

DIN EN 61162-450

ICS 47.020.70

Entwurf

Einsprüche bis 2017-05-03
Vorgesehen als Ersatz für
DIN EN 61162-450:2012-04 und
DIN EN 61162-450/A1:2016-11

**Navigations- und Funkkommunikationsgeräte und -systeme für die
Seeschifffahrt –
Digitale Schnittstellen –
Teil 450: Mehrere Datensender und mehrere Datenempfänger –
Ethernet-Verbund
(IEC 80/810/CD:2016);
Text in Englisch**

Maritime navigation and radiocommunication equipment and systems –
Digital interfaces –
Part 450: Multiple talkers and multiple listeners – Ethernet interconnection
(IEC 80/810/CD:2016);
Text in English

Matériels et systèmes de navigation et de radiocommunication maritimes –
Interfaces numériques –
Partie 450: Émetteurs multiples et récepteurs multiples – Interconnexion Ethernet
(IEC 80/810/CD:2016);
Text en Anglaise

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2017-03-03 wird der Öffentlichkeit zur Prüfung und
Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses
Entwurfs besonders zu vereinbaren.

Stellungnahmen werden erbeten

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Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten
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Gesamtumfang 89 Seiten

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DIN-Normenstelle Schiffs- und Meerestechnik (NSMT)

Nationales Vorwort

Die englische Originalfassung des internationalen Dokuments IEC 80/810/CD:2016 „Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection“ (CD, en: Committee Draft) ist unverändert in diesen Norm-Entwurf übernommen worden.

Das internationale Dokument wurde vom TC 80 „Maritime navigation and radiocommunication equipment and systems“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet und den nationalen Komitees zur Stellungnahme vorgelegt.

Die IEC und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

Da der Abstimmungszeitraum für einen FDIS bzw. Schluss-Entwurf prEN nur 2 Monate beträgt, und dann keine sachlichen Stellungnahmen mehr abgegeben werden können, sondern nur noch eine „JA/NEIN“-Entscheidung möglich ist, wobei eine „NEIN“-Entscheidung fundiert begründet werden muss, wird bereits der CD als DIN-Norm-Entwurf veröffentlicht, um die Stellungnahmen aus der Öffentlichkeit frühzeitig berücksichtigen zu können.

Für dieses Dokument ist das nationale Arbeitsgremium K 738 „Elektronische Navigationsinstrumente“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf ein Dokument ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils aktuellste Ausgabe des in Bezug genommenen Dokuments.

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Der Zusammenhang der zitierten Dokumente mit den entsprechenden Deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für den vorliegenden Normentwurf erfüllt.

Da sich die Benutzer des vorliegenden Normentwurfs der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der IEC 61162-450 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich enthält und Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA des vorliegenden Normentwurfs hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Dieser Normentwurf steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

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Änderungen

Gegenüber DIN EN 61162-450:2012-04 und DIN EN 61162-450/A1:2016-11 wurden folgende Änderungen vorgenommen:

- a) Auf dem IGMP-Herumspionieren basierende Filterung des Netzverkehrs ist erlaubt und Netzknoten müssen IGMP implementieren;
- b) Ein neuer, informativer Anhang E erläutert IGMP-bezogene Kompatibilitätsprobleme, wenn auf der 1. Ausgabe basierende Netzknoten in einem Netzwerk benutzt werden und IGMP-Herumspionieren zur Filterung des Netzverkehrs benutzt wird;
- c) Ein neuer, informativer Anhang F erläutert, wie die Einrichtung eines Kopplers zur Filterung des Netzverkehrs benutzt werden kann;
- d) Neue Einkapselung von PGNs nach IEC 61162-3;
- e) Neues, alternatives, pragmatisches, allgemeines Multicast (PGM) wurde als eine Alternative zur Erhöhung der Leistungsfähigkeit bei wiederholt übertragbaren Bildern in der Bildübertragung hinzugefügt;
- f) Neues HTTP-Verfahren zur Dateiübertragung;
- g) Klarstellung zu SNGF für den Anwendungsfall, dass sich mehr als ein Gerät die serielle Schnittstelle teilt;
- h) Klarstellung zu SNGF bei Überlauf des Pufferspeichers.

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung^{N1)}

1 Anwendungsbereich

Dieser Teil der IEC 61162 legt die Schnittstellenanforderungen und Prüfverfahren fest für Hochgeschwindigkeitskommunikation zwischen den Navigations- und Funkkommunikationsgeräten an Bord sowie zwischen solchen Systemen und anderen Schiffssystemen, die mit Navigations- und Funkkommunikationsgeräten kommunizieren müssen. Dieser Teil der IEC 61162 baut auf der Anwendung einer geeigneten Reihe existierender internationaler Normen auf, um ein Gerüst für die Implementierung einer Datenübertragung zwischen Geräten über ein schiffsseitiges Ethernet-Netzwerk zu bieten.

Im Vergleich zu den Normen IEC 61162-1 and IEC 61162-2 bietet die vorliegende Norm eine Alternative mit höherer Geschwindigkeit und größerer Kapazität unter Beibehaltung des Basis-Datenformats dieser Normen. Diese Norm bietet einen größeren Datendurchsatz als IEC 61162-3.

Diese Norm legt ein auf Ethernet basierendes Bus-artiges Netzwerk fest, in dem jeder Empfänger von jedem Sender Meldungen mit den folgenden Eigenschaften empfangen kann:

Die vorliegende Norm enthält Festlegungen für Multicast-Verteilung von Informationen, die nach IEC 61162-1 formatiert sind, zum Beispiel, Positionsbestimmungen und andere Messungen sowie Festlegungen für die Übertragung allgemeiner Datenblöcke (binäres Abbild), zum Beispiel, zwischen Radar und VDR.

Die vorliegende Norm enthält Vorbereitungen für die nach IEC 61162-1 formatierte Multicast-Verteilung, zum Beispiel Positionsbestimmungen und andere Messungen.

- Diese Norm ist auf Protokolle für Geräte (Netzknoten) beschränkt, die mit einem einzelnen Ethernet-Netzwerk verbunden sind, das nur aus OSI-Schicht-1 und -2-Geräten und -Kabeln (Netzinfrastruktur) besteht.
- Diese Norm stellt nur Anforderungen für Geräteschnittstellen bereit. Mit der Festlegung von Protokollen zur Übertragung von Datensätzen nach IEC 61162-1 und allgemeinen, binären Bilddaten wird garantiert, dass diese Anforderungen Interoperabilität zwischen Geräten, die diese Norm implementieren sowie ein bestimmter Grad an Zuverlässigkeit vom Gerät selbst garantiert.
- Diese Norm erlaubt Geräten, die andere Protokolle anwenden, als diejenigen, die mit dieser Norm festgelegt sind, eine Netzinfrastruktur zu teilen, vorausgesetzt, dass sie mit Schnittstellen versehen sind, welche die für ONF beschriebenen Anforderungen erfüllen (siehe 4.6).
- Diese Norm enthält Festlegungen zur Filterung des Netzverkehrs, um das Verkehrsaufkommen für jedes einzelne Gerät auf eine handhabbare Menge zu begrenzen (siehe 4.3.4).
- Diese Norm enthält keine Systemanforderungen, die nicht aus der Summe einzelner Geräteanforderungen abgeleitet werden können. Um Systemeigenschaften sicherzustellen, die nicht aus den Geräteeigenschaften alleine abgeleitet werden können, sind deshalb zusätzliche Untersuchungen oder weitere Normen erforderlich. Insbesondere gilt dies für Anforderungen zur Aufrechterhaltung der Systemfunktionalität im Falle eines Einzelfehlers in Geräten oder Netzen. Der informative Anhang D enthält eine Anleitung wie mit solchen Problemen umzugehen ist.

3 Begriffe

3.1

ASCII

[en: ASCII]

druckbares, innerhalb eines Bytes, in 7 Bit codiertes Zeichen

^{N1)} Nationale Fußnote: Die Nummerierung aus IEC 80/810/CD: 2016-07-15 wurde beibehalten.

3.2

Binäres Abbild

[en: binary image]

Datenblock mit für das Protokoll unbekannter Formatierung, das heißt, keine IEC 61162-1-formatierten Daten, die mit dem in 7.3 definierten Protokoll übertragen werden können

Anmerkung 1 zum Begriff: Der Begriff „Binäres Abbild“ wird benutzt, um das allgemeine Datenübertragungsprotokoll (welches im gewöhnlichen Textformat sein kann oder nicht) von der Übertragung von Datensätzen zu unterscheiden, die immer im 7-Bit-ASCII-Format übertragen werden.

3.3

Byte

[en: byte]

Gruppe von 8 Bit, die als eine Einheit betrachtet und manchmal „Oktett“ genannt wird

3.4

Anweisung-Rückmeldung-Paar (CRP)

[en: command-response pair (CRP)]

Zwischen Teilnehmern ausgetauschte Meldungen, die durch den Austausch Zustandsänderungen auf beiden Seiten synchronisieren

Anmerkung 1 zum Begriff: CRP-Paare sind im Anhang A definiert.

Anmerkung 2 zum Begriff: Sowohl die Anweisung als auch die Rückmeldung können in einigen Fällen auch als Sensor Broadcast Meldung benutzt werden. Die Implementierung der Semantik eines Meldungs austausches ist somit unterschiedlich zwischen verschiedenen Beteiligten.

3.5

Datagramm

[en: datagram]

eine atomare UDP-Übertragungseinheit im Ethernet wie bei ISO/IEC RFC 768 definiert und in dieser Norm verwendet

3.6

Ethernet

[en: Ethernet]

ein Trägererkennung-, Mehrfachzugangs-Kollisionserkennungs-LAN-Protokoll-Standard (CSMA/CD) nach IEEE 802.3 einschließlich späterer Änderungen und Ergänzungen zur IEEE 802

Anmerkung 1 zum Begriff: Die Typen von Ethernet-Medien, die zur Implementation dieser Norm verwendet werden können, sind im Abschnitt 5 definiert.

3.7

Funktionsblock

[en: function block]

spezifizierte Funktionalität, die in einem Gerät implementiert ist

Anmerkung 1 zum Begriff: In Geräten sind normalerweise mehrere Funktionsblöcke implementiert. Anforderungen an Geräte sind die Summe der Anforderungen an die implementierten Funktionsblöcke. Funktionsblöcke sind im Abschnitt 4 definiert. Arten von Funktionsblöcken sind System-Funktionsblock (SF), Sonstiger Netz-Funktionsblock (ONF), Netz-Funktionsblock (NF) und Seriell-nach-Netz Gateway-Funktionsblock (SNGF).

3.8

Internet Gruppen-Management-Protokoll (IGMP)

[en: Internet group management protocol]

Kommunikationsprotokoll für Hosts und benachbarte Router in IPv4-Netzen, um Multicast Gruppenmitgliedschaften einzurichten. IGMP ist integraler Bestandteil von IP-Multicast.

3.9**IGMP Herumschnüffeln**

[en: IGMP snooping]

Prozess zum Mithören des Internet-Gruppen-Management-Protokoll (IGMP) Netzverkehrs.

3.10**Stelle zur Zuweisung von Internet-Nummern (IANA)**

[en: internet assigned number authority]

globale Koordination der Domain Name Server (DNS) Root, IP-Adressierung und anderer Internet-Protokoll-Ressourcen einschließlich UDP- und TCP-Port-Nummern

Anmerkung 1 zum Begriff: Die derzeit zugewiesenen Nummern sind unter <http://www.iana.org/assignments/port-numbers> gelistet.

3.11**Internet-Protokoll**

[en: internet protocol]

verwendet und definiert in ISOC RFC 791 (einschließlich der Aktualisierungen)

3.12**Meldung**

[en: message]

Sammlung eines oder mehrerer Datensätze, die durch Mechanismen innerhalb des Datensatzes, z. B. Folgenummern wie im TXT-Datensatz gruppiert werden, d. h. ein einzelner Datensatz ist eine Meldung

3.13**Meldungsname**

[en: message type]

Klassifizierung der IEC 61162-1 Datensatz-Formatierer in SMB-, MSM- und CRP-Typen

Anmerkung 1 zum Begriff: SMB, MSM and CRP sind im Anhang A definiert.

Anmerkung 2 zum Begriff: Diese Norm legt unterschiedliche Anforderungen für unterschiedliche Meldungsnamen fest.

3.14**Mehr-Datensatz-Meldungen (MSM)**

[en: multi-sentence messages]

logische Gruppe von Meldungen und/oder Datensätzen, wobei die volle Bedeutung der Gruppe vom Empfänger abhängig ist, der die vollständige Gruppe von Meldungen liest

Anmerkung 1 zum Begriff: Mehr-Datensatz-Meldungen, die mit einem TAG-Konstrukt zusammengefasst sind, sind auch eine Datensatz-Gruppe.

Anmerkung 2 zum Begriff: MSM sind im Anhang A definiert.

3.15**Netz**

[en: network]

ein physikalisches Ethernet-Netz mit einem Internet-Adressraum, das nur aus Netzknoten, Kopplern, Kabeln und Zusatzgeräten wie Stromversorgungen besteht

3.16**Netz-Funktionsblock (NF)**

[en: network function block]

Funktionsblock, der die physikalische Verbindung zum Netz und die Transportebene bereitstellt, wie in 4.3 beschrieben

3.17

Netz-Infrastruktur

[en: network infrastructure]

der Teil des Netzes, der den Übertragungsweg zwischen Netzknoten bereitstellt

Anmerkung 1 zum Begriff: Netzknoten sind nicht Teil der Netz-Infrastruktur.

3.18

Netzknoten

[en: network node]

ans Netz angeschaltetes physikalisches Gerät mit Internet-Adresse (auch Internet Host genannt)

Anmerkung 1 zum Begriff: Ein Netzknoten entspricht normalerweise den Geräten; der Begriff wird in dieser Norm verwendet.

3.19

Alternativer Netz-Funktionsblock (ONF)

[en: other network function block]

Funktionsblock der die Schnittstelle zum Netz darstellt, aber nicht die Protokollfestlegung in den Abschnitten 5, 6 und 7 dieser Norm anwendet (zum Beispiel kontinuierliche Echtzeit-Übertragung von Radar- und Video-Bildern in geschlossenen Video-Systemen (CCTV))

Anmerkung 1 zum Begriff: Protokoll dieser Norm anwenden, nebeneinander betrieben werden können.

3.20

Pragmatisches, allgemeines Multicast (PGM)

[en: Pragmatic General Multicast]

Transportprotokoll für Multicast Rechnernetze, wie in ISOC RFC 3208 beschrieben

3.21

Sensor Broadcast Meldungen (SBM)

[en: sensor broadcast messages]

Meldungen, die aus nur einem Datensatz bestehen

Anmerkung 1 zum Begriff: SBM werden mit einer ausreichend hohen Aktualisierungsrate gesendet, damit der Empfänger den korrekten Zustand auch in Umgebungen, wo einige Meldungen verloren gehen können, mitführen kann.

Anmerkung 2 zum Begriff: SBM werden im Anhang A definiert.

3.22

Datensatz

[en: sentence]

Transporteinheit für die Standardinformation nach IEC 61162-1

3.23

Datensatz-Gruppe

[en: sentence group]

logische Gruppe von Datensätzen (kann auch aus einem Datensatz bestehen), die zusammen verarbeitet werden muss, um die Gesamtbedeutung der in den Datensatz (-sätzen) enthaltenen Information zu erhalten

Anmerkung 1 zum Begriff: Die Gruppierung von Datensätzen in eine Datensatz-Gruppe wird durch TAG Block Mechanismen vorgenommen. Die Datensätze in einer Datensatz-Gruppe können den gleichen oder unterschiedliche Formate haben. Eine durch diesen Mechanismus gruppierte Mehr-Datensatz-Meldung ist auch eine Datensatz-Gruppe.

Anmerkung 2 zum Begriff: Diese Norm erlaubt die explizite Gruppierung von Datensätzen durch Kodierung in einem Datagramm. Diese Norm erzwingt keinerlei Verbindung zwischen Datagramm und Datensatz-Gruppe. Somit darf ein Datagramm mehr als eine Datensatz-Gruppe enthalten, oder eine Sentence-Gruppe darf auf zwei oder mehr Datagramme aufgeteilt werden.

3.24**Seriell-nach-Netz Gateway-Funktionsblock (SNGF)**

[en: serial to network gateway function block]

Funktionsblock, der den Transfer von Datensätzen zwischen dem Netz und Geräten ermöglicht, die mit den seriellen Schnittstellen nach IEC 61162-1 und IEC 61162-2 verträglich sind

3.25**System-Funktionsblock (SF)**

[en: system function block]

Funktionsblock, der als einziger durch eine eindeutige Systemfunktions-ID (SFI) identifiziert wird, der Information im Datagramm-Format nach Abschnitt 7 aussenden kann

3.26**Systemfunktions-ID (SFI)**

[en: system function ID]

Kennziffernfolge nach 4.4.2

3.27**Übertragungsgruppe**

[en: transmission group]

ein Paar von Multicast-Adresse und Port-Nummer, das von einer SF zur Übertragung von Datensätzen verwendet wird

Anmerkung 1 zum Begriff: Übertragungsgruppen sind in Tabelle 4 und Anhang A definierte Standard-Übertragungsgruppen für einen SF.

3.28**Transport Annotation und Gruppe (TAG)**

[en: transport annotate and group (TAG)]

in NMEA 0183 formatierter Datenblock, der Kennziffern bei Datensätzen nach IEC 61162-1 ergänzt

Anmerkung 1 zum Begriff: Der informative Anhang B gibt einen Überblick über TAG-Blöcke, die in dieser Norm verwendet werden.

3.29**Anwender-Datagramm-Protokoll (UDP)**

[en: user datagram protocol]

verbindungsloses Datagramm-Protokoll nach ISOC RFC 768; es sieht keine Transportschicht-Bestätigungen für empfangene Pakete vor

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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.

This second edition of IEC 61162-450 cancels and replaces the first edition published in 2011, of which it constitutes a technical revision.

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

- Network traffic filtering is allowed based on IGMP snooping and nodes are required to implement IGMP;
- New informative Annex E explains about IGMP related compatibility issues when nodes based on 1st edition are used in a network using IGMP snooping for network traffic filtering.

- 57 • New informative Annex F explains how the setup of a switch could be used for network
- 58 traffic filtering;
- 59 • New encapsulation of IEC 61162-3 PGNs;
- 60 • New alternative Pragmatic General Multicast (PGM) is added as an alternative to improve
- 61 performance of re-transmittable images a for image transfer;
- 62 • New HTTP method for file transfer;
- 63 • Clarification for SNGF about the use case when more than one equipment share the serial
- 64 line;
- 65 • Clarification for SNGF about buffer overflow.
- 66 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.
- 67 The committee has decided that the contents of the base publication and its amendment will
- 68 remain unchanged until the stability date indicated on the IEC web site under
- 69 "http://webstore.iec.ch" in the data related to the specific publication. At this date, the
- 70 publication will be
 - 71 • reconfirmed,
 - 72 • withdrawn,
 - 73 • replaced by a revised edition, or
 - 74 • amended.
- 75 A bilingual version of this publication may be issued at a later date.
- 76

**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 file), for example between radar and VDR.
- This standard includes provisions for multicast distribution of information formatted according to IEC 61162-3, for example position fixes and other measurements.
- 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, IEC 61162-3 PGN messages and general binary file 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 4.7).
- This standard include provisions for filtering of the network traffic in order to limit the amount of traffic to manageable level for each individual equipment (see 4.3.4).
- 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 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 2616, *Hypertext Transfer Protocol -- HTTP/1.1*

ISOC RFC 3208, *PGM Reliable Transport Protocol Specification*

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*

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

157 3 Terms and definitions

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

159 3.1

160 ASCII

161 printable 7 bit character encoded in one byte

162 3.2

163 binary file

164 data block without formatting known to this protocol, i.e., non IEC 61162-1 formatted data,
165 that can be transmitted with the protocol defined in 7.3 or in 7.5.

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

168 3.3

169 byte

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

171 3.4

172 command-response pair

173 CRP

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

176 NOTE 1 CRP are defined in Annex A.

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

180 3.5

181 datagram

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

184 3.6

185 Ethernet

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

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

189 3.7

190 function block

191 specified functionality implemented by equipment

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

196 3.8

197 Internet Group Management Protocol

198 IGMP

199 communications protocol used by hosts and adjacent routers on IPv4 networks to establish
200 multicast group memberships. IGMP is an integral part of IP multicast.

3.9**IGMP snooping**

process of listening to Internet Group Management Protocol (IGMP) network traffic.

3.10**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>.

3.11**internet protocol****IP**

used and defined in ISOC RFC 791 (and updates)

3.12**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

3.13**message type**

classification of IEC 61162-1 sentence formatters into SBM, MSM and CRP types

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

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

3.14**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.

3.15**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

3.16**network function block****NF**

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

3.17**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.

244 **3.18**
245 **network node**
246 physical device connected to the network and which have an Internet address (also called an
247 Internet host)

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

249 **3.19**
250 **other network function block**
251 **ONF**
252 function block that interfaces to the network, but which is not using the protocol definition in
253 Clauses 5, 6 and 7 of this standard (for example real time streaming of Radar and CCTV
254 image transfer, VDR sound transfer, etc.)

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

257 **3.20**
258 **Pragmatic General Multicast**
259 **PGM**
260 multicast computer network transport protocol as described in ISOC RFC 3208

261 **3.21**
262 **sensor broadcast message**
263 **SBM**
264 messages consisting of only one sentence

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

267 NOTE 2 SBM are defined in Annex A.

268 **3.22**
269 **sentence**
270 standard information carrying unit as defined in IEC 61162-1

271 **3.23**
272 **sentence group**
273 logical group of sentences (which may consist of only one) that need to be processed
274 together to give full meaning to the information contained in the sentence(s)

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

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

281 **3.24**
282 **serial to network gateway function block**
283 **SNGF**
284 function block that enables transfer of sentences between the network and devices that are
285 compliant with the IEC 61162-1 and IEC 61162-2 serial line interface

286 **3.25**
287 **system function block**
288 **SF**
289 function block, identified by a unique system function ID (SFI), that is the only function block
290 that can send information in a datagram format as defined in clause 7

3.26

system function ID

SFI

parameter string as defined in 4.4.2

3.27

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.

3.28

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.

3.29

user datagram protocol

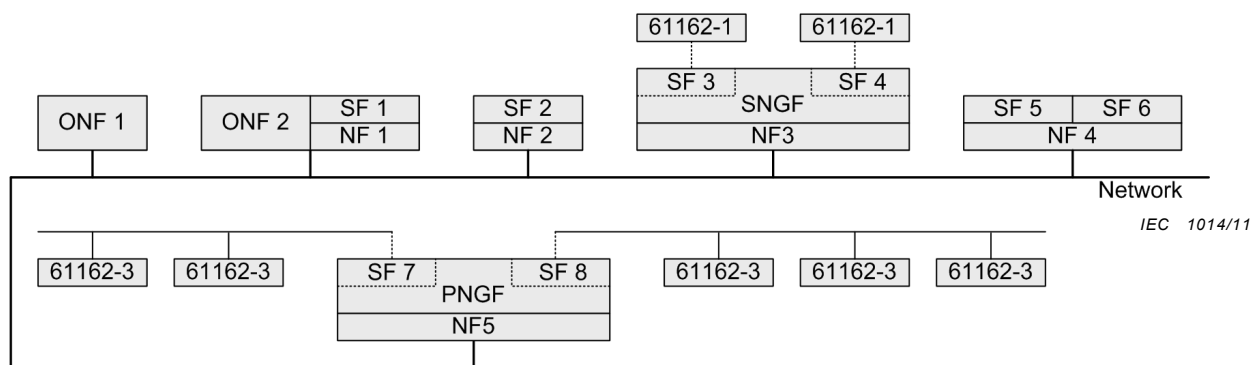
UDP

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.



SF is "System Function Block"
SNGF is "Serial to Network Gateway Function Block"
PNGF is "PGN 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 file) 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 system device function block presented by an IEC 61162-3 compliant equipment connected to network gateway function (PNGF). In this case, the PNGF will format outgoing sentences according to requirements of this standard (SF7, SF8, PNGF and NF5)
- a device that does not send or receive IEC 61162-450 compliant data (sentences and/or binary file), 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) 4.5 (SNGF) and 4.6 (PNGF).
- 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 4.7.
- 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)

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.

NOTE 1 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.*

Switches used in an IEC 61162-450 network shall have means to filter network traffic using IGMP snooping. When the IGMP snooping is enabled and when a multicast data is received, the switch shall forward it only to the ports which have joined the same multicast group. The means which shall be provided to support multicast data filtering using IGMP snooping are:

- IGMP snooping shall be provided based on IGMPv1, IGMPv2 or IGMPv3. Selection of the IGMP version shall be based on highest version supported by all the connected nodes;
- Multicast traffic filtering shall be provided based on IP multicast address;
- Multicast data filtering shall not be enabled for the address range of 224.0.0.1 to 224.0.0.255.

NOTE 2 In addition to or instead of multicast filtering techniques, such as IGMP snooping, it is also possible to configure manually individual ports of the switches to block unnecessary traffic flow (for example to isolate simple sensors from ECDIS and radar).

Another possible method to filter and control network traffic is described in Annex F.

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 7.3.11 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.

411

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 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.

412

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

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

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

421

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 file error	7.3.11
201	PNGF buffer overflow	4.6.2
202	PGN message errors	7.4.2 and 7.4.4
203	No available address for devices	7.4.3.2

422

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

4.3.4 Provisions for network traffic filtering - IGMP

NOTE The purpose of the IGMP for this standard is to provide the possibility to perform network traffic filtering based on IGMP snooping.

The manufacturer shall specify the version of IGMP as defined in ISOC RFC 1112, RFC 2236 and RFC 3376 that the NF supports. At least version 1 as defined in ISOC RFC 1112 shall be implemented.

See Annex E for compatibility issues of nodes based on the previous 1st edition of this standard.

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 file 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.

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.

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 unless prohibited by an individual equipment standard. Only the transmission groups listed in 6.2.2 are allowed to be configured.

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.

The SNGF may support one or more serial ports. Each serial port shall be implemented as a separate SF and assigned a separate SFI. If practical, the 'cc' part of the SFI shall be based on the talker mnemonic in use by the serial port. As a destination, each serial port shall be based on the SFI.

The SNGF may support one or more sources distinguished by different talker mnemonics at each serial port. Each source in a shared serial port shall be implemented as a separate SF and assigned a separate SFI. If practical, the 'cc' part of the SFI shall be based on the talker mnemonic in use by each source in a shared serial port. As a destination, each source in a shared serial port shall be based on the SFI.

The TAG block for source identification (s:) shall be based on the SFI. If available, routing from a 450-network to serial ports shall be based on the TAG block for destination identification (d:).

The default SFI of an SNGF used for administrative purposes such as syslog 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 separate SF implemented 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 is 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 single sentence, multi sentence message 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. This replacing shall not cause logging of an error nor sending anything to syslog;

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 the 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. The datagram shall include the correct SFI, source identification (s:) and, if required, destination identification (d:).

4.6 PGN to network gateway function (PNGF) requirements

(see TBD)

4.6.1 General requirements

(see TBD)

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

The default SFI of a PNGF used for administrative purposes such as syslog shall use the talker mnemonic "SI".

The PNGF may implement different types of filtering based on the PGN messages from and to IEC 61162-3 network. Any filtering methods shall be described in manufacturer's documentation.

NOTE The accurate timing between PGN messages available in the IEC 61162-3 network is not supported when the same is converted into IEC 61162-450 network.