC 61162-1 and “xxxx” is four numeric characters.

An SF implementing the functionality of an equipment that has been given a talker mnemonic code in IEC 61162-1 shall use this talker mnemonic as the “cc” characters in the SFI.

NOTE Other SF may have their SFI string format defined in other standards or the manufacturer may have to choose a code. In the latter case, the already defined talker mnemonic codes should be avoided.

The numeric character string “xxxx” will be an instance number in the range “0000” to “9999”. The numeric character string “9999” is reserved for an un-configured SF and shall not be used by any transmitting SF during normal operation. However, all receiving equipment shall accept the “9999” string.

During normal operation, the SFI parameter string shall be unique for all SF in an IEC 61162-450 network.

NOTE It is recommended that all SF on a ship, independent on whether they are residing on one common network or not, are given a ship unique SFI.

Means shall be provided by the manufacturer to configure the SFI for each SF (see 7.2.3.4).

4.4.3 Implementing configurable transmission groups

(see 8.4.3)

Each SF shall be assigned a single transmission group for all outgoing messages. The default for this transmission group is determined by the SFI as described in Annex A.

For each SF that the equipment implements, the manufacturer shall document the default transmission groups the SF listens to and what sentences it expects to receive on each group. The default transmission groups can be selected by the manufacturer from the list of groups in 6.2.2.

Means shall be provided to configure all transmission groups to another than the default. Only the transmission groups listed in 6.2.2 are allowed to be configured.

NOTE All transmission groups can be used for configuration, i.e., a system integrator may use, for instance the NAVD group also for non-navigational SFs, if desired. However, an overall load analysis of the network needs to take the actual configuration into consideration.

4.5 Serial to network gateway function (SNGF) requirements

4.5.1 General requirements

(see 8.5.1)

The SNGF shall implement all relevant functionality defined in 4.4 for each SF it supports.

Each serial port shall be implemented as a separate SF and assigned a separate SFI.

The default SFI shall use the talker mnemonic "SI".

The SNGF may implement different types of filtering with regard to what serial line sentences are retransmitted as datagrams and what datagrams will result in a serial line sentence being sent. Any filtering methods shall be described in manufacturer's documentation.

NOTE A typical filtering method would be to use the destination TAG 'd' to determine what sentences in incoming datagrams are to be sent on the serial line.

4.5.2 Serial line output buffer management

(see 8.5.2)

An SNGF function block shall provide an independent buffer for each serial port it can send sentences onto. The manufacturer shall specify the maximum buffer capacity for each port. The maximum capacity may be configurable at installation.

The buffer shall be implemented as a FIFO (First In, First Out) buffer. In case of a full buffer, newly arrived sentences shall be discarded, unless these sentences are specified as prioritized (see below). Newly arrived sentences will be inserted into the buffer when buffer space is available. The method of treatment of sentences grouped by the TAG g (see 7.2.3.3) may be configurable or specified in the manufacturer's documentation.

The SNGF may implement a priority-based functionality for some sentences with specified sentence formatters. The prioritised formatters may be configurable or specified in the manufacturer's documentation.

Processing of prioritized sentences shall be as follows:

- only one sentence with identical talker ID and sentence formatter shall exist in the buffer;

NOTE When prioritizing AIS VDM and VDO sentences, the string beginning with the "!" character and ending with the 7th character of the encapsulation field should be used for comparison to identify identical sentences. A match of this string from a newly arrived sentence with one in the buffer means the sentence contains the same ITU-R M.1371 message from the same MMSI as the sentence already in the buffer, and can then replace the older sentence at its position in the queue.

- if a sentence, or a TAG block grouped sentences, with identical talker ID and sentence formatter exists in the buffer, the new sentence or sentences will replace the existing sentence at its position in the queue;

NOTE When prioritizing TAG block grouped sentences, several fields within the TAG block need to be compared as well as the sentence comparisons. All of the compared components should match those of the current TAG block group in order to replace TAG block group in the queue. The components to compare are: The TAG block source parameter code value, the "number of lines" portion of the TAG block group parameter code, and the sentences within the TAG block group.

- otherwise, the new sentence shall follow the FIFO principle as described above.

If a sentence is discarded from the queue, this event shall be logged as an error internally in the equipment as defined in 4.3.3. The equipment shall have separate error counts for each serial port.

4.5.3 Datagram output requirements

(see 8.5.3)

The SNGF shall format outgoing datagrams as defined in 7.2.

The SNGF shall transmit one IEC 61162-1 sentence per outgoing IEC 61162-450 datagram to minimise delays.

4.6 Other network function (ONF) requirements

(see 8.6)

The ONF represents a function that is allowed to share the same network infrastructure as the network function blocks (NF) on an IEC 61162-450 network.

The ONF shall conform to the requirements given in 4.2.1.

The ONF equipment shall not use any IP multicast address reserved by this standard as defined in 5.4.

Documentation shall be provided describing the network protocols used by the ONF to send datagrams or byte streams for instance UDP, TCP/IP or other.

Documentation shall be provided demonstrating that the ONF cannot negatively impact the normal performance of the network or other equipment connected to the network.

5 Low level network requirements

5.1 Electrical and mechanical requirements

(see 8.7.1)

The cable and connectors used shall at least meet the specifications listed in Table 3 when used in protected environment as defined in IEC 60945.

The safety requirements and installation practices specified in IEEE 802.3, 14.7 and Clause 27 shall be followed. Also refer to IEEE 802.3, informative Annex 67.

Fibre optic interfaces shall comply with the laser safety requirements for Class 1 devices specified in IEC 60825-2.

Table 3 – Interfaces, connectors and cables

IEEE 802.3 Interface	Max network segment link distance	Mechanical device interface connector type (protected environment)	Pin assignment	Cable category, minimum
100BASE-TXS IEEE 802.3, 14.7 and Clauses 24 and 25	100 m	IEC 60603-7-3, 8-way shielded modular connector Refer to 802.3 Clause 3, IEC 60603-7 Figures 1 through 5 and IEEE 802.3/25	See b)	CAT5 STP Two shielded twisted pairs ANSI/ TIA/EIA-568-A:1995 and ISO/IEC 11801:1995 (Class D).
(not specified)	See a)	Terminal block	See b)	CAT5 STP Two shielded twisted pairs
100BASE-SX IEEE 802.3, Clauses 24 and 26	550 m	IEC 61754-20 LC type duplex optical connector. d)		Two multimode optical fibres Short wavelength 850 nm
1000BASE-T IEEE 802.3, Clause 40 (802.3ab)	100 m	IEC 60603-7-7, 8-way shielded modular connector Refer to 802.3 Clause 3 and IEC 60603-7 Figures 1 through 5. See IEEE 802.3/25	See c)	CAT5 STP Four shielded twisted pairs ANSI/ TIA/EIA-568-A:1995 and ISO/IEC 11801:1995 (Class D).
1000BASE-SX IEEE 802.3, Clause 38 (802.3z)	220 m (62/125 µm, low modal bw) 550 m (50/125 µm, high modal bw)	IEC 61754-20 LC type duplex optical connector. d)		Two multimode optical fibres Short wavelength 850 nm
For use in exposed environments, additional provisions are necessary. Consideration should be given to the M12-type specified in IEC 61076-2-101, Amendment 1 for copper network cable. And similar rugged connector for external fibre optic connectorization.				
a) In this case, the maximum operating distance should be specified by the manufacturer. b) The 8-way modular connector specified in IEC 60603-7 is the "8P8C" type that has commonly been used in desktop computer LAN connections and incorrectly but widely referred to as "RJ45". Wires are in the order 1, 2, 3, 6, 4, 5, 7, 8 on the modular jack; the same at each end of a cable. The color-order from wire 1 to 7 shall be green/white, green, orange/white, blue, blue/white, orange, brown/white, brown; the same at both ends of the cable. Refer to IEEE 802.3, 25.4.3 and IEC 60603-7-3. c) The 8-way modular connector specified in IEC 60603-7 is the "8P8C" type that has commonly been used in desktop computer LAN connections and incorrectly but widely referred to as "RJ45". Wires are in the order 1, 2, 3, 6, 4, 5, 7, 8 on the modular jack; the same at each end of a cable. The color-order from wire 1 to 7 shall be green/white, green, orange/white, blue, blue/white, orange, brown/white, brown; the same at both ends of the cable. Refer to IEEE 802.3, 40.8.1 and IEC 60603-7-7. d) See TIA/EIA-604-10-A:2002.				