



IEC 61924-2

Edition 1.0 2012-12

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems –
Integrated navigation systems –
Part 2: Modular structure for INS – Operational and performance requirements,
methods of testing and required test results**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XG**

ICS 47.020.70

ISBN 978-2-83220-503-7

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

CONTENTS

FOREWORD.....	7
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and abbreviations	10
3.1 Terms and definitions	10
3.2 Abbreviations	19
4 MSC resolutions	19
4.1 General	19
4.2 Purpose of integrated navigation systems	20
4.3 Application	21
5 Test requirements and results	23
5.1 General	23
5.2 Exceptions for tests previously performed	23
5.3 Test site	23
5.4 Methods of test.....	24
6 Module A – Requirements for integration of navigational information	24
6.1 Interfacing and data exchange.....	24
6.1.1 Combination, processing and evaluation of data	24
6.1.2 Availability, validity and integrity	24
6.1.3 Failure of data exchange	25
6.1.4 Interfaces in general	25
6.1.5 Interface to alert management	25
6.2 Accuracy	25
6.2.1 Requirement.....	25
6.2.2 Methods of test and required results	25
6.3 Validity, plausibility, latency.....	26
6.3.1 Validity	26
6.3.2 Plausibility	27
6.3.3 Latency	27
6.4 Consistent common reference system (CCRS)	28
6.4.1 Consistency of data	28
6.4.2 Consistent common reference point (CCRP).....	28
6.4.3 Consistency of thresholds.....	30
6.5 Integrity monitoring.....	31
6.5.1 Requirement.....	31
6.5.2 Methods of test and required results	32
6.6 Marking of-data	33
6.6.1 Requirement.....	33
6.6.2 Methods of tests and required results	33
6.7 Selection of sensors and sources	33
6.7.1 Requirement.....	33
6.7.2 Methods of test and required results	34
7 Module B – Task related requirements for Integrated Navigation Systems	34
7.1 Description	34
7.2 Task and functional requirements for an INS	35
7.2.1 General	35

7.2.2	Task “Route planning”	35
7.2.3	Task “Route monitoring”	37
7.2.4	Task “Collision Avoidance”	40
7.2.5	Task “Navigation Control Data”	44
7.2.6	Task “Alert management”	46
7.2.7	Task “Status and data display”	46
7.3	Functional requirements for INS task stations	47
7.3.1	Number of task stations	47
7.3.2	Track control	49
7.3.3	Automatic control functions	49
7.4	Functional requirements for displays of INS	50
7.4.1	General	50
7.4.2	Default display configurations and operational modes	53
7.4.3	Mode and status awareness	54
7.4.4	Information display	55
7.5	Human machine interface	56
7.5.1	General	56
7.5.2	System design	57
7.5.3	Display	57
7.5.4	Input	57
7.6	INS Back-up requirements and redundancies	58
7.6.1	General	58
7.6.2	Hardware redundancies (back-up)	60
7.7	System failures and fallback arrangement	60
7.7.1	General description	60
7.7.2	Restored operation	60
7.7.3	Failure or change of sensor for automatic control function	61
7.7.4	Failure of sensor	61
7.7.5	Storage of system related parameters	62
7.7.6	Safe response to malfunction	62
7.7.7	Alert management	63
7.7.8	Fallback for navigational information failure	64
7.8	Technical requirements	65
7.8.1	General	65
7.8.2	Hardware and/or processors	66
7.8.3	Power supply	66
7.8.4	Power interruptions and shutdown	67
7.8.5	Data communication interface and protocols	68
7.8.6	Installation	68
8	Module C – Alert management	69
8.1	Description	69
8.1.1	Purpose of alert management	69
8.1.2	Scope of alert management	69
8.1.3	Application of alert management	69
8.2	General requirements	70
8.2.1	Provisions	70
8.2.2	Number of alerts for one situation	70
8.2.3	Alerts to be handled by the alert management	70
8.2.4	Logical architecture of the alert management	71

8.2.5	Alert management HMI	71
8.2.6	Audible announcements	72
8.2.7	Display at several locations	72
8.3	Priorities and categories	72
8.3.1	Priorities of alerts	72
8.3.2	Criteria for classification of alerts	73
8.3.3	Categories of alerts	73
8.4	State of alerts	74
8.4.1	General	74
8.4.2	Alarms	76
8.4.3	Warnings	80
8.4.4	Cautions	84
8.4.5	Alert escalation	84
8.5	Consistent presentation of alerts within the INS	86
8.5.1	Requirement	86
8.5.2	Methods of test and required results	86
8.6	Central alert management HMI	88
8.6.1	General requirements	88
8.6.2	Silencing of audible alerts	91
8.6.3	Category A and B alert history list	91
8.7	Acknowledgement location	93
8.7.1	Requirement	93
8.7.2	Methods of test and required results	93
8.8	Self-monitoring of alert management	94
8.8.1	Monitoring of system communication	94
8.8.2	Testing of alerts	94
8.8.3	Failures	94
8.9	Interface requirements for alert related communication	95
8.9.1	Communication concept	95
8.9.2	Alert priorities, states, etc.	95
8.9.3	Alert source identity	97
8.9.4	Acknowledge and silence	98
8.9.5	Fault tolerance of alert communication	99
8.10	Integration of systems in alert management	99
8.10.1	Overall alert management	99
8.10.2	Inclusion of other equipment	100
8.10.3	Connection of other equipment	100
9	Module D – Documentation requirements	100
9.1	Manuals	100
9.1.1	Requirement	100
9.1.2	Methods of tests and required results	101
9.2	Information regarding the system configuration	101
9.2.1	Requirement	101
9.2.2	Methods of tests and required results	102
9.3	Failure analysis	102
9.3.1	Requirement	102
9.3.2	Methods of test and required results	102
9.4	Onboard familiarization material	102
9.4.1	Requirement	102

9.4.2 Methods of test and required results	102
Annex A (informative) Modular structure for IMO performance standards	104
Annex B (informative) Guidance to equipment manufacturers for the provision of on-board familiarization material	107
Annex C (normative) Classification of alerts	110
Annex D (normative) Default display configurations	112
Annex E (informative) Data flow diagram/consistent common reference system (CCRS)	114
Annex F (normative) IEC 61162 interfaces	116
Annex G (informative) Guidance for testing	120
Annex H (normative) Verification of CCRP calculations	122
Annex I (normative) Sentence for integrity and plausibility	124
Annex J (normative) INS alert related communication	125
Annex K (normative) Sentences for advanced alert related communication	138
Annex L (normative) Alert communication with ALR and ACK	143
Annex M (normative) Icons for alert management	146
Bibliography	148
 Figure E.1 – Data flow diagram/consistent common reference system (CCRS)	 115
Figure F.1 – INS logical interfaces	116
Figure J.1 – Legacy sensor communication showing priority reduction	128
Figure J.2 – Legacy sensor communication in case priority reduction is not possible	129
Figure J.3 – Alerts' communication showing priority reduction	131
Figure J.4 – Alerts with communication in case priority reduction is not possible	132
Figure J.5 – Alert state diagram	136
Figure L.1 – State diagram	143
 Table 1 – Applicable modules of performance standards of stand alone equipment	 22
Table 2 – Applicable modules of other standards for INS to substitute for individual equipment	22
Table 3 – Marking of data	33
Table 4 – Announcement states and related conditions	74
Table 5 – Announcement state and presentation for Alarms	75
Table 6 – Announcement state and presentation for Warnings	75
Table 7 – Announcement state and presentation for Cautions	76
Table A.1 – Modular structure for radar performance standards	104
Table A.2 – Modular structure for track control performance standards	106
Table C.1 – Classification of INS alerts as specified in these performance standards	110
Table C.2 – Classification for INS for alerts specified in the individual equipment performance standards	110
Table D.1 – Task “Route monitoring”	112
Table D.2 – Task “Collision avoidance”	112
Table F.1 – IEC 61162-1 sentences transmitted by the INS	117
Table F.2 – IEC 61162-1 sentences received by the INS	118

Table H.1 – Required results.....	122
Table H.2 – Required results.....	123
Table H.3 – Required results for dynamic scenario	123
Table H.4 – Required resolution for test	123
Table J.1 – Conversion from ALR to ALF	126
Table J.2 – Conversion from ACN to ACK.....	127
Table J.3 – Unique alert identifier at alert source	134
Table M.1 – Alert management icons – Basic	146
Table M.2 – Alert management icons – Additional qualifiers	147

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND
RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –
INTEGRATED NAVIGATION SYSTEMS –****Part 2: Modular structure for INS –
Operational and performance requirements,
methods of testing and required test results**

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 61924-2 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

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

FDIS	Report on voting
80/677/FDIS	80/684/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 in the IEC 61924 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Integrated navigation systems*, can be found on the IEC website.

Text in *italics* signifies that the wording is identical to that of the referenced IMO resolution and/or the SOLAS convention.

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 standard may be issued at a later date.

The contents of the corrigendum of November 2013 have been included in this copy.

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.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – INTEGRATED NAVIGATION SYSTEMS –

Part 2: Modular structure for INS – Operational and performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61924 specifies the minimum requirements for the design, manufacture, integration, methods of testing and required test results for an integrated navigation system (INS) to comply with the International Maritime Organization (IMO) requirements of Resolution MSC.252(83). In addition, it takes account of IMO Resolution A.694(17) to which IEC 60945 is associated. When a requirement in this standard is different from IEC 60945, the requirement of this standard takes precedence.

NOTE 1 IEC 61924:2006 specifies the minimum requirements for the design, manufacture, integration, methods of testing and required test results for an integrated navigation system to comply with the earlier IMO requirements of Resolution MSC 86(70), Annex 3. Integrated navigation systems in accordance with IEC 61924:2006 are not suitable for installation after 1 January 2011.

NOTE 2 All text of this standard, whose wording is identical to that in IMO Resolution MSC.252(83) will be printed in *italics* and the Resolution and paragraph number indicated between brackets.

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

IEC 61162-1:2010, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

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

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

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 61174:2008, *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*

IEC 62065:2002, *Maritime navigation and radiocommunication equipment and systems – Track control systems – Operational and performance requirements, methods of testing and required test results*

IEC 62288:2008, *Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results*

IEC 62388:2007, *Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results*

IEC 62616:2010, *Maritime navigation and radiocommunication equipment and systems – Bridge navigational watch alarm system (BNWAS)*

IMO A.694(17), *General requirements for shipborne radio equipment forming part of the Global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO/ICAO, *International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual) Volume 3*

IMO MSC/Circ.982, *Guidelines on ergonomic criteria for bridge equipment and layout*

IMO MSC.191(79), *Performance standards for presentation of navigation-related information on shipborne navigational displays*

IMO MSC.232(82), *Revised performance standards for Electronic Chart Display and Information Systems (ECDIS)*

IMO MSC.252(83), *Performance Standards for Integrated Navigation Systems (INS)*

IMO MSC.302(87), *Performance standards for Bridge Alert Management (BAM)*

ISO 11674:2006, *Ships and marine technology – Heading control systems*