IEC 61162-450

Edition 1.0 2011-06

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

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE XB

ICS 47.020.70

ISBN 978-2-88912-492-3

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

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

The text of this standard is based on the following documents:

FDIS	Report on voting
80/615/FDIS	80/621/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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A bilingual version of this publication may be issued at a later date.

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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)*

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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*

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

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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 SMB, MSM and CRP types

NOTE 1 SMB, MSM and CRP types are defined in Annex A.

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

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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.

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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)

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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.

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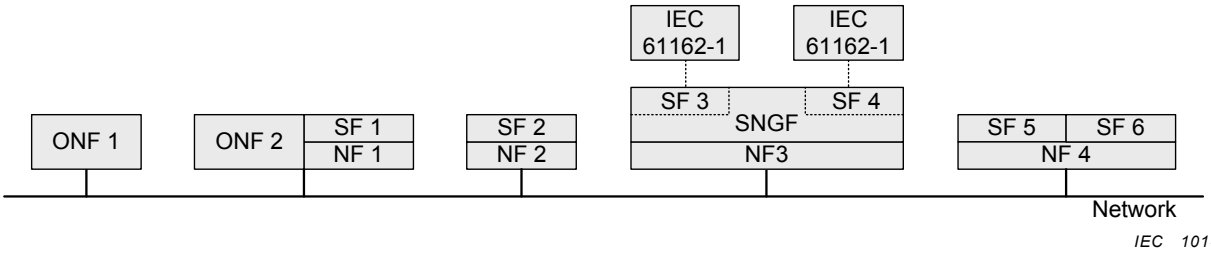

SF is “System Function Block”
SNGF is “Serial to Network Gateway Function Block”
NF is “Network Function Block”
ONF is “Other Network Function Block”

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;

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