



IEC 61162-1

Edition 4.0 2010-11

# INTERNATIONAL STANDARD



---

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

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE **XG**

---

ICS 47.020.70

ISBN 978-2-88912-256-1

## CONTENTS

FOREWORD .....	7
INTRODUCTION.....	9
1 Scope .....	10
2 Normative references .....	10
3 Terms and definitions .....	11
4 Manufacturer's documentation .....	11
5 Hardware specification .....	11
5.1 General .....	11
5.2 Interconnecting wire.....	11
5.3 Conductor definitions .....	11
5.4 Electrical connections/shield requirements .....	12
5.5 Connector .....	12
5.6 Electrical signal characteristics.....	12
5.6.1 General.....	12
5.6.2 Signal state definitions.....	12
5.6.3 Talker drive circuits .....	12
5.6.4 Listener receive circuits .....	12
5.6.5 Electrical isolation .....	13
5.6.6 Maximum voltage on bus .....	13
6 Data transmission .....	13
7 Data format protocol .....	14
7.1 Characters .....	14
7.1.1 General.....	14
7.1.2 Reserved characters .....	14
7.1.3 Valid characters .....	14
7.1.4 Undefined characters.....	14
7.1.5 Character symbols.....	14
7.2 Fields .....	14
7.2.1 String .....	14
7.2.2 Address field.....	15
7.2.3 Data fields .....	15
7.2.4 Checksum field.....	16
7.2.5 Sequential message identifier field .....	17
7.3 Sentences.....	17
7.3.1 General structure.....	17
7.3.2 Description of approved sentences .....	17
7.3.3 Parametric sentences .....	18
7.3.4 Encapsulation sentences .....	19
7.3.5 Query sentences.....	21
7.3.6 Proprietary sentences .....	21
7.3.7 Command sentences.....	22
7.3.8 Valid sentences .....	23
7.3.9 Multi-sentence messages .....	23
7.3.10 Sentence transmission timing .....	23
7.3.11 Additions to approved sentences .....	23

7.4	Error detection and handling.....	24
7.5	Handling of deprecated sentences .....	24
8	Data content .....	24
8.1	Character definitions.....	24
8.2	Field definitions.....	27
8.3	Approved sentences .....	29
8.3.1	General format .....	29
8.3.2	AAM – Waypoint arrival alarm .....	29
8.3.3	ABK – AIS addressed and binary broadcast acknowledgement.....	29
8.3.4	ABM – AIS addressed binary and safety related message.....	31
8.3.5	ACA – AIS channel assignment message .....	31
8.3.6	ACK – Acknowledge alarm .....	33
8.3.7	ACS – AIS channel management information source.....	33
8.3.8	AIR – AIS interrogation request .....	33
8.3.9	AKD – Acknowledge detail alarm condition .....	35
8.3.10	ALA – Report detailed alarm condition .....	35
8.3.11	ALR – Set alarm state.....	36
8.3.12	APB – Heading/track controller (autopilot) sentence B.....	37
8.3.13	BBM – AIS broadcast binary message .....	37
8.3.14	BEC – Bearing and distance to waypoint – Dead reckoning.....	38
8.3.15	BOD – Bearing origin to destination .....	39
8.3.16	BWC – Bearing and distance to waypoint – Great circle .....	39
8.3.17	BWR – Bearing and distance to waypoint – Rhumb line.....	39
8.3.18	BWW – Bearing waypoint to waypoint .....	40
8.3.19	CBR – Configure broadcast rates for AIS AtoN station message command.....	40
8.3.20	CUR – Water current layer – Multi-layer water current data .....	41
8.3.21	DBT – Depth below transducer .....	41
8.3.22	DDC – Display dimming control .....	42
8.3.23	DOR – Door status detection .....	42
8.3.24	DPT – Depth .....	44
8.3.25	DSC – Digital selective calling information .....	44
8.3.26	DSE – Expanded digital selective calling.....	45
8.3.27	DTM – Datum reference.....	45
8.3.28	ETL – Engine telegraph operation status .....	46
8.3.29	EVE – General event message .....	47
8.3.30	FIR – Fire detection .....	47
8.3.31	FSI – Frequency set information.....	49
8.3.32	GBS – GNSS satellite fault detection .....	49
8.3.33	GEN – Generic binary information .....	51
8.3.34	GFA – GNSS fix accuracy and integrity.....	52
8.3.35	GGA – Global positioning system (GPS) fix data .....	53
8.3.36	GLL – Geographic position – Latitude/longitude .....	53
8.3.37	GNS – GNSS fix data .....	54
8.3.38	GRS – GNSS range residuals .....	55
8.3.39	GSA – GNSS DOP and active satellites .....	57
8.3.40	GST – GNSS pseudorange noise statistics .....	59
8.3.41	GSV – GNSS satellites in view .....	60

8.3.42	HBT – Heartbeat supervision sentence.....	61
8.3.43	HDG – Heading, deviation and variation.....	62
8.3.44	HDT – Heading true .....	62
8.3.45	HMR – Heading monitor receive .....	63
8.3.46	HMS – Heading monitor set.....	63
8.3.47	HSC – Heading steering command.....	64
8.3.48	HSS – Hull stress surveillance systems.....	64
8.3.49	HTC – Heading/track control command; HTD – Heading /track control data.....	64
8.3.50	LR1 – AIS long-range reply sentence 1 .....	66
8.3.51	LR2 – AIS long-range reply sentence 2 .....	66
8.3.52	LR3 – AIS long-range reply sentence 3 .....	67
8.3.53	LRF – AIS long-range function.....	67
8.3.54	LRI – AIS long-range interrogation .....	68
8.3.55	MEB – Message input for broadcast command.....	69
8.3.56	MSK – MSK receiver interface.....	71
8.3.57	MSS – MSK receiver signal status .....	71
8.3.58	MTW – Water temperature .....	71
8.3.59	MWD – Wind direction and speed.....	71
8.3.60	MWV – Wind speed and angle.....	72
8.3.61	NAK – Negative acknowledgement.....	72
8.3.62	NRM – NAVTEX receiver mask.....	73
8.3.63	NRX – NAVTEX received message .....	74
8.3.64	OSD – Own ship data.....	75
8.3.65	POS – Device position and ship dimensions report or configuration command .....	76
8.3.66	PRC – Propulsion remote control status .....	77
8.3.67	RMA – Recommended minimum specific LORAN-C data .....	78
8.3.68	RMB – Recommended minimum navigation information .....	79
8.3.69	RMC – Recommended minimum specific GNSS data .....	79
8.3.70	ROR – Rudder order status .....	81
8.3.71	ROT – Rate of turn .....	81
8.3.72	RPM – Revolutions .....	81
8.3.73	RSA – Rudder sensor angle.....	81
8.3.74	RSD – Radar system data .....	82
8.3.75	RTE – Routes.....	82
8.3.76	SFI – Scanning frequency information.....	83
8.3.77	SSD – AIS ship static data .....	83
8.3.78	STN – Multiple data ID.....	85
8.3.79	THS – True heading and status.....	85
8.3.80	TLB – Target label .....	85
8.3.81	TLL – Target latitude and longitude.....	86
8.3.82	TRC – Thruster control data .....	86
8.3.83	TRD – Thruster response data .....	87
8.3.84	TTD – Tracked target data .....	87
8.3.85	TTM – Tracked target message .....	90
8.3.86	TUT – Transmission of multi-language text.....	90
8.3.87	TXT – Text transmission .....	92
8.3.88	UID – User identification code transmission.....	92

8.3.89	VBW – Dual ground/water speed.....	93
8.3.90	VDM – AIS VHF data-link message.....	93
8.3.91	VDO – AIS VHF data-link own-vessel report.....	94
8.3.92	VDR – Set and drift.....	94
8.3.93	VER – Version.....	95
8.3.94	VHW – Water speed and heading.....	96
8.3.95	VLW – Dual ground/water distance.....	96
8.3.96	VPW – Speed measured parallel to wind.....	96
8.3.97	VSD – AIS voyage static data.....	96
8.3.98	VTG – Course over ground and ground speed.....	98
8.3.99	WAT – Water level detection.....	98
8.3.100	WCV – Waypoint closure velocity.....	99
8.3.101	WNC – Distance waypoint to waypoint.....	99
8.3.102	WPL – Waypoint location.....	99
8.3.103	XDR – Transducer measurements.....	100
8.3.104	XTE – Cross-track error, measured.....	101
8.3.105	XTR – Cross-track error, dead reckoning.....	101
8.3.106	ZDA – Time and date.....	101
8.3.107	ZDL – Time and distance to variable point.....	102
8.3.108	ZFO – UTC and time from origin waypoint.....	102
8.3.109	ZTG – UTC and time to destination waypoint.....	102
9	Applications.....	102
9.1	Example parametric sentences.....	102
9.1.1	General.....	102
9.1.2	Example 1 – LORAN-C latitude/longitude.....	102
9.1.3	Example 2 – LORAN-C arrival alarm.....	103
9.1.4	Example 3 – Proprietary sentence.....	103
9.1.5	Example 4 – RMA examples.....	104
9.1.6	Example 5 – FSI examples.....	104
9.1.7	Example 6 – MSK/MSS examples.....	105
9.1.8	Example 7 – DSC and DSE sentences.....	105
9.1.9	Example 8 – FIR, DOR and WAT sentences.....	106
9.2	Example encapsulation sentences.....	106
9.3	Examples of receiver diagrams.....	106
Annex A	(informative) Glossary.....	108
Annex B	(normative) Guidelines for methods of testing and required test results.....	116
Annex C	(normative) Six-bit binary field conversion.....	122
Annex D	(normative) Alarm system fields.....	125
Annex E	(informative) Example of use of FIR, DOR and WAT sentences.....	135
Annex F	(informative) Example encapsulation sentence.....	139
Bibliography	.....	145

Figure 1 – Listener receive circuit ..... 13

Figure 2 – Data transmission format..... 14

Figure 3 – Example 1, J-FET, N channel, opto-isolator based listener circuit..... 106

Figure 4 – Example 2, NPN opto-isolator based listener circuit..... 107

Figure C.1 – 6-bit binary code converted to valid IEC 61162-1 character ..... 123

Figure C.2 – Valid IEC 61162-1 character converted to 6-bit binary code ..... 124

Figure E.1 – Example system diagram ..... 136

Figure F.1 – Message data format..... 140

Figure F.2 – Work sheet for decoding and interpreting encapsulated string ..... 144

  

Table 1 – Reserved characters ..... 24

Table 2 – Valid characters ..... 25

Table 3 – Character symbol ..... 26

Table 4 – Talker identifier mnemonics ..... 27

Table 5 – Field type summary ..... 28

Table B.1 – Example – Data string GGA sent by the EUT to the test receiver  
(listener) ..... 119

Table B.2 – Checksum ..... 120

Table B.3 – Example – Data string GGA received by the EUT ..... 120

Table B.4 – Example – Checksum..... 121

Table B.5 – Break of data line..... 121

Table C.1 – Six-bit binary field conversion table ..... 122

Table D.1 – System alarm fields ..... 125

Table F.1 – Example message from ITU-R M.1371..... 143

## 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 fourth edition cancels and replaces the third edition published in 2007, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- in Table 1 the "comment" block delimiter has been renamed "TAG" block delimiter,
- new identifiers have been added to Table 4,
- the following sentences have been removed from 8.3 as they are not used by other standards prepared by technical committee 80: ALM and MLA which described almanac data from satellite navigation systems, DCN which described DECCA data, DSI and DSR

which controlled the DSC transponder, GLC and LCD which described LORAN data, and GMP which supported land use of map projections,

- new sentences CBR, GFA, HBT, NAK, MEB, POS, TTD and VER have been added,
- corrections have been made to the following sentences: ABK, BBM, DOR, FIR, SSD, TUT, and VTG,
- extra fields have been added to AIR to support further ITU messages,
- new fields have been added to GBS, GRS, GSA and GSV to support new satellite navigation systems,
- a new navigational status indicator has been added to GNS and RMC,
- a new sentence status flag had been added to DDC, FSI, HSC and NRM,
- three additional tests have been added to Annex B.

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

FDIS	Report on voting
80/606/FDIS	80/609/RVD

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

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

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

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

- 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 publication using a colour printer.**

## INTRODUCTION

International standard IEC 61162 is a four part standard which specifies four digital interfaces for application in marine navigation, radiocommunication and system integration. The four parts are:

- IEC 61162-1 Single talker and multiple listeners;
- IEC 61162-2 Single talker and multiple listeners, high speed transmission;
- IEC 61162-3 Multiple talkers and multiple listeners – Serial data instrument network;
- IEC 61162-4 Multiple talkers and multiple listeners – Ship systems interconnection.

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.

This fourth edition removes some sentences which are not in use, adds some new sentences for new applications and makes some corrections and additions. In particular the sentences of relevance to satellite navigation receivers have been expanded to facilitate the description of new satellite systems.

Liaison has been maintained with NMEA and this edition has been aligned where appropriate with NMEA 0183 version 4.00.

# 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. This data is 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.

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

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

ISO/IEC 8859-1:1998, *Information technology – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No.1*

ITU-T X.27/V.11:1996, *Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s*