DIN EN IEC 61162-450

ICS 47.020.70

Ersatz für
DIN EN 61162-450:2012-04 und
DIN EN 61162-450/A1:2016-11
Siehe Anwendungsbeginn

Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt – Digitale Schnittstellen – Teil 450: Mehrere Datensender und mehrere Datenempfänger – Ethernet-Verbund (IEC 61162-450:2018); Englische Fassung EN IEC 61162-450:2018

Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection (IEC 61162-450:2018); English version EN IEC 61162-450:2018

Matériels et systèmes de navigation et de radiocommunication maritimes – Interfaces numériques – Partie 450: Emetteurs multiples et récepteurs multiples – Interconnexion Ethernet (IEC 61162-450:2018); Version anglaise EN IEC 61162-450:2018

Gesamtumfang 94 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE
DIN-Normenstelle Schiffs- und Meerestechnik (NSMT)

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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2018-06-08 angenommene Europäische Norm als DIN-Norm ist 2019-02-01.

Für DIN EN 61162-450:2012-04 und DIN EN 61162-450/A1:2016-11 besteht eine Übergangsfrist bis 2021-06-08.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 61162-450:2017-04.

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.

Die enthaltene IEC-Publikation wurde vom TC 80 „Maritime navigation and radiocommunication equipment and systems“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieses Dokuments bis zu dem Datum (stability date) unverändert bleiben soll, das auf der IEC-Website unter „http://webstore.iec.ch“ zu diesem Dokument angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees das Dokument
– bestätigt,
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– geändert.

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.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe des Dokuments.

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 die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der EN IEC 61162-450 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 2, der die Abkürzungen und Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für die meisten der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

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;

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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.

Frühere Ausgaben

DIN EN 61162-450: 2012-04
DIN EN 61162-450/A1: 2016-11

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Nationaler Anhang NA
(informativ)

Auszugsweise Übersetzung[N1]

1 Anwendungsbereich

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

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

- Dieses Dokument enthält Bestimmungen für Multicast-Verteilung von Informationen, die entsprechend IEC 61162-1 formatiert sind, zum Beispiel, Positionsangaben und andere Messungen sowie Bestimmungen für die Übertragung allgemeiner Datenblöcke (binäres Abbild), zum Beispiel, zwischen Radar und VDR und enthält auch Bestimmungen für die Multicast-Verteilung von Informationen, die nach IEC 61162-3 formatiert sind, zum Beispiel Positionsbestimmungen und andere Messungen.
- Dieses Dokument ist auf Protokolle für Geräte (Netzknoten) beschränkt, die mit einem einzelnen Ethernet-Netzwerk verbunden sind, das nur aus Geräten und Kabeln der OSI-Schichten-1 und -2 (Netzinfrastruktur) besteht.
- Dieses Dokument enthält nur Anforderungen an Geräteschnittstellen. Mit der Festlegung von Protokollen zur Übertragung von Datensätzen nach IEC 61162-1, PGN-Meldungen nach IEC 61162-3 und allgemeinen, binären Bilddaten wird sichergestellt, dass durch die Einhaltung der Anforderungen Interoperabilität zwischen Geräten, die dieses Dokument implementieren, sowie ein bestimmter Grad an sicherem Verhalten vom Gerät selbst erreicht werden.
- Dieses Dokument erlaubt es, Geräten, die andere als die in diesem Dokumente festgelegten Protokolle verwenden, eine gemeinsame Netzinfrastruktur zu nutzen, vorausgesetzt, dass sie mit Schnittstellen versehen sind, welche die für ONF beschriebenen Anforderungen erfüllen.
- Dieses Dokument enthält Bestimmungen zur Filterung des Netzverkehrs, um die Menge des Datenverkehrs für jedes einzelne Gerät auf ein überschaubares Maß zu begrenzen.

Dieses Dokument enthält keine Systemanforderungen, die nicht aus der Summe einzelner Geräteanforderungen abgeleitet werden können. Eine zugehörige Norm, IEC 61162-460 adressiert weitere Systemanforderungen

3 Begriffe

3.1
ASCII
(en: ASCII)
druckbares, innerhalb eines Bytes, in 7 Bit codiertes Zeichen

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

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[N1] Nationale Fußnote: Die Nummerierung aus IEC 61162-450:2018-05 wurde beibehalten.

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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, als eine Einheit betrachtet

Anmerkung 1 zum Begriff: Dies wird manchmal auch „Oktett“ genannt.

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 Meldungsaustausches ist somit unterschiedlich zwischen verschiedenen Beteiligten.

3.5
Datagramm
(en: datagram)
atomare UDP-Übertragungseinheit im Ethernet wie bei ISOC RFC 768 definiert und in diesem Dokument verwendet

3.6
Ethernet
(en: Ethernet)
Trägererkennungs-, Mehrfachzugangs-Kollisionserkennungs-LAN-Protokoll-Standard (CSMA/CD) nach IEEE Std 802.3 einschließlich späterer Änderungen und Ergänzungen zur IEEE 802

Anmerkung 1 zum Begriff: Die Typen von Ethernet-Medien, die zur Implementation von diesem Dokument 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.

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

Anmerkung 1 zum Begriff: Das IGMP ist integraler Bestandteil von IP-Multicast.

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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)
Signalisierungsprotokoll, 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

Anmerkung 1 zum Begriff: 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: Dieses Dokument 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)
physikalisches Ethernet-Netz mit einem Internet-Adressraum, das nur aus Netzknoten, Kopplern, Kabeln und Zusatzgeräten wie Stromversorgungen besteht

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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)
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

Anmerkung 1 zum Begriff: Wird auch Internet Host genannt.

Anmerkung 2 zum Begriff: Ein Netzknoten entspricht normalerweise den Geräten. Der Begriff „Gerät“ wird in diesem Dokument verwendet.

3.19
sonstiger 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 anwendet

Anmerkung 1 zum Begriff: Zum Beispiel kontinuierliche Echtzeit-Übertragung von Radar- und Video-Bildern in geschlossenen Video-Systemen (CCTV).

Anmerkung 2 zum Begriff: Die in 4.7 definierten Anforderungen, stellen sicher, dass ONF- mit SF-Netzknoten und Funktionsblöcken, die das Protokoll dieses Dokuments verwenden, betrieben werden können.

3.20
PGN nach Netz-Gateway-Funktionsblock
PNGF
(en: PGN to network gateway function block)
Funktionsblock, der die Übertragung von Datensätzen zwischen dem Netz und Geräten ermöglicht, die der IEC 61162-3-Schnittstelle für serielle Datenerfassungsgeräte entsprechen

3.21
PGN-Meldung
Parametergruppennummer-Meldung
(en: parameter group number message)
Meldung, bestehend aus einer 8-Bit- oder 16-Bit-Nummer, die jede Parametergruppe identifiziert

Anmerkung 1 zum Begriff: Die Parametergruppennummer (PGN) entspricht dem dreistelligen Datensatzformatierer nach IEC 61162-1. Definitionsgemäß werden Parametergruppen, die durch 16-Bit-Parametergruppennummern identifiziert werden, an alle Adressen im Netzwerk gesendet. Parametergruppen, die durch 8-Bit-Parametergruppennummern identifiziert werden, können verwendet werden, um Daten durch die Verwendung einer bestimmten Adresse zu leiten.

[Quelle: IEC 61162-3:2008, 3.1.21, modifiziert – Das Wort „Meldung“ wurde zum Begriff hinzugefügt und die Definition wurde umformuliert.]

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3.22
Sensor-Broadcast-Meldungen
SBM
(en: sensor broadcast messages)
Meldungen, die aus nur einem Datensatz bestehen

Anmerkung 1 zum Begriff: SBMs 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: SBMs werden im Anhang A definiert.

3.23
Datensatz
(en: sentence)
Transporteinheit für die Standardinformation nach IEC 61162-1

3.24
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.

Anmerkung 2 zum Begriff: Dieses Dokument erlaubt die explizite Gruppierung von Datensätzen durch Kodierung in einem Datagramm. Dieses Dokument 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.

3.25
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

3.26
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

3.27
Systemfunktions-ID
SFI
(en: system function ID)
Kennziffernfolge nach 4.4.2

3.28
Übertragungsgruppe
(en: transmission group)
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.

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3.29
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: Anhang B gibt einen Überblick über TAG-Blöcke, die in diesem Dokument verwendet werden.

3.30
Anwender-Datagramm-Protokoll
UDP
(en: user datagram protocol)
verbindungsloses Datagramm-Protokoll nach ISOC RFC 768

Anmerkung 1 zum Begriff: ISOC RFC 768 sieht keine Transportschicht-Bestätigungen für empfangene Pakete vor.

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EUROPEAN STANDARD

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EN IEC 61162-450

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English Version

Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection (IEC 61162-450:2018)

Matériels et systèmes de navigation et de radiocommunication maritimes - Interfaces numériques - Partie 450: Emetteurs multiples et récepteurs multiples - Interconnexion Ethernet (IEC 61162-450:2018)

Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt - Digitale Schnittstellen - Teil 450: Mehrere Datensender und mehrere Datenempfänger - Ethernet-Verbund (IEC 61162-450:2018)

This European Standard was approved by CENELEC on 2018-06-08. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

The text of document 80/880/FDIS, future edition 2 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 approved by CENELEC as EN IEC 61162-450:2018.

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)	2019-03-08
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2021-06-08

This document supersedes EN 61162-450:2011.

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

Endorsement notice

The text of the International Standard IEC 61162-450:2018 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 61162-450:2011	NOTE	Harmonized as EN 61162-450:2011 (not modified).
IEC 61162-460	NOTE	Harmonized as EN 61162-460.
IEC 61174	NOTE	Harmonized as EN 61174.
IEC 61754-20	NOTE	Harmonized as EN 61754-20.
IEC 61996-1	NOTE	Harmonized as EN 61996-1.
IEC 62388:2007	NOTE	Harmonized as EN 62388:2008[Z1] (not modified).

[Z1] Superseded by EN 62388:2013 (IEC 62388:2013).

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where 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.

Publication	Year	Title	EN/HD	Year
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	2016	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners	EN 61162-1	2016
IEC 61162-3	2008	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 3: Serial data instrument network	EN 61162-3	2008
IEEE Std 802.3	2015	IEEE Standard for Ethernet	-	-
IETF RFC 768	-	User Datagram Protocol	-	-
IETF RFC 791	-	Internet Protocol (IP) - DARPA Internet Program Protocol Specification	-	-
IETF RFC 792	-	Internet Control Message Protocol (ICMP)	-	-
IETF RFC 793	1981	Transmission Control Protocol (TCP)	-	-
IETF RFC 826	-	An Ethernet Address Resolution Protocol	-	-
IETF RFC 1112	-	Host Extensions for IP multicasting	-	-
IETF RFC 1918	-	Address Allocation for Private Internets	-	-
IETF RFC 2236	-	Internet Group Management Protocol, Version 2	-	-
IETF RFC 2474	-	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers	-	-
IETF RFC 3376	-	Internet Group Management Protocol, Version 3	-	-
IETF RFC 5000	-	Internet Official Protocol Standards	-	-
IETF RFC 5227	-	IPv4 Address Conflict Detection	-	-

AVA Documents
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Publication	Year	Title	EN/HD	Year
IETF RFC 5424	-	The Syslog Protocol	-	-
NMEA 0183	2008	Standard for interfacing marine electronic devices, Version 4.00	-	-

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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 radiocommunication equipment. This document is based on the application of an appropriate suite of existing international standards to provide a framework for implementing data transfer between devices on a shipboard Ethernet network.

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

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

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

IEEE Std 802.3-2015, *IEEE Standard for Ethernet*

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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)*

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

ISOC RFC 826, *An ethernet Address Resolution Protocol*

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

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

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

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

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

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

ISOC RFC 5227, *IPv4 Address Conflict Detection*

ISOC RFC 5424, *The Syslog Protocol*

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

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 file
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 or in 7.5

Note 1 to entry: The term "binary file" 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

Note 1 to entry: This corresponds to what is also sometimes called an octet.

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3.4
command-response pair
CRP
messages exchanged between parties that synchronize state changes on both sides through the exchange

Note 1 to entry: CRP are defined in Annex A.

Note 2 to entry: 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
atomic UDP transmission unit on the Ethernet as defined in ISOC RFC 768 and as constrained elsewhere in this document

3.6
Ethernet
carrier sense, multiple access collision detect (CSMA/CD) local area network protocol standard as defined in IEEE Std 802.3 and later revisions and additions to IEEE 802

Note 1 to entry: The types of Ethernet media that can be used for implementation of this document are defined in Clause 5.

3.7
function block
specified functionality implemented by equipment

Note 1 to entry: 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.

3.8
Internet Group Management Protocol
IGMP
communications protocol used by hosts and adjacent routers on IPv4 networks to establish multicast group memberships

Note 1 to entry: The 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 1 to entry: The currently assigned numbers are listed in http://www.iana.org/assignments/port-numbers.

3.11
Internet protocol
IP
signalling protocol 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

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Note 1 to entry: 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 to entry: SBM, MSM and CRP types are defined in Annex A.

Note 2 to entry: This document defines different requirements to the transmission of different message types.

3.14
multi-sentence message
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 to entry: Multi-sentence messages that are grouped together with a TAG construct are also a sentence group.

Note 2 to entry: MSM are defined in Annex A.

3.15
network
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
part of the network that provides a transmission path between network nodes

Note 1 to entry: The network nodes are not part of the network infrastructure.

3.18
network node
physical device connected to the network and which have an Internet address

Note 1 to entry: It is also called an Internet host.

Note 2 to entry: A network node will normally correspond to equipment. “Equipment” is used in this document.

3.19
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

Note 1 to entry: For example, real time streaming of radar and CCTV image transfer, or VDR sound transfer.

Note 2 to entry: Requirements as defined in 4.7 ensure that an ONF can co-reside with SF network nodes and function blocks that make use of this document's protocol.

3.20
PGN to network gateway function block
PNGF
function block that enables transfer of sentences between the network and devices that are compliant with the IEC 61162-3 serial data instrument network interface

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3.21
PGN message
parameter group number message
message consisting of an 8-bit or 16-bit number that identifies each parameter group

Note 1 to entry: The parameter group number (PGN) is analogous to the three-character sentence formatter in IEC 61162-1. By definition, parameter groups identified by 16-bit parameter group numbers are broadcast to all addresses on the network. Parameter groups identified by 8-bit parameter group numbers may be used to direct data for use by a specific address.

[SOURCE: IEC 61162-3:2008, 3.1.21, modified – The word "message" has been added to the term, and the definition has been rephrased.]

3.22
sensor broadcast message
SBM
message consisting of only one sentence

Note 1 to entry: SBMs 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 to entry: SBMs are defined in Annex A.

3.23
sentence
standard information carrying unit as described in IEC 61162-1

3.24
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 to entry: The grouping of sentences into sentence group is done by TAG block mechanisms.

Note 2 to entry: This document allows the explicit grouping of sentences by using coding in a datagram. This document 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.

3.25
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

3.26
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

3.27
system function ID
SFI
parameter string as defined in 4.4.2

3.28
transmission group
pair of a multicast address and a port number that are used by an SF to transmit sentences

Note 1 to entry: The transmission groups are defined in Table 4, and Annex A defines default transmission groups for the SF.

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3.29
transport annotate and group
TAG
formatted block of data, defined in NMEA 0183, that adds parameters to IEC 61162-1 sentences

Note 1 to entry: Annex B gives an overview of the TAG blocks used in this document.

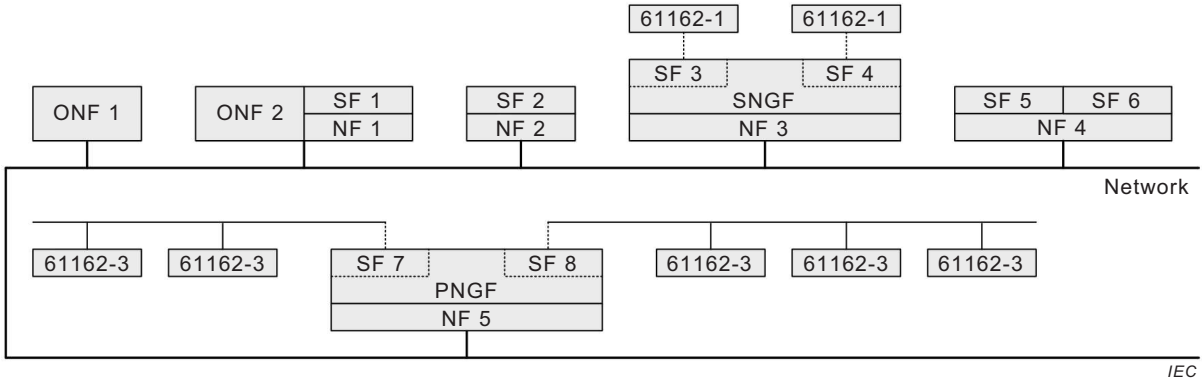
3.30
user datagram protocol
UDP
connection-less datagram protocol defined by ISOC RFC 768

Note 1 to entry: ISOC RFC 768 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 Clause 4.



Key

SF	system function block
NF	network function block
SNGF	serial to network gateway function block
ONF	other network function block
PNGF	PGN to network gateway 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 document (SF3, SF4, SNGF and NF3);

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- 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 document (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.

  NOTE This requirement only applies to devices on the network when the network is in normal operation. During commissioning or maintenance, when the system is not being used for safety-related navigation, other equipment can be temporarily connected to the network that does not comply with 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, repeater hubs shall not be used to interconnect components of an IEC 61162-450 network.

NOTE 1 Repeater hubs are network infrastructure devices without internal storage that repeat incoming datagrams onto all outgoing connections.

NOTE 2 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 datagram 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 the following:

- IGMP snooping shall be provided based on IGMPv1, IGMPv2 or IGMPv3; the 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 as recommended in RFC 4541.

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

See Annex D for IGMP snooping compatibility issues of nodes based on IEC 61162-450:2011.

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

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) the maximum number of datagrams per second received, intended for and processed by the equipment,

a) the maximum number of datagrams per second received by, but not intended for, the equipment, and

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

NOTE 1 "Received by" means datagrams that are received on all transmission groups that the equipment listens to.

NOTE 2 "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, for example by trained service engineer. It is allowed that the inspection is done through a simple network mechanism, such as a terminal emulator, as defined in this document 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 document 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.

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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 document, 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 document.
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 document, 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. The "syslog" packet for multiple occurrence of same message identity shall not be reported more often than once per minute. The "syslog" packet for any occurrence of message identity shall not be delayed more than 10 min.

This document does not specify requirements for equipment receiving syslog messages. This type of equipment would fall into the category of ONF. As Table 1 is a subset of the full ISOC RFC 5424 specification, implementers of such equipment shall 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 document have been assigned a message identity as defined in Table 2.

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Table 2 – Syslog error message codes

Message identity	Description	Subclause
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	7.3.9
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

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 document 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 D for compatibility issues of nodes based on IEC 61162-450:2011.

4.4 System function block (SF) requirements

4.4.1 General requirements

(see 8.4.1 and 8.2.3)

Equipment that implements an SF shall satisfy the following requirements:

- requirements in 6.2 shall be satisfied for all equipment implementing SF;
- implements at least one of the datagram types defined in Clause 7, but does not have to implement all of them;
- implemented datagram types shall be specified in the manufacture's documentation (see 7.1.1);
- requirements in 7.2 shall be satisfied for all equipment implementing IEC 61162-1 sentence transmitting or receiving function blocks;
- requirements in 7.3 shall be satisfied for equipment that implements an SF that can transmit or receive binary file data;
- requirements in 7.4 shall be satisfied for all equipment implementing IEC 61162-3 PGN message transmitting or receiving function blocks.

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. If the talker

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