

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems – Digital
interfaces –
Part 1: Single talker and multiple listeners**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 IEC, Geneva, Switzerland

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

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

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

About IEC publications

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

IEC Catalogue - webstore.iec.ch/catalogue

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

IEC publications search - www.iec.ch/searchpub

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 It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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

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



IEC 61162-1

Edition 5.0 2016-08

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems – Digital
interfaces –
Part 1: Single talker and multiple listeners**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 47.020.70

ISBN 978-2-8322-3594-2

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

CONTENTS

FOREWORD	8
INTRODUCTION	10
1 Scope	11
2 Normative references	11
3 Terms and definitions	13
3.1 General	13
3.2 Terms and definitions	13
4 Manufacturer's documentation	13
5 Hardware specification	13
5.1 General	13
5.2 Interconnecting wire	13
5.3 Conductor definitions	13
5.4 Electrical connections/shield requirements	14
5.5 Connector	14
5.6 Electrical signal characteristics	14
5.6.1 General	14
5.6.2 Signal state definitions	14
5.6.3 Talker drive circuits	14
5.6.4 Listener receive circuits	14
5.6.5 Electrical isolation	15
5.6.6 Maximum voltage on bus	15
6 Data transmission	15
7 Data format protocol	16
7.1 Characters	16
7.1.1 General	16
7.1.2 Reserved characters	16
7.1.3 Valid characters	16
7.1.4 Undefined characters	16
7.1.5 Character symbols	16
7.2 Fields	16
7.2.1 String	16
7.2.2 Address field	16
7.2.3 Data fields	17
7.2.4 Checksum field	18
7.2.5 Sequential message identifier field	18
7.3 Sentences	19
7.3.1 General structure	19
7.3.2 Description of approved sentences	19
7.3.3 Parametric sentences	20
7.3.4 Encapsulation sentences	21
7.3.5 Query sentences	23
7.3.6 Proprietary sentences	23
7.3.7 Command sentences	24
7.3.8 Valid sentences	25
7.3.9 Multi-sentence messages	25

7.3.10	Sentence transmission timing.....	25
7.3.11	Additions to approved sentences.....	25
7.4	Error detection and handling	26
7.5	Handling of deprecated sentences.....	26
8	Data content.....	26
8.1	Character definitions	26
8.2	Field definitions	28
8.3	Approved sentences	32
8.3.1	General format.....	32
8.3.2	AAM – Waypoint arrival alarm	32
8.3.3	ABK – AIS addressed and binary broadcast acknowledgement	32
8.3.4	ABM – AIS addressed binary and safety related message	33
8.3.5	ACA – AIS channel assignment message	34
8.3.6	ACK – Acknowledge alarm	36
8.3.7	ACN – Alert command.....	36
8.3.8	ACS – AIS channel management information source	37
8.3.9	AIR – AIS interrogation request.....	37
8.3.10	AKD – Acknowledge detail alarm condition	38
8.3.11	ALA – Report detailed alarm condition.....	39
8.3.12	ALC – Cyclic alert list.....	40
8.3.13	ALF – Alert sentence	41
8.3.14	ALR – Set alarm state	43
8.3.15	APB – Heading/track controller (autopilot) sentence B	43
8.3.16	ARC – Alert command refused	44
8.3.17	BBM – AIS broadcast binary message.....	45
8.3.18	BEC – Bearing and distance to waypoint – Dead reckoning	46
8.3.19	BOD – Bearing origin to destination	46
8.3.20	BWC – Bearing and distance to waypoint – Great circle.....	46
8.3.21	BWR – Bearing and distance to waypoint – Rhumb line	46
8.3.22	BWW – Bearing waypoint to waypoint	47
8.3.23	CUR – Water current layer – Multi-layer water current data	47
8.3.24	DBT – Depth below transducer.....	48
8.3.25	DDC – Display dimming control.....	48
8.3.26	DOR – Door status detection.....	49
8.3.27	DPT – Depth.....	50
8.3.28	DSC – Digital selective calling information.....	50
8.3.29	DSE – Expanded digital selective calling	51
8.3.30	DTM – Datum reference	51
8.3.31	EPV – Command or report equipment property value.....	52
8.3.32	ETL – Engine telegraph operation status	54
8.3.33	EVE – General event message.....	55
8.3.34	FIR – Fire detection	55
8.3.35	FSI – Frequency set information.....	56
8.3.36	GBS – GNSS satellite fault detection.....	57
8.3.37	GEN – Generic binary information	58
8.3.38	GFA – GNSS fix accuracy and integrity	59
8.3.39	GGA – Global positioning system (GPS) fix data	60
8.3.40	GLL – Geographic position – Latitude/longitude.....	61

8.3.41	GNS – GNSS fix data.....	61
8.3.42	GRS – GNSS range residuals	64
8.3.43	GSA – GNSS DOP and active satellites.....	65
8.3.44	GST – GNSS pseudorange noise statistics.....	67
8.3.45	GSV – GNSS satellites in view	68
8.3.46	HBT – Heartbeat supervision sentence.....	69
8.3.47	HCR – Heading correction report	70
8.3.48	HDG – Heading, deviation and variation	70
8.3.49	HDT – Heading true	71
8.3.50	HMR – Heading monitor receive.....	71
8.3.51	HMS – Heading monitor set	72
8.3.52	HRM – heel angle, roll period and roll amplitude measurement device	72
8.3.53	HSC – Heading steering command.....	73
8.3.54	HSS – Hull stress surveillance systems.....	73
8.3.55	HTC – Heading/track control command; HTD – Heading /track control data	73
8.3.56	LR1 – AIS long-range reply sentence 1	75
8.3.57	LR2 – AIS long-range reply sentence 2	75
8.3.58	LR3 – AIS long-range reply sentence 3	76
8.3.59	LRF – AIS long-range function	76
8.3.60	LRI – AIS long-range interrogation	77
8.3.61	MOB – Man over board notification	78
8.3.62	MSK – MSK receiver interface.....	80
8.3.63	MSS – MSK receiver signal status.....	80
8.3.64	MTW – Water temperature	80
8.3.65	MWD – Wind direction and speed.....	80
8.3.66	MWV – Wind speed and angle	81
8.3.67	NAK – Negative acknowledgement.....	81
8.3.68	NRM – NAVTEX receiver mask	82
8.3.69	NRX – NAVTEX received message	83
8.3.70	NSR – Navigation status report	85
8.3.71	OSD – Own ship data.....	86
8.3.72	POS – Device position and ship dimensions report or configuration command.....	87
8.3.73	PRC – Propulsion remote control status	88
8.3.74	RLM – Return link message	89
8.3.75	RMA – Recommended minimum specific LORAN-C data	90
8.3.76	RMB – Recommended minimum navigation information	90
8.3.77	RMC – Recommended minimum specific GNSS data.....	91
8.3.78	ROR – Rudder order status.....	92
8.3.79	ROT – Rate of turn.....	93
8.3.80	RRT – Report route transfer.....	93
8.3.81	RPM – Revolutions	94
8.3.82	RSA – Rudder sensor angle	94
8.3.83	RSD – Radar system data	94
8.3.84	RTE – Routes	95
8.3.85	SFI – Scanning frequency information	96
8.3.86	SMI – SafetyNET Message, All Ships/NavArea	96
8.3.87	SM2 – SafetyNET Message, Coastal Warning Area	98

8.3.88	SM3 – SafetyNET Message, Circular Area address	100
8.3.89	SM4 – SafetyNET Message, Rectangular Area Address	102
8.3.90	SMB – IMO SafetyNET Message Body	105
8.3.91	SPW – Security password sentence	106
8.3.92	SSD – AIS ship static data	107
8.3.93	STN – Multiple data ID	107
8.3.94	THS – True heading and status	108
8.3.95	TLB – Target label	108
8.3.96	TLL – Target latitude and longitude	108
8.3.97	TRC – Thruster control data	109
8.3.98	TRL – AIS transmitter-non-functioning log	110
8.3.99	TRD – Thruster response data	111
8.3.100	TTD – Tracked target data	111
8.3.101	TTM – Tracked target message	113
8.3.102	TUT – Transmission of multi-language text.....	114
8.3.103	TXT – Text transmission	115
8.3.104	UID – User identification code transmission.....	116
8.3.105	VBW – Dual ground/water speed.....	116
8.3.106	VDM – AIS VHF data-link message	117
8.3.107	VDO – AIS VHF data-link own-vessel report	118
8.3.108	VDR – Set and drift.....	118
8.3.109	VER – Version	119
8.3.110	VHW – Water speed and heading.....	119
8.3.111	VLW – Dual ground/water distance.....	120
8.3.112	VPW – Speed measured parallel to wind	120
8.3.113	VSD – AIS voyage static data.....	120
8.3.114	VTG – Course over ground and ground speed	121
8.3.115	WAT – Water level detection	121
8.3.116	WCV – Waypoint closure velocity	122
8.3.117	WNC – Distance waypoint to waypoint	123
8.3.118	WPL – Waypoint location	123
8.3.119	XDR – Transducer measurements	123
8.3.120	XTE – Cross-track error, measured	124
8.3.121	XTR – Cross-track error, dead reckoning.....	125
8.3.122	ZDA – Time and date	125
8.3.123	ZDL – Time and distance to variable point.....	125
8.3.124	ZFO – UTC and time from origin waypoint	125
8.3.125	ZTG – UTC and time to destination waypoint.....	126
9	Applications.....	126
9.1	Example parametric sentences.....	126
9.1.1	General	126
9.1.2	Example 1 – LORAN-C latitude/longitude	126
9.1.3	Example 2 – LORAN-C arrival alarm	126
9.1.4	Example 3 – Proprietary sentence	127
9.1.5	Example 4 – RMA examples.....	127
9.1.6	Example 5 – FSI examples.....	128
9.1.7	Example 6 – MSK/MSS examples.....	128
9.1.8	Example 7 – DSC and DSE sentences	128

9.1.9	Example 8 – FIR, DOR and WAT sentences	129
9.2	Example encapsulation sentences.....	129
9.3	Examples of receiver diagrams.....	130
Annex A (informative)	Glossary.....	131
Annex B (normative)	Guidelines for methods of testing and required test results	138
B.1	General	138
B.2	Definition of environmental conditions for the tests	138
B.3	Examination of the manufacturer's documentation	138
B.4	Test of hardware.....	139
B.4.1	Interface units.....	139
B.4.2	Input circuit test	139
B.4.3	Check of electrical isolation	139
B.4.4	Maximum input voltage test.....	139
B.4.5	Test arrangement for performance tests according to IEC 60945	139
B.4.6	Test under maximum interface workload.....	139
B.4.7	Test for correct parsing of sentences	140
B.4.8	Test under long term conditions	141
B.4.9	Protocol test of the interface of the EUT	141
Annex C (normative)	Six-bit binary field conversion.....	147
Annex D (normative)	Alarm system fields	150
Annex E (informative)	Example of use of FIR, DOR and WAT sentences	159
E.1	Example of the use of system status messages	159
E.2	Use of system division codes	159
E.3	Send complete status.....	160
E.4	Change measurement point status	161
E.5	Point status change during a status update	161
E.6	Failure in a sub-system	161
E.7	Status updates when a sub-system is in fault	162
E.8	Signal a correction of a sub-system fault	162
Annex F (informative)	Example encapsulation sentence	163
F.1	Example encapsulation sentence	163
F.2	AIS VHF data-link message VDM sentence encapsulation example	163
F.3	Background discussion – Encapsulation coding.....	163
F.4	Decoding the encapsulated string.....	165
F.5	Conversion from symbols to binary bits	165
F.6	Organising the binary message data	166
F.7	Interpreting the decoded binary strings.....	166
Bibliography	169
Figure 1	– Listener receive circuit	15
Figure 2	– Data transmission format.....	15
Figure 3	– Example 1, J-FET, N channel, opto-isolator based listener circuit	130
Figure 4	– Example 2, NPN opto-isolator based listener circuit.....	130
Figure C.1	– 6-bit binary code converted to valid IEC 61162-1 character	148
Figure C.2	– Valid IEC 61162-1 character converted to 6-bit binary code.....	149
Figure E.1	– Example system diagram	160

Figure F.1 – Message data format.....	164
Figure F.2 – Work sheet for decoding and interpreting encapsulated string.....	168
Table 1 – Reserved characters	26
Table 2 – Valid characters	26
Table 3 – Character symbol	27
Table 4 – Talker identifier mnemonics.....	28
Table 5 – Field type summary	31
Table B.1 – Example – Special characters	140
Table B.2 – Example – Parsing	140
Table B.3 – Example – Future extensions	141
Table B.4 – Example – Data string GGA sent by the EUT to the test receiver (listener).....	142
Table B.5 – Example – Checksum data sent	143
Table B.6 – Example – Data string GNS received by the EUT.....	144
Table B.7 – Example – Checksum data received.....	145
Table B.8 – Example – Break of data line.....	146
Table B.9 – Example – Receiving interval	146
Table B.10 – Example – Talker ID.....	146
Table C.1 – Six-bit binary field conversion table	147
Table D.1 – System alarm fields.....	150
Table F.1 – Example message from ITU-R M.1371	167

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 1: Single talker and multiple listeners

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61162-1 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This fifth edition cancels and replaces the fourth edition published in 2010, and constitutes a technical revision.

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

- new identifiers have been added to Table 4;
- the sentences CBR and MEB have been removed as they are now solely used by AIS shore based equipment;
- new sentences ACN, ALC, ALF, ARC, EPV, HCR, HRM, MOB, NSR, RLM, RRT, SM1, SM2, SM3, SM4, SMB, SPW and TRL have been added;

- revisions have been made to ABK, ABM, GNS, NAK, NRM, RMC, ROR and TTD;
- the methods of testing in Annex B have been revised.

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

FDIS	Report on voting
80/799/FDIS	80/806/RVD

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

A list of all parts in the IEC 61162 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Digital interface*, can be found on the IEC website.

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

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

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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 61162 Maritime navigation and radiocommunication equipment and systems – Digital interfaces consists of 5 parts which specify digital interfaces for application in marine navigation, radiocommunication and system integration, as follows:

- Part 1: *Single talker and multiple listeners;*
- Part 2: *Single talker and multiple listeners, high speed transmission;*
- Part 3: *Multiple talkers and multiple listeners – Serial data instrument network;*
- Part 450: *Multiple talkers and multiple listeners – Ethernet interconnection;*
- Part 460: *Multiple talkers and multiple listeners – Ethernet interconnection – Safety and security*

IEC technical committee 80 interface standards are developed with input from manufacturers, private and government organisations and equipment operators. The information is intended to meet the needs of users at the time of publication, but users should recognise that as applications and technology change, interface standards should change as well. Users of this standard are advised to immediately inform the IEC of any perceived inadequacies therein.

The first edition of IEC 61162-1 was published in 1995. The second edition published in 2000 removed some sentences which were no longer in use, added some new sentences and included details of the ship equipment defined in IMO resolutions together with appropriate sentences for communication between them. This information was subsequently removed from the third edition when it became the practice to specify the sentence formatters in the individual standards for equipment.

The third edition published in 2007 introduced a re-arrangement of the text and new sentences particularly to support the Automatic Identification System and the Voyage Data Recorder. The third edition also introduced a further type of start of sentence delimiter. The conventional delimiter "\$" was retained for the conventional sentences which are now called parametric sentences. The new delimiter "!" identifies sentences that conform to special purpose encapsulation.

The fourth edition removed some sentences which were not in use, added some new sentences for new applications and made some corrections and additions. In particular the sentences of relevance to satellite navigation receivers were expanded to facilitate the description of new satellite systems.

This fifth edition also removes some sentences which are no longer in use, adds some new sentences for new applications and makes some corrections and additions.

Liaison has been maintained with NMEA and this edition has been aligned where appropriate with NMEA 0183 version 4.10.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 1: Single talker and multiple listeners

1 Scope

This part of IEC 61162 contains the requirements for data communication between maritime electronic instruments, navigation and radiocommunication equipment when interconnected via an appropriate system.

This part of IEC 61162 is intended to support one-way serial data transmission from a single talker to one or more listeners. These data are in printable ASCII form and may include information such as position, speed, depth, frequency allocation, etc. Typical messages may be from about 11 to a maximum of 79 characters in length and generally require transmission no more rapidly than one message per second.

The electrical definitions in this standard are not intended to accommodate high-bandwidth applications such as radar or video imagery, or intensive database or file transfer applications. Since there is no provision for guaranteed delivery of messages and only limited error checking capability, this standard should be used with caution in all safety applications.

For applications where a faster transmission rate is necessary, reference should be made to IEC 61162-2.

For applications to shore based equipment of the automatic identification system (AIS) reference should be made to the IEC 62320 series.

2 Normative references

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

IEC 60945:2002, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61097-6, *Global maritime distress and safety system (GMDSS) – Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)*

IEC 61108 (all parts), *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS)*

IEC 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interface*

IEC 61162-2:1998, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission*