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Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 8: Enabling DSC radio equipment with remote control capabilities

Reference
DEN/ERM-TGMAR-087-8

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DSC, GMDSS, maritime, radio, SAR

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document is part 8 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.1].

National transposition dates	
Date of adoption of this EN:	14 February 2022
Date of latest announcement of this EN (doa):	31 May 2022
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 2022
Date of withdrawal of any conflicting National Standard (dow):	30 November 2023

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document states minimum requirements for GMDSS radiocommunication equipment using Digital Selective Calling (DSC) Class A [2], with the capability to fully operate handling of the automated procedures defined in part 2 of this multi-part deliverable, see ETSI EN 300 338-2 [2] from a remote position such as a central HMI.

In addition other proprietary control interfaces may apply to support full remote control of other DSC EQUIPMENT functions.

Such proprietary control interfaces (whether based on proprietary IEC 61162-1 [3] sentences or other protocols) are not part of the present document, and may co-exist with the requirements in the present document.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] Recommendation ITU-R M.493-15: "Digital selective-calling system for use in the maritime mobile service".

[2] ETSI EN 300 338-2: "Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 2: Class A DSC".

[3] IEC 61162-1 edition 5 (2016): "Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners".

[4] IEC 61162-2: "Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 2: Single talker and multiple listeners, high-speed transmission".

[5] IEC 61162-450 edition 2 (2018): "Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 300 338-1: "Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 1: Common requirements".

[i.2] IEC 61097-3 edition 2 (2017): "Global maritime distress and safety system (GMDSS) - Part 3: Digital selective calling (DSC) equipment - Operational and performance requirements, methods of testing and required results".

[i.3] IEC 61162-460 edition 2 (2018): "Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 460: Multiple talkers and multiple listeners - Ethernet interconnection - Safety and security".

[i.4] NMEA 0183: "Standard for Interfacing Marine Electronic Devices".

[i.5] ETSI EN 300 338-7: "Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 7: Implementation of Bridge Alert Management (BAM) in DSC radio equipment".

[i.6] ETSI EN 301 925: "Radiotelephone transmitters and receivers for the maritime mobile service operating in VHF bands; Technical characteristics and methods of measurement".

[i.7] ETSI EN 300 373-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 1: Technical characteristics and methods of measurement".

[i.8] ITU Radio Regulations (2020).

[i.9] Recommendation ITU-R-M.541-10 (10/2015): "Operational procedures for the use of digital selective-calling equipment in the maritime mobile service".

[i.10] Recommendation ITU-R M.1084-5 (03/2012): "Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service".

[i.11] IMO Resolution A.803(19): "Performance Standards for Shipborne VHF Radio Installations Capable of Voice Communication and Digital Selective Calling".

[i.12] IMO Resolution A.804(19): "Performance Standards for Shipborne MF Radio Installations Capable of Voice Communication and Digital Selective Calling".

[i.13] IMO Resolution A.806(19): "Performance Standards for Shipborne MF/HF Radio Installations Capable of Voice Communication, Narrow-Band Direct Printing and Digital Selective Calling".

[i.14] MSC/Circular.862: "Clarifications of Certain Requirements in IMO Performance Standards for GMDSS Equipment".

[i.15] IEC 62320-2:2016: "Maritime navigation and radiocommunication equipment and systems - Automatic identification system (AIS) - Part 2: AIS AtoN Stations - Operational and performance requirements, methods of testing and required test results".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 300 338-1 [i.1] and the following apply:

acknowledged: automated procedure it indicates that the objective of the initial DSC message has been achieved

activation: initial triggering of the MoB device i.e. both parts of the two step procedure are performed

active mode: activated mode, transmitting in an emergency situation

distress alert: name given to the single distress DSC message with the format symbol 112

distress DSC message: DSC message or acknowledgement containing the distress information

distress information: symbols within a DSC message describing a distress situation consisting of the MMSI of the vessel in distress, the nature of distress, the position of the vessel in distress, the UTC time of that position and the mode of subsequent communication

non distress DSC message: DSC messages or acknowledgements that do not have the format specifier or category of "distress"

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAS	Audible Alert Sound
ACn	AC0, AC1, AC2, AC3, AC4 or AC5 sentence
AIn	AI1, AI2, AI3, AI4, AI5, AI6, AI7, AI8, AI9 sentence
AIS	Automatic Identification System
ALC	Cyclic Alert List
ALF	BAM Alert Details
AOn	AO1, AO2, AO3, AO4 or AO5 sentence
AP	Automated procedure
APn	AP0, AP1, AP2, AP3, AP4 or AP5 sentence
ARQ	Automatic Request Query
ASCII	American Standard Communications Indication
AtoN	Aids to Navigation
AUQ	Automated Query Procedure
BIT	Binary Digit
CAM	Central Alert Mechanism
CD	NMEA indicator for DSC
CIRM	Comité International Radio-Maritime
CSTDMA	Carrier Sense Time Division Multiple Access
CUL	Cyclic Procedure List
DCR	Device Capability Report
DROBOSE	Distress Relay On Behalf Of Someone Else
DSC	Digital Selective Calling
DSE	Expanded Digital Selective Calling
ECDIS	Electronic Chart Display and Information Systems
ECI	Enhanced Caller Information EN European Standard
EPFS	Electronic Position Fixing System
EPIRB	Electronic Position Indicating Radio Beacon
EPV	Equipment Property Value
ERM	European Radio Management
FATDMA	Manually Managed AIS TDMA access for AtoN and Base Stations
FEC	Forward Error Correction
FIFO	First in, First Out
FSC	Frequency Status and Command
FSI	Frequency Set information
FSS	Frequency Selection Set
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HBT	Heartbeat
HF	High Frequency
HMI	Human Manual Intervention
IEC	International Electronic Commission
IMO	International Maritime Organisation
IN	NMEA indicator for Integrated Navigation
ITU	International Telecommunication Union

ITU-R	International Telecommunication Union - Radio
LSB	Least Significant Bit
MF	Medium Frequency
MF/HF	Medium Frequencies/High Frequencies [Radio Frequencies]
MHZ	MegaHertz (Frequency indication)
MMSI	Maritime Mobile Service Identity
MOB	Man Over Board
MSB	Most Significant Bit
MSC	Maritime Safety Committee (IMO)
NAK	Negative acknowledgment
NBDP	Narrow Band Direct Printing
NMEA	National Marine Electronics Association
NW	North West point of geographical area location
OK	Accepted
RATDMA	Random Access AIS TDMA for Class 'A' network entry
SFI	Scanning Frequency information
SNGF	Serial Network Gateway Function SNMP Server Network Management Protocol
TAG	Advanced Communications for NMEA networks
TCP/IP	Transmission Control Packet/Internet Protocol
TX/RX	Transmitter/Receiver or Transceiver
UDP	Unaddressed Data Packet
UTC	Universal Time Co-ordinated
VDL	VHF Data Link
VHF	Very High Frequency
VoIP	Voice over IP

4 General requirements

4.1 General

For safety reasons the remote control facility is a functional extension to, not a substitution of, any facilities as required in ETSI EN 300 338-2 [2]. Full compliance with ETSI EN 300 338-2 [2] shall be required.

The remote protocol described in the current document shall support the concept of the automated procedures defined in ITU Recommendation ITU-R M.493-15 [1]. This will enable the simultaneous overview of several active automated procedures on a larger display, as well as supporting distribution of target states to navigation instruments.

The signalling interface defined is also suitable to exploit for testing purposes.

The evolution of new radio performance standards and carriage requirements may initially require only parts of the interface functionality. It shall be possible for the manufacturer to state and document partial compliance to the present document. E.g.:

- Sentences supported.
- Features supported:
    - Information only. Document supported fields of status sentences to reflect radio state - selected from Table 1.
    - Radio control. Document supported fields of control and status sentences - selected from Table 1 and Table 2.

4.2 Interfaces

4.2.1 General

Data interfaces for remote control purposes shall be compatible with at least one of IEC 61162-1 [3], IEC 61162-2 [4] and IEC 61162-450 [5]. The manufacturer shall specify which alternative of IEC 61162 ([3], [4] or [5]) the physical interface supports.

4.2.2 Physical connection

The general required interface may be:

- physically part of the individual equipment/function; or
- connected using a proprietary interface to an external unit supporting the required interfaces towards the remote controller system (e.g. being part of a larger system).

In both configurations, compliance to the present document shall be demonstrated as a whole presented on the required interfaces (clause 4.2.1).

4.2.3 Ethernet protocols

The IEC 61162-1 [3] sentences sent over the Ethernet (see IEC 61162-450 [5]) are using the UDP multicast datagrams.

Other protocols/logical connections may exist on the same physical connection (including TCP/IP or SNMP) if the equipment supports these layers.

The traffic limitations and requirements shall be kept as specified in IEC 61162-450 [5] (see annex B).

4.2.4 Audio interfaces

Audio interfaces for the remote support of subsequent communications in a DSC automated procedure or communication in a non-DSC communication automated procedure may be accomplished by the analog interfaces as defined in the equipment standards ETSI EN 301 925 [i.6] and ETSI EN 300 373-1 [i.7], but alternative digital audio interfaces shall be allowed (e.g. VoIP).

The manufacturer shall declare the audio interface to use for testing.

4.2.5 Sentences to support on the interface

For remote display and/or command purposes and test purposes the equipment shall be capable of transmitting and receiving the sentences (see IEC 61162-1 [3] and annex A) as defined in Table 1 and Table 2.

Connection of, or failure within any connected equipment, shall not affect the required performance of the DSC equipment.

Table 1: Remote control sentences transmitted by the DSC equipment

Mnemonic	Interface	Name	Comment
AP0	Automated Procedure Configuration Status	Config status	Report status of parameters available in standby mode
AP1[a]	Remote display status or allowed command of Sending Distress automated procedure	Automated Procedure Status and available control	Report status of the ITU procedure Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4

Mnemonic	Interface	Name	Comment
AP2[a]	Remote display status or allowed command of Receiving Distress automated procedure	Automated Procedure Status and available control	Report status of the ITU procedure Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4
AP3[a]	Remote display status or allowed command of Sending non-distress automated procedure	Automated Procedure Status and available control	Report status of the ITU procedure Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4
AP4[a]	Remote display status or allowed command of Receiving non-distress automated procedure	Automated Procedure Status and available control	Report status of the ITU procedure Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4
AP5[a]	Remote display status or allowed command of communication automated procedure	Automated Procedure Status and available control	Report status of the ITU procedure Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4
AO1	Available options in sending own distress procedure	Reports options in the current state of the procedure.	
AO2	Available options in receiving distress procedure	Reports options in the current state of the procedure.	
AO3	Available options in sending non distress procedure	Reports options in the current state of the procedure.	
AO4	Available options in receiving non distress procedure	Reports options in the current state of the procedure.	
AO5	Available options in communications procedure	Reports options in the current state of the procedure.	
CUL[a]	Remote display or command	Cyclic Procedure List	Control proper operation of the ITU procedure Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4
DSC[b] DSE ECI[a]	Remote display or command	Digital selective calling information	Report a received DSC call detail information
EPV	Remote display or command	Equipment property value	Report equipment property values
FSS[a]	Remote display or command	Frequency selection set	Report setting of radio frequency
HBT	Remote display or command	Heartbeat	Integrity test

Mnemonic	Interface	Name	Comment
NAK	Remote display or command	Negative acknowledgement	Used to inform commander about refusal to set equipment property values
OCC[a]	Remote display or command	Occupation Control	Control possible multiple command sources Support for Recommendation ITU-R M.493-15 [1], annexes 3 and 4
SFI	Remote display or command	Scanning frequency information	Report scanning frequency of DSC
DCR	Device Capability Report	Class of DSC and mdes frequencies available	Functionality available.
NOTE a: See annex A. NOTE b: Test Requirement.			

Table 2: Remote control sentences received by the DSC equipment

Mnemonic	Interface	Name	Comment
AC0	Remote command of Automated Procedure Configuration	Config command	Setting of parameters available in standby mode
AC1[a]	Remote control commands for Sending Distress automated procedure	Automated Procedure Control	Used to control the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AC2[a]	Remote control commands for Receiving Distress automated procedure	Automated Procedure Control	Used to control the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AC3[a]	Remote control commands for Sending non-distress automated procedure	Automated Procedure Control	Used to control the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AC4[a]	Remote control commands for Receiving non-distress automated procedure	Automated Procedure Control	Used to control the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AC5[a]	Remote control commands for communication automated procedure	Automated Procedure Control	Used to control the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI1	Automated procedure Initiate - Sending Own Distress. This is a command sentence	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4

Mnemonic	Interface	Name	Comment
AI2	Initiate All ships urgency and safety (VHF) - Frequency	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI3	Initiate Geographical area urgency and safety (MF/HF)	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI4	Initiate Individual Urgency and safety (VHF/MF/HF) - Frequency/Position	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI5	Initiate Individual Urgency and safety- Test	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI6	Initiate Routine Group - Frequency	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI7	Initiate Routine Individual- Frequency/Position/Data	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI8	Automated procedure Initiate DROBOSE	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AI9	Initiate Communications Call	Automated Procedure Start	Used to initiate the ITU procedure Support for Recommendation ITU-R M.493-15 [1] annexes 3 and 4
AAS	Audible Alert Sound Status and Control, This is a command sentence	Config of Alert sounds.	
AUQ[a]	DSC Automated procedure query information	Automated Procedure Query	Used to query for details of an automated DSC procedure
FSS[a]	Remote display or command	Frequency selection set	Used to control radio frequency
HBT	Remote display or command	Heartbeat	Integrity test
SFI	Remote display or command	Scanning frequency information	Used to set scanning frequencies of DSC
NOTE a: See annex A.			

5 DSC remote control communication

5.1 Introduction

Clause 5 concerns the support of remote control of multiple automated procedures as defined in ETSI EN 300 338-2 [2] and Recommendation ITU-R M.493-15 [1], annexes 3 and 4.

It allows for the integration between radio and navigation equipment in the way that multiple automated procedures including subsequent communication can be handled on e.g. an ECDIS using compliant DSC radios. Sentences are defined in annex A.

The automated procedure identifier value is used to facilitate communication within the remote control interface sentences. The sentences support a cyclic range of 0 - 99. The value is increased and assigned as a unique identifier each time a new automated procedure is allocated. The value remains assigned to the automated procedure through its life-cycle.

The automated procedure identifier value is to be used in all sentences addressing specific automated procedures.

The automated procedure identifier value should be identical to the instance number used for alert communication towards a CAM (ALC, ALF) (see ETSI EN 300 338-7 [i.5]).

Sentences DSC, DSE from IEC 61162-1 [3] only consider single received and transmitted DSC calls. The sentences described in the present standard handle control of automated procedures throughout its entire life-cycle. DSE sentences are used to provide additional information of single calls within the procedure.

For symbol error rate test purposes only, DSC and DSE sentences shall be sufficient. For test purposes the transmitter/receiver(s) shall be controlled by FSS and SFI sentences and these simple call messages are signalled for transmit and receive on the applicable IEC 61162 interface [3], [4] and [5].

The manufacturer may additionally add a number of documented proprietary sentences to support remote operation. These sentences shall fulfil the requirements for proprietary sentences as described in IEC 61162-1 [3], paragraph 7.3.6.

5.2 Use of AC0, AC1, AC2, AC3, AC4 and AC5

If the equipment cannot process an ACn command request the equipment shall generate a NAK sentence response providing an appropriate "reason code".

In case the reason for generating the NAK is a result of a procedural or operational warning that can be resolved by a simple command (OK or CANCEL), the procedure may require the action to resolve this either by HMI entry or by using another ACn sentence (with the necessary command).

The manufacturer shall specify how to identify those NAK sentences from other sentences, and the options shall be described in the NAK sentence. Furthermore the corresponding APn sentence may be transmitted with available allowed command options.

Any subsequent communication within a procedure, if allowed, shall be controlled by using the FSS command.

5.3 Use of AO1, AO2, AO3, AO4 and AO5

The purpose of these AOn sentences are solely the query for the available options in the automated procedures.

They shall in no way change the status of any automated procedure.

5.4 Use of AP0, AP1, AP2, AP3, AP4 and AP5

The APn sentence shall be broadcast to all upon any creation, state change or update of an automated procedure in the equipment, including a state changing command from a remote station.

The APn sentence is also used to report the allowed commands to be issued in the ACn command sentence. Thus giving the remote unit the possibility to present only the allowed command options for a given procedure.

The APn sentence should be transmitted whenever the valid command set for an automated procedure has changed.

Furthermore, the APn sentence shall be transmitted in reply to a query.

Self-terminating procedures shall be reported with all available states, but shall not require any control actions.

5.5 Use of AI1 to AI9

These AIn sentences are for initiating specific types of DSC calls and will result in the related APn broadcast from the DSC equipment.

5.6 Use of AUQ

This Query sentence is designed to support remote control of DSC radios. Query types include automated procedures and related DSC radio messages, distress, received and transmit logs.

If the AUQ Sentence is NOT accepted by the DSC radio, the DSC Radio shall generate a NAK Sentence.

5.7 Use of DCR Device Capability Report

This sentence is a generic NMEA 0183 [i.4] sentence used to report the capabilities of a device. The identification of the device's capabilities is specified in the appropriate equipment standard.

6 Remote control in standby, DSC and non-DSC automated procedures

6.1 General

Testing of the automated procedure remote interface shall be carried out according to the applicable clauses in ETSI EN 300 338-2 [2] where the automatic procedures are validated. Guidance to the tests:

a) when an automated procedure is created or changes state, it shall be verified that the correct status of the procedure is reported via the APn sentence;

b) when operator options are available and tested, the selection of at least one of these options shall be performed via the ACn sentence (see clause A.1), and validate that the selection is reflected on both display and via the APn sentence in parallel (see clause A.1).

The tests outlined reflect chosen scenarios where values for MMSI numbers, frequencies, procedure instance numbers, etc. are inserted. These values may differ because of the actual test scenarios chosen by the test personnel. Check sum values are shown as "hh" and shall be validated in general.

The important things to validate, are the sequence of sentences and that the information and states coincides with the information and states shown on the display of the DSC equipment.

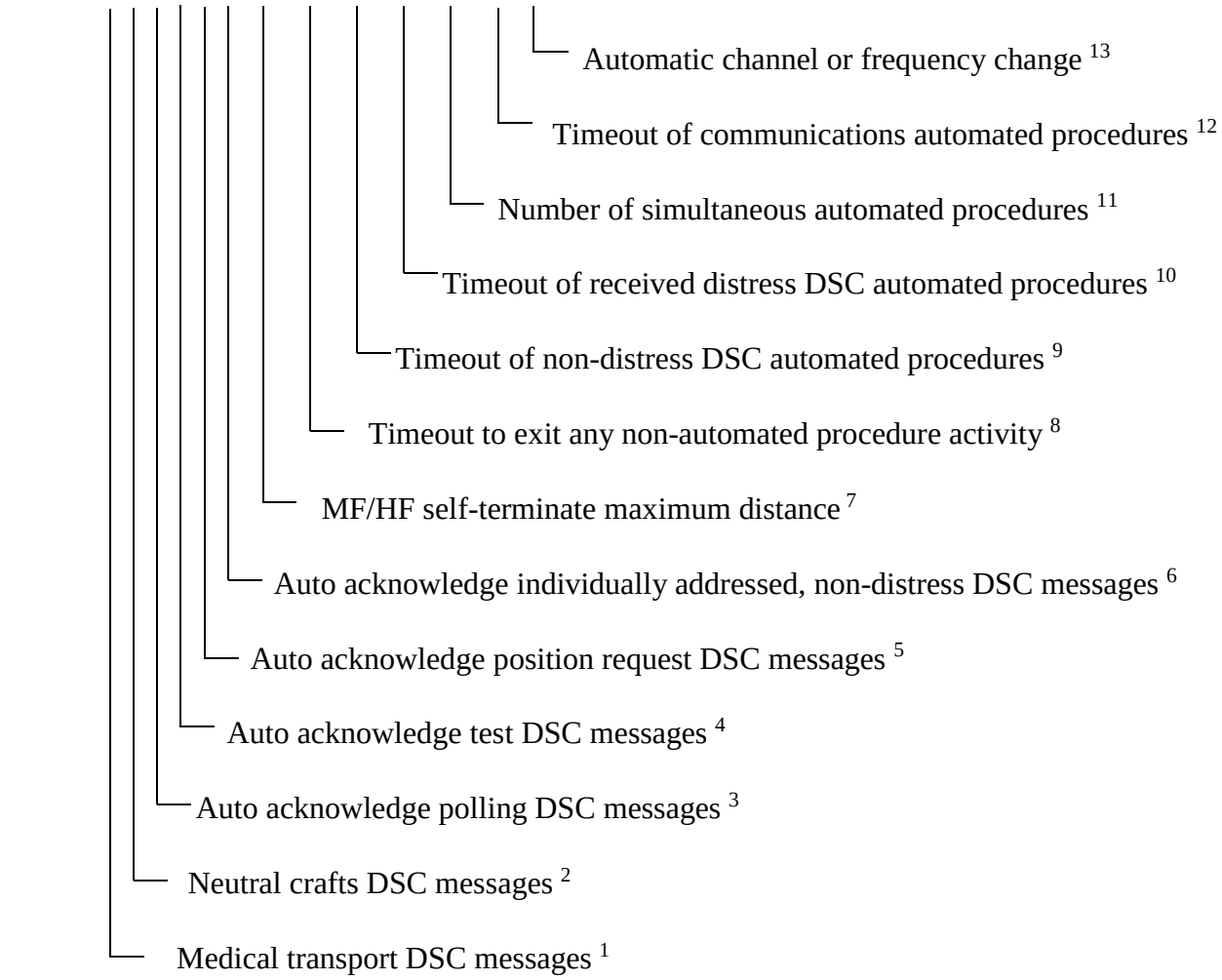
Annex A (normative): Sentences to support DSC remote control

A.1 Introduction

A.1.1 AP0 - Automated Procedure Configuration Status

This sentence supports DSC Radio remote control and is applicable to all DSC maritime mobile radios, including VHF, MF and HF. The AP0 sentence is only generated by the DSC controller and shall be used to provide configuration status from the DSC controller, based on current. The AP0 and AC0 sentences facilitate remote control configuration of a black box DSC radio. This sentence is broadcasted to all upon equipment startup and initialization, any configuration item state change or query. The AC0 sentence will only be accepted by the DSC controller to alter settings when the DSC controller is in standby mode, i.e. no active automated procedures, while the AP0 sentence may be queried at any time for current settings.

Furthermore, the sentence shall be transmitted in reply to a standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active procedure.



Use of fields:

1) The send "Medical transport DSC messages" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off (default)

   1 = On

2) The send "Neutral crafts DSC messages" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off (default)

   1 = On

3) The "Auto acknowledge polling DSC messages" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

4) The "Auto acknowledge test DSC messages" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

5) The "Auto acknowledge position request DSC messages" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off (default)

   1 = On

6) The "Auto acknowledge individually addressed, non-distress DSC messages" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

7) The "MF/HF self-terminate maximum distance" option configuration is reported in this data field. The option on MF/HF equipment to set the maximum distance for sounding a two-tone alarm that does not self-terminate upon initiation of a received distress automated procedure to some value greater than or equal to 500 nautical miles. Any value from 1 to 500 shall be interpreted as 500. If the DSC radio does not support MF/HF operation, this field may be null, otherwise, this field shall not be null. This is a variable length integer field and may contain the following values:

   0 = never self-terminate

   Range 500 - 9 999 miles (default is 500)

8) The "Activity timeout to exit any non-automated procedure activity" option configuration is reported in this data field. This field shall not be null. This is a variable length integer field and may contain the following values:

   0 = no timeout

   Range 1 - 999 minutes (default is 10)

9) The activity "Timeout of non-distress DSC automated procedures" option configuration is reported in this data field. This field shall not be null. This is a variable length integer field and may contain the following values:

   0 = no timeout

   Range 1 - 999 minutes (default is 15)

10) The activity "Timeout of received distress DSC automated procedures" option configuration is reported in this data field. This field shall not be null. This is a variable length integer field and may contain the following values:

   0 = no timeout (default)

   Range 1 - 999 minutes

11) The maximum "Number of simultaneous automated procedures" option configuration is reported in this data field. All DSC radios are required to support a minimum of seven (7) simultaneous Automated Procedures. DSC radios may be designed to support more than the minimum. This field shall not be null. This is a variable length integer field and may contain the following values:

   0 = no timeout (default)

   Range 7 - 99

12) The no activity "Timeout of communications automated procedures" option configuration is reported in this data field. This field shall not be null. This is a variable length integer field and may contain the following values:

   Range 10 - 500 seconds (default 30 seconds)

13) The "automatic channel or frequency change" option configuration is reported in this data field. This field shall not be null. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

A.1.2 AP1 - Sending Distress Automated Procedure Status VHF and MF/HF

This sentence supports DSC Radio remote control and is applicable to all DSC maritime mobile radios, including VHF, MF and HF. The AP1 sentence is only generated by the DSC Radio and shall be used to provide status from the DSC Radio, based on an active sending distress automated procedure, with related AO1 sentences. AC1 and AO1 sentences facilitate remote control operations of a black box DSC radio.

This sentence is broadcasted to all upon any creation, state change or update of a sending distress automated procedure in the equipment.

This sentence shall be transmitted in reply to a standard query sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for the active sending distress automated procedure, resulting in an AP1 sentence. If there is no existing sending distress automated procedure, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such active procedure".

There can only be one automated procedure for own ship distress. This own ship distress Automated procedure number can be between 0 - 99 and is unique across all automated procedures. For example, if the radio has *n* procedures running when this distress alert is made then the alert may become procedure *n+1*.

This sentence can also be transmitted in response to an AUQ sentence.

The Automated Procedure Identifier value has a range of 0 - 99.

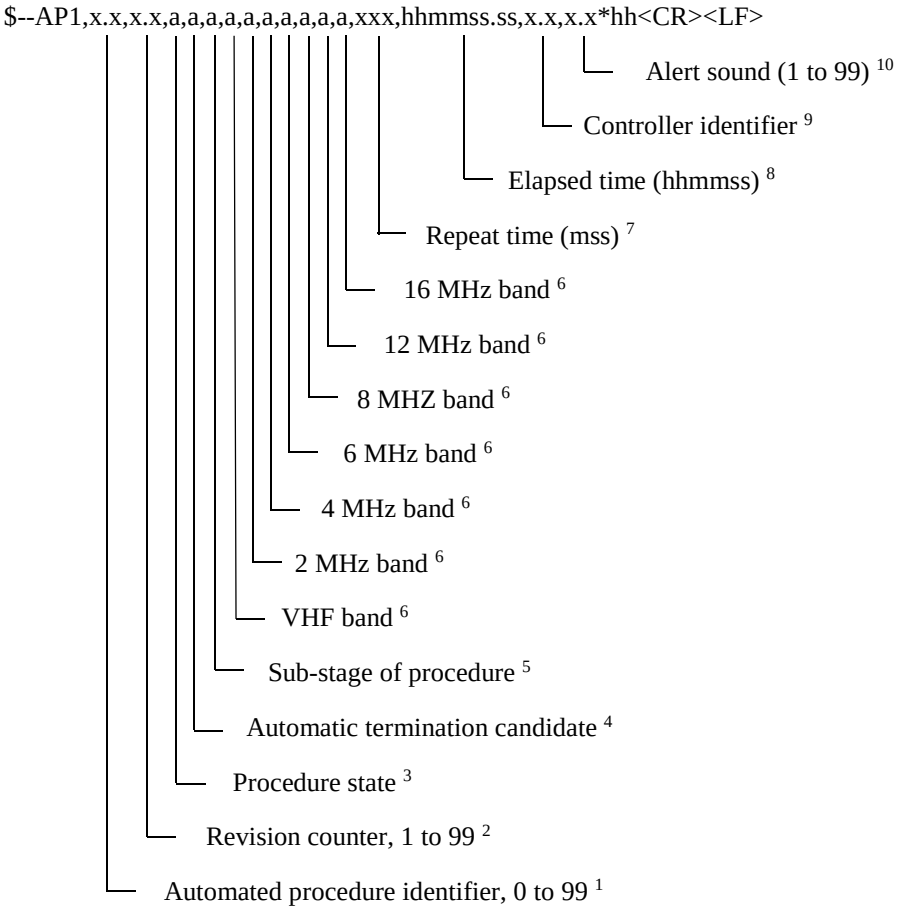
The Automated Procedure Identifier shall be unique across all Automated Procedure Status Sentences, AP1, AP2, AP3, AP4 and AP5. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP1, AO1 and AC1 shall have matching values in both of these fields if they are related.

Whenever an AP1 sentence is transmitted, the corresponding AO1 sentence shall also be transmitted relating to the same automated procedure.

If NMEA TAG Blocks are used, the AP1 sentence is also linked to the associated AO1 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications.



Use of fields:

1) This field provides the unique automated procedure identifier. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. The Revision counter is a variable length integer field that starts with 1 and has a step increment of 1. The count resets to 1 after 99 is used. The Revision counter increments on each change of content of any field in this sentence compared to last time it was transmitted for each Automated Procedure Identifier. This field shall not be null.

3) The procedure state is used to show activation of automated procedures. This field shall not be null:

   A = Procedure is 'Active'

   Q = Procedure has been 'Quit'. This is the last status sentence from this procedure

4) Automatic termination candidate. This procedure has been marked as the next candidate for automatic 'Termination' in case a new automated procedure is required to be initiated by the reception of a new DSC call. This field shall not be null:

   V = Not selected for termination

5) Sub-stages of a procedure. This field shall not be null:

   A = Acknowledged (when the distress alert (AP1) is acknowledged, the AP1 will be sent with the sub-stage set to A = Acknowledged, and the procedure state set to Q = Procedure has been 'Quit'. The DSC Controller will then auto-tune to the channel provided in the acknowledgement and will initiate an AP5 conveying the frequency information)

   B = Paused (DSC Controller is busy on other traffic, i.e. active communications procedure)

   C = Cancelled (self-cancelled)

   P = Paused countdown to resend distress (still unacknowledged - DSC Controller is busy on other traffic)

   Q = Channel Occupied

   T = Transmitting

   U = Waiting for Acknowledgment

   V = Voice cancelled on current band

   X = Linked for communication (subsequent communication on the distress frequency appropriate to that band)

6) DSC frequency band control in a distress automated procedure. If the frequency band is not used then the field is null. The character represents the state of the automated procedure within a specified band. In VHF/MF/HF equipment:

   A = Acknowledged

   C = Self-Cancelled

   R = Received band

   T = Transmitting

   U = Unacknowledged

   V = Voice cancelled

7) "Repeat time is a fixed 3-digit field (mss, where m is 0 to 9 minutes and ss is 01 to 59 seconds). Leading zeros are used to keep field lengths fixed. During an own unacknowledged distress, this is the time until the next Distress alert attempt is transmitted.

8) Elapsed time is the time waiting for acknowledgement (in unacknowledged procedure) after the initial transmitted call or time after first acknowledgement of a procedure has been received. This is a fixed length 6-digit time field with the value in units of seconds with no decimal place and no decimal value of seconds, (hhmmss).

9) Controller identifier:

   This represents the individual controller unit that initiated this sending distress automated procedure. This field shall not be null. All remote controllers shall be allowed to modify this sending distress automated procedure. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each remote controller on the vessel as defined in the equipment or installation standard upon installation.

If this field is "0" in the AP1 sentence, the automated procedure was initiated/modified by the priority (typically on the Bridge) controller.

All remote controller units may command this automated procedure. Once a remote controller unit commands the automated procedure, its controller identifier value will be reflected in further AP1 sentences for this procedure, until a different controller commands this automated procedure. For sending own distress, the DSC Radio will accept commands (AC1 sentence) from any remote controller unit and the priority controller. The controller identifier in the AP1 sentence will always reflect the last controller that commanded this automated procedure.

0 = Priority (on the Bridge) Controller that has commanded this automated procedure.

1 - 99 = Remote Controller that has commanded this automated procedure.

10) Alert Sound. See Annex H of IEC 61097-3 [i.2] for the latest information. This field shall be null when no alert sound is necessary. See the AAS - Audible Alert Sound sentence:

1 = two-tone

2 = distress ack

3 = urgency

4 = urgency ack

5 = routine, safety

6 = routine, safety ack

7 = self-terminating

8 = discrete

9 = warning

10 = count

11 - 99 = Reserved for future assignment

A.1.3 AP2 - Receiving Distress Automated Procedure Status VHF and MF/HF

This sentence supports DSC Radio remote control and is applicable to all DSC maritime mobile radios, including VHF, MF and HF. The AP2 sentence is only generated by the DSC Controller and shall be used to provide status from the DSC Controller, based on an active receiving distress automated procedure, with related AO2 sentences. AC2 and AO2 sentences facilitate remote control operations of a black box DSC radio.

This sentence is broadcasted to all upon any creation, state change or update of an automated procedure in the equipment.

Furthermore, the sentence shall be transmitted in reply to a standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active procedure, resulting in one or more AP2 sentences. If there are no existing automated procedures, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such active procedures".

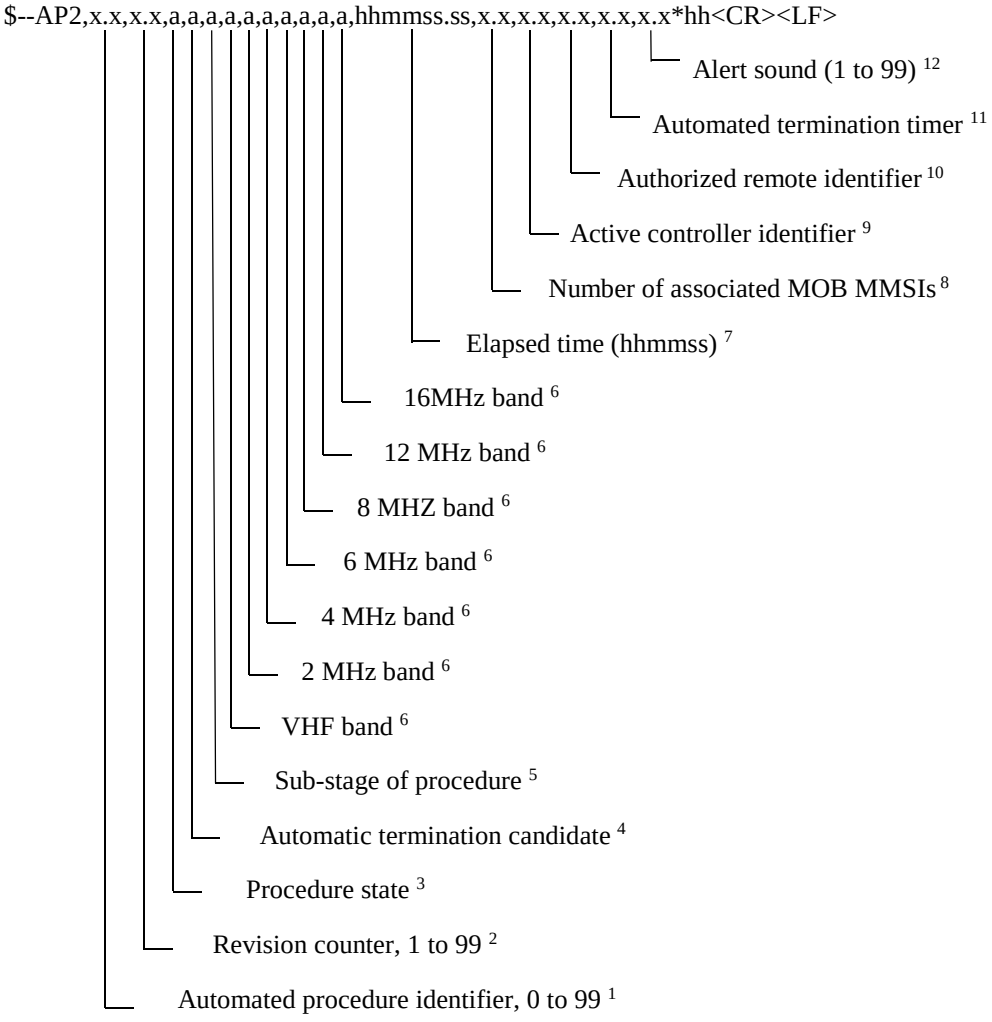
This sentence can also be transmitted in reply to an AUQ sentence (see the AUQ sentence).

The Automated procedure identifier value has a range of 0 - 99. The Automated Procedure Identifier shall be unique across all Automated Procedure Status Sentences, AP1, AP2, AP3, AP4 and AP5. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel. There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP2, AO2 and AC2 shall have matching values in both of these fields if they are related. This value is independent of the number of Automated procedures operating in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

Whenever an AP2 sentence is transmitted, the corresponding AO2 sentence shall also be transmitted relating to the same automated procedure.

If NMEA TAG Blocks are used, the AP2 sentence is also linked to the associated AO2 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications.



Use of fields:

1) This field provides the unique automated procedure identifier. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. The Revision counter is a variable length integer field that starts with 1 and has a step increment of 1. The count resets to 1 after 99 is used. The Revision counter increments on each change of content of any field in this sentence compared to last time it was transmitted for each Automated Procedure Identifier. This field shall not be null.

3) The procedure state is used to show activation of automated procedures. This field shall not be null:

   A = Procedure is 'Active'

   H = Procedure is 'On hold'

   Q = Procedure has been 'Quit'. This is the last status sentence from this procedure

4) Automatic termination candidate. This procedure has been marked as the next candidate for automatic 'Termination' in case a new automated procedure is required to be initiated by the reception of a new DSC call. This field shall not be null:

   A = Selected for termination

   V = Not selected for termination

5) Sub-stage of a procedure. This field shall not be null:

   A = Acknowledged

   B = Paused (DSC Radio is busy on other traffic, i.e. active Communications Procedure)

   C = Cancelled (self-cancelled) distress (i.e. self-acknowledged)

   Q = Channel Occupied (Waiting for Free Channel)

   S = Waiting to send acknowledgement (after receiving a call with an acknowledgement request) (see Recommendation ITU-R-M.541-10 [i.9] for specific details)

   T = Transmitting

   U = Waiting for Acknowledgment (after receiving a distress call, not linked for communication) (see Recommendation ITU-R-M.541-10 [i.9] for specific details)

   X = Linked for subsequent communication

   Y = Automatic termination paused

6) DSC frequency band status in a distress automated procedure. If the frequency band is not used then the field is null. The character represents the state of the automated procedure within a specified band. In VHF/MF/HF equipment:

   A = Acknowledged

   C = Self-Cancelled

   R = Received band

   T = Transmitting

   U = Unacknowledged

   V = Voice cancelled

7) Elapsed time is the time waiting for acknowledgement (in unacknowledged procedure) after initial transmitted/received call or time after first acknowledgement of a procedure has been transmitted/received. This is a fixed length 6-digit time field with the value in units of seconds with no decimal place and no decimal value of seconds (hhmmss).

8) Number of associated MOB MMSIs. This identifies multiple received distress calls associated with a received distress automated procedure. This is represented as a variable length integer.

9) Active controller identifier:

   Null = This automated procedure was initiated by external radio call. No shipboard controller has yet interacted with this automated procedure

   0 = Priority (on the Bridge) Controller that has commanded this automated procedure

1 - 99 = Remote Controller that has commanded this automated procedure

A numeric value represents the individual controller unit that has interacted with this receiving distress automated procedure. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard upon installation.

10) Authorized remote identifier:

Null = Indicates that the DSC Radio will accept AC2 commands sentences from any remote controller

1 - 99 = Identifies the only authorized remote controller from which the DSC Radio will accept AC2 command sentences.

Once a remote controller unit makes a command or modification to the automated procedure, it will become the authorized remote controller and its controller identifier value will be reflected in this field in further AP2 sentences for this procedure.

Only the priority controller (typically on the Bridge) and the authorized remote controller shall be allowed to modify this receiving distress automated procedure. The value in this field identifies the remote controller unit that is allowed by the DSC radio to modify the automated procedure. The DSC radio may be pre-configured as to which remote controller unit should have command capability by default.

11) The Automated termination timer provides the number of seconds that remain before this Automated Procedure is automatically terminated, range 0 to 999.

12) Alert Sound. See Annex H of IEC 61097-3 [i.2] for the latest information. This field shall be null when no alert sound is necessary. See the AAS - Audible Alert Sound sentence:

1 = two-tone

2 = distress ack

3 = urgency

4 = urgency ack

5 = routine, safety

6 = routine, safety ack

7 = self-terminating

8 = discrete

9 = warning

10 = count

11 - 99 = Reserved for future assignment

See IEC 61097-3 [i.2], AP1 note 10 Annex H for relevant information on the additional associated Alert Sound enumerations.

A.1.4 AP3 - Sending Non-Distress Automated Procedure Status

This sentence supports DSC Radio remote control and is applicable to all DSC maritime mobile radios, including VHF, MF and HF. The AP3 sentence is only generated by the DSC controller and shall be used to provide status from the DSC controller, based on an active sending non-distress automated procedure, with related AO3 sentences. AC3 and AO3 sentences facilitate remote control operations of a black box DSC controller.

This sentence is broadcasted to all upon any creation, state change or update of an automated procedure in the equipment.

Furthermore, the sentence shall be transmitted in reply to a standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active procedure, resulting in one or more AP3 sentences. If there are no existing automated procedures, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such active procedures".

The Automated procedure identifier value has a range of 0 - 99. The Automated Procedure Identifier shall be unique across all Automated Procedure Status Sentences, AP1, AP2, AP3, AP4 and AP5. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE 1: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

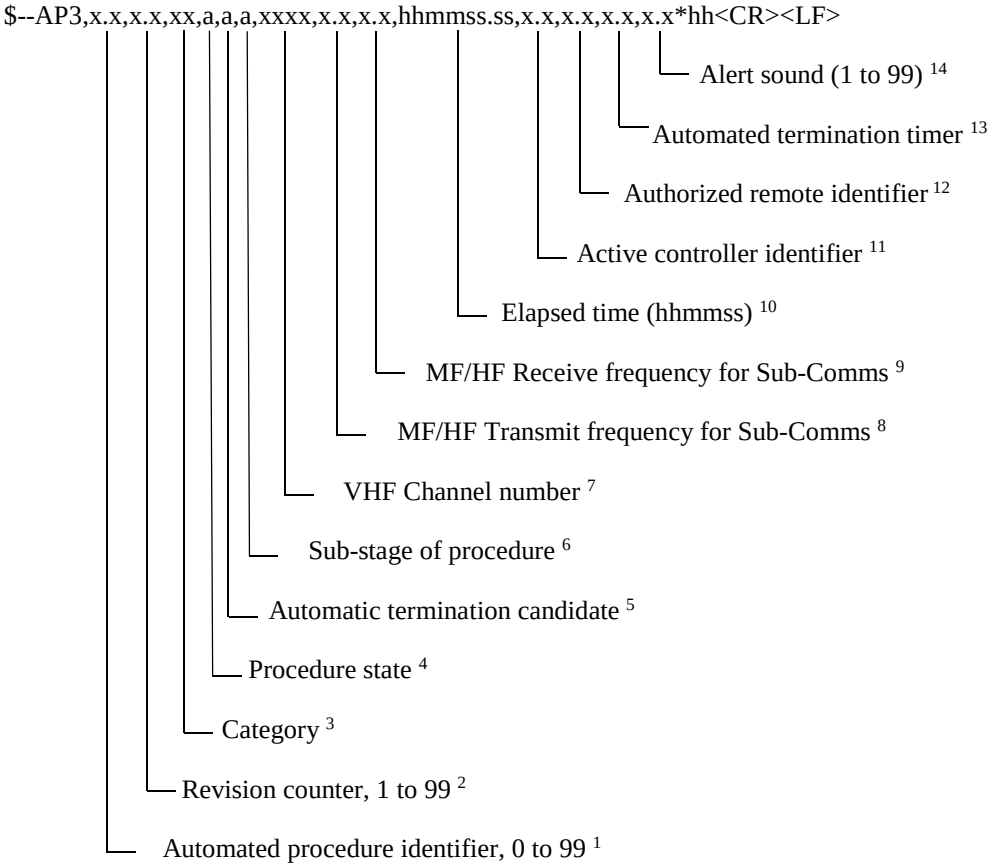
There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP3, AO3 and AC3 shall have matching values in both of these fields if they are related.

Whenever an AP3 sentence is transmitted, the corresponding AO3 sentence shall also be transmitted relating to the same automated procedure.

If NMEA TAG Blocks are used, the AP3 sentence is also linked to the associated AO3 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications.

NOTE 2: When this procedure is for the purpose of establishing subsequent communications, it will automatically terminate this procedure when those communications are established after positive acknowledgment (able to comply). The communication automatic procedure (see AP5) will automatically begin at this point.

If this procedure has been terminated and a late acknowledgment has been received, the automated procedure would be reconstructed as background procedure on hold. The user will then have the option to make it active or terminate it.



Use of fields:

1) This field provides the unique automated procedure identifier. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. The Revision counter is a variable length integer field that starts with 1 and has a step increment of 1. The count resets to 1 after 99 is used. The Revision counter increments on each change of content of any field in this sentence compared to last time it was transmitted for each Automated Procedure Identifier. This field shall not be null.

3) In the Category field, the values shall be one of the following:

   00 = Routine

   08 = Safety

   10 = Urgency

4) The Procedure state is used to show activation of automated procedures:

   A = Procedure is 'Active'

   C= Procedure completed. Completed means that when the DSC controller is configured to auto acknowledge calls such as position request call, polling call, or test call has been completed and automatically terminated

   H = Procedure is 'On hold'

   Q = Procedure has been 'Quit'. This is the last status sentence from this procedure

5) Automatic termination candidate The procedure has been marked as the next candidate for automatic 'Termination' in case a new automated procedure is required to be initiated by a new (send or receive DSC call):

   A = selected for termination

   V = Not selected for termination

6) Sub-stage of a procedure:

   A = Acknowledged

   Q = Channel Occupied

   T = Transmitting

   U = Unacknowledged (waiting for acknowledgement, not linked for communication)

   X = Linked for subsequent communication

   Y = Automatic termination paused

7) This VHF Channel number is represented as a fixed 4 digit field with leading zeros as necessary. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of a typical value from the referenced Table is "0016" for channel 16, 156,800 MHz, Calling, distress & safety.

8) The MF/HF Transmit frequency for Sub-Comms field is a variable length number in units of KHz. The value shall contain no more than 2 decimal digits when decimal digits are provided. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

   - Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00".
   - Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".

- Frequency 16 615,25 KHz may only be represented as "16615.25"

9) The MF/HF Receive frequency for Sub-Comms field is a variable length number in units of KHz. The value shall contain no more than 2 decimal digits when decimal digits are provided. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

   - Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00".
   - Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".
   - Frequency 16 615,25 KHz may only be represented as "16615.25".

10) Elapsed time. Time waiting for acknowledgement (in an unacknowledged procedure) after initial transmitted/received call or time after first acknowledgement of a procedure has been transmitted/received. This is a fixed 6-digit time field with the value in units of seconds with no decimal place and no decimal value of seconds, (hhmmss).

11) Active controller identifier:

    0 = Priority (on the Bridge) Controller has initiated or modified this automated procedure

    1 - 99 = Remote Controller that has initiated or modified this automated procedure

    A numeric value represents the individual controller unit that has interacted with this sending non-distress automated procedure. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard upon installation. This field shall not be null.

12) Authorized remote identifier:

    Null = Indicates that the DSC controller will accept AC3 commands sentences from any remote controller

    1 - 99 = Identifies the only authorized remote controller from which the DSC controller will accept AC3 command sentences

    Once a remote controller unit makes a command or modification to the automated procedure, it will become the authorized remote controller and its controller identifier value will be reflected in this field in further AP3 sentences for this procedure.

    Only the priority controller (typically on the Bridge) and the authorized remote controller shall be allowed to modify this sending non-distress automated procedure. The value in this field identifies the remote controller unit that is allowed by the DSC controller to modify the automated procedure. The DSC controller may be pre-configured as to which remote controller unit should have command capability by default.

13) The Automated termination timer provides the number of seconds that remain before this Automated Procedure is automatically terminated, range 0 to 999.

14) Alert Sound. See Annex H of IEC 61097-3 [i.2] for the latest information. This field shall be null when no alert sound is necessary. See the AAS - Audible alert sound sentence:

    1 = two-tone

    2 = distress ack

    3 = urgency

    4 = urgency ack

    5 = routine, safety

    6 = routine, safety ack

    7 = self-terminating

    8 = discrete

9 = warning

10 = count

11 - 99 = Reserved for future assignment

See AP1 note 10 for relevant information from IEC 61097-3 [i.2], Annex H with the additional associated Alert Sound enumerations.

A.1.5 AP4 - Receiving Non-Distress Automated Procedure Status

This sentence supports DSC Radio remote control and is applicable to all DSC maritime mobile radios, including VHF, MF and HF. The AP4 sentence is only generated by the DSC controller and shall be used to provide status from the DSC controller, based on an active receiving non-distress automated procedure, with related AO4 sentences. AC4 and AO4 sentences facilitate remote control operations of a black box DSC radio.

This sentence is broadcasted to all upon any creation, state change or update of an automated procedure in the equipment.

Furthermore, the sentence shall be transmitted in reply to a standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active procedure, resulting in one or more AP4 sentences. If there are no existing automated procedures, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such active procedures".

The Automated procedure identifier value has a range of 0 - 99. The Automated Procedure Identifier shall be unique across all Automated Procedure Status Sentences, AP1, AP2, AP3, AP4 and AP5. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

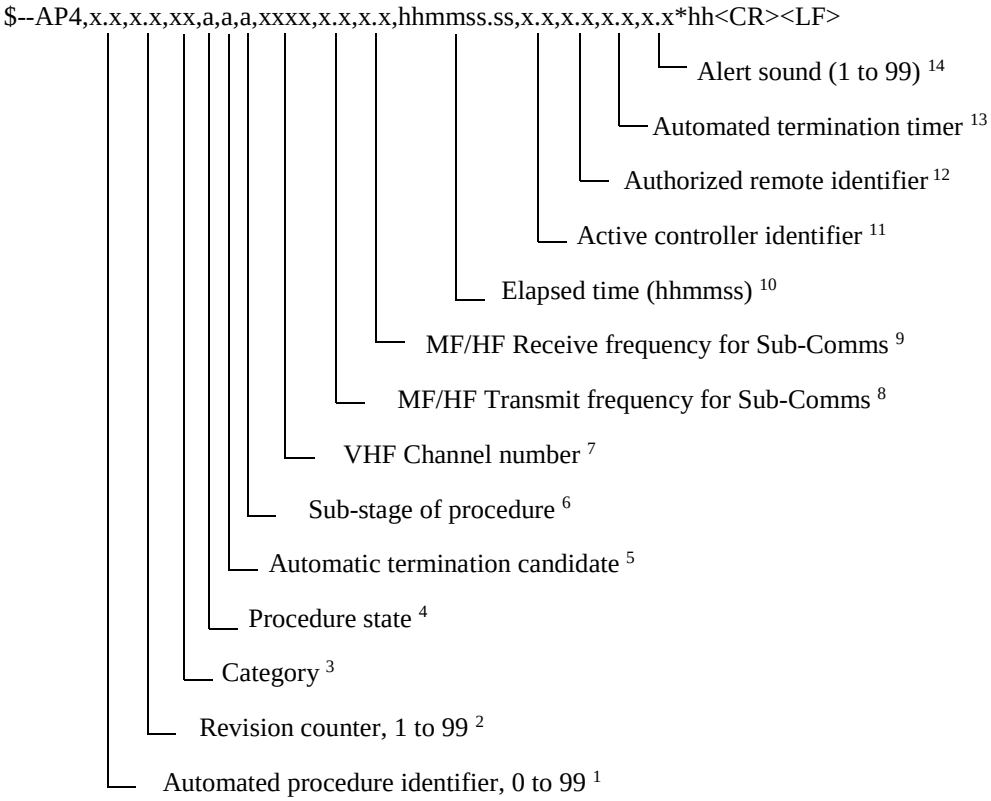
NOTE 1: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP4, AO4, and AC4 shall have matching values in both of these fields if they are related.

Whenever an AP4 sentence is transmitted, the corresponding AO4 sentence shall also be transmitted relating to the same automated procedure.

If NMEA TAG Blocks are used, the AP4 sentence is also linked to the associated AO4 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications

NOTE 2: When this procedure is for the purpose of establishing subsequent communications, it will automatically terminate this procedure when those communications are established after positive acknowledgment (able to comply). The communication automatic procedure (see AP5) will automatically begin at this point.



Use of fields:

1) This field provides the unique automated procedure identifier. This field shall not be null. The revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier.

2) The Revision counter is a variable length integer field that starts with 1 and has a step increment of 1. The count resets to 1 after 99 is used. The Revision counter increments on each change of content of any field in this sentence compared to last time it was transmitted for each Automated Procedure Identifier. This field shall not be null.

3) In the Category field, the values shall be one of the following:

   00 = Routine

   08 = Safety

   10 = Urgency

4) The Procedure state is used to show activation of automated procedures:

   A = Procedure is 'Active'

   C= Procedure completed. Completed means that an auto acknowledge procedure such as position request call, polling call, test call or unable to comply has been completed and automatically terminated. This is the last status sentence from this procedure

   H = Procedure is 'On hold'

   Q = Procedure has been 'Quit'. This is the last status sentence from this procedure

5) Automatic termination candidate. The procedure has been marked as the next candidate for automatic 'Termination' in case a new automated procedure is required to be initiated by a new send or receive DSC call:

   A = Selected for termination

   V = Not selected for termination

6) Sub-stage of a procedure:

A = Acknowledged

B = Paused (DSC Radio is busy on other traffic, i.e. active communications procedure).

Q = Channel Occupied

T = Transmitting

U = Unacknowledged (waiting for acknowledgement, not linked for communication)

X = Linked for subsequent communication

Y = Automatic termination paused

7) This VHF Channel number is represented as a fixed 4-digit field with leading zeros as necessary. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of typical value from the referenced table is "0016" for channel 16, 156,800 MHz, Calling, distress & safety.

8) The MF/HF Transmit frequency for Sub-Comms field is a variable length number in units of KHz. The value shall contain no more than 2 decimal digits when decimal digits are provided. This field shall be null when not applicable. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00".

Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".

Frequency 16 615,25 KHz may only be represented as "16615.25".

9) The MF/HF Receive frequency for Sub-Comms field is a variable length number in units of KHz. The value shall contain no more than 2 decimal digits when decimal digits are provided. This field shall be null when not applicable. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00".

Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".

Frequency 16 615,25 KHz may only be represented as "16615.25".

10) Elapsed time. Time waiting for acknowledgement (in unacknowledged procedure) after initial transmitted/received call or time after first acknowledgement of a procedure has been transmitted/received. This is a fixed 6-digit time field with the value in units of seconds with no decimal place and no decimal value of seconds, (hhmmss).

11) Active controller identifier:

Null = This automated procedure was initiated by external radio call. No shipboard controller has yet interacted with this automated procedure.

0 = Priority (on the Bridge) Controller that has commanded this automated procedure.

1 - 99 = Remote Controller that has commanded this automated procedure.

A numeric value represents the individual controller unit that has interacted with this receiving non-distress automated procedure. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard upon installation.

12) Authorized remote identifier:

Null = Indicates that the DSC controller will accept AC4 commands sentences from any remote controller.

1 - 99 = Identifies the only authorized remote controller from which the DSC controller will accept AC4 command sentences.

Once a remote controller unit makes a command or modification to the automated procedure, it will become the authorized remote controller and its controller identifier value will be reflected in this field in further AP4 sentences for this procedure.

Only the priority controller (typically on the Bridge) and the authorized remote controller shall be allowed to modify this receiving non-distress automated procedure. The value in this field identifies the remote controller unit that is allowed by the DSC controller to modify the automated procedure. The DSC controller may be pre-configured as to which remote controller unit should have command capability by default:

13) The Automated termination timer provides the number of seconds that remain before this Automated Procedure is automatically terminated, range 0 to 999.

14) Alert Sound. See Annex H of IEC 61097-3 [i.2]: for the latest information. This field shall be null when no alert sound is necessary. See the AAS - Audible Alert Sound sentence:

1 = two-tone

2 = distress ack

3 = urgency

4 = urgency ack

5 = routine, safety

6 = routine, safety ack

7 = self-terminating

8 = discrete

9 = warning

10 = count

11 - 99 = Reserved for future assignment

See AP1 note 10 for relevant information from IEC 61097-3 [i.2] Edition 3, Annex H with the additional associated Alert Sound enumerations.

A.1.6 AP5 - Communications Automated Procedure Status

This sentence supports DSC Radio remote control and is applicable to all DSC maritime mobile radios, including VHF, MF and HF. The AP5 sentence is only generated by the DSC controller and shall be used to provide status from the DSC controller, based on an active communications automated procedure, with related AO5 sentences. AC5 and AO5 sentences facilitate remote control operations of a black box DSC radio. This sentence is broadcasted to all upon any creation, state change or update of an automated procedure in the equipment.

NOTE 1: See ETSI EN 300 338-2 [2], clause 6.8.1 for initiation and see ETSI EN 300 338-2 [2], clause 6.8.6 for termination.

Any subsequent communications as a result of a received DSC call shall be handled as a communication procedure.

Furthermore, the sentence shall be transmitted in reply to a standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active procedure, resulting in one or more AP5 sentences. If there are no existing automated procedures, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such active procedures".

The Automated procedure identifier value has a range of 0 - 99. The Automated Procedure Identifier shall be unique across all Automated Procedure Status Sentences, AP1, AP2, AP3, AP4, and AP5. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

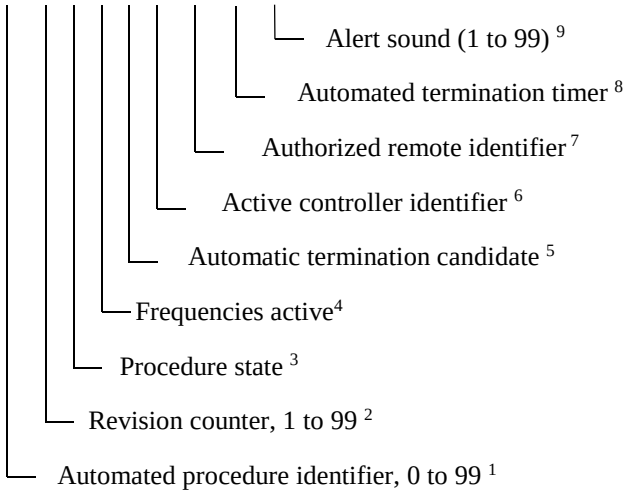
NOTE 2: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP5, AO5 and AC5 shall have matching values in both of these fields if they are related.

Whenever an AP5 sentence is transmitted, the corresponding AO5 sentence shall also be transmitted relating to the same automated procedure.

If NMEA TAG Blocks are used, the AP5 sentence is also linked to the associated AO5 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications

\$--AP5,x.x,x.x,a,hh,a,x.x,x.x,x.x,x.x*hh<CR><LF>



Use of fields:

1) This field provides the unique automated procedure identifier. This field shall not be null. The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier.

2) The Revision counter is a variable length integer field that starts with 1 and has a step increment of 1. The count resets to 1 after 99 is used. The Revision counter increments on each change of content of any field in this sentence compared to last time it was transmitted for each Automated Procedure Identifier. This field shall not be null.

3) The Procedure state is used to show activation of automated procedures:

   A = Procedure is 'Active'.(transmit or receive modes)

   B = Paused (DSC Controller is busy on other traffic, i.e. active communications procedure)

   H = Procedure is 'On hold'

   Q = Procedure has been 'Quit'. This is the last status sentence from this procedure

   Y = Automatic termination paused

4) Frequencies Active:

The first two hex characters represent the Frequency bands supported. The field is used as a bit mask to identify one or more frequencies. The field is defined as a 8-bit hex field where the Least Significant Bit (LSB) represents the first band, the next bit represents the second band and so on up to the Most Significant Bit (MSB). Only the active frequency used is reported:

Selection values:

0 = Frequency band not supported

1 = Frequency band supported

0xxx xxx1 = VHF

0xxx xx1x = 2 MHz (MF)

0xxx x1xx = 4 MHz (HF)

0xxx 1xxx = 6 MHz (HF)

0xx1 xxxx = 8 MHz (HF)

0x1x xxxx = 12 MHz (HF)

01xx xxxx = 16 MHz (HF)

1xxx xxxx = Reserved bit shall always be set to 0

5) Automatic termination candidate - The procedure has been marked as the next candidate for automatic 'Termination' in case a new automated procedure is required to be initiated by a new send or receive DSC call:

A = Selected for termination

V = Not selected for termination

6) Active controller identifier:

Null = This automated procedure was initiated by external radio call. No shipboard controller has yet interacted with this automated procedure

0 = Priority (on the Bridge) Controller that has commanded this automated procedure

1 - 99 = Remote Controller that has commanded this automated procedure

A numeric value represents the individual controller unit that has interacted with this receiving non-distress automated procedure. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard upon installation.

7) Authorized remote identifier:

Null = Indicates that the DSC controller will accept AC5 commands sentences from any remote controller

1 - 99 = Identifies the authorized remote controller from which the DSC controller will accept AC5 command sentences

Once a remote controller unit makes a command or modification to the automated procedure, it will become the authorized remote controller and its controller identifier value will be reflected in this field in further AP5 sentences for this procedure.

Only the priority controller (typically on the Bridge) and the authorized remote controller shall be allowed to modify this receiving non-distress automated procedure. The value in this field identifies the remote controller unit that is allowed by the DSC controller to modify the automated procedure. The DSC controller may be pre-configured as to which remote controller unit should have command capability by default.

8) The Automated termination timer provides the number of seconds that remain before this Automated Procedure is automatically terminated, range 0 to 999.

9) Alert Sound. See Annex H of IEC 61097-3 [i.2]. This field shall be null when no alert sound is necessary. See the AAS - Audible Alert Sound sentence:

1 = two-tone

2 = distress ack

3 = urgency

4 = urgency ack

5 = routine, safety

6 = routine, safety ack

7 = self-terminating

8 = discrete

9 = warning

10 = count

11 - 99 = Reserved for future assignment

See AP1 note 10 for relevant information from IEC 61097-3 [i.2], Annex H with the additional associated Alert Sound enumerations.

A.1.7 AO1 - Automated procedure Options - Sending Own Distress

This sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF, and HF. The AO1 sentence is only generated by the DSC Radio and shall be used with other sentences such as AP1and AC1 to facilitate remote control operations of a black box DSC radio. This is not a command sentence.

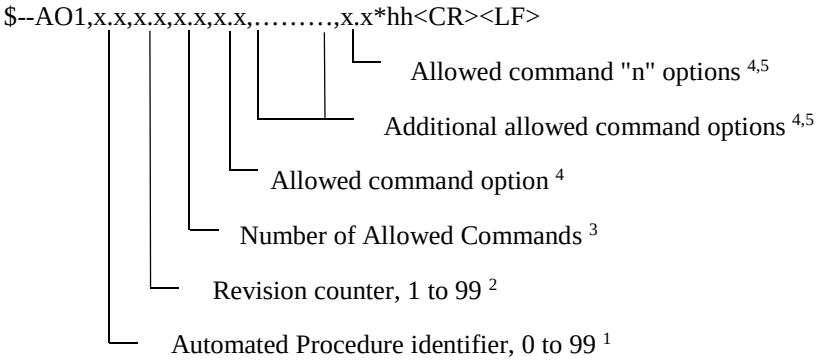
This sentence provides the available command options for any given state of the DSC Radio's Automated Procedure for Sending Distress Messages as reported in an associated AP1 sentence. This sentence is broadcast to all upon any creation, state change or update of an automated procedure (AP1) from the DSC radio. Only the DSC radio can generate this sentence. When there are no available command options provided in this sentence, a remote control unit should inform the user there no available command options.

This sentence shall be transmitted in reply to the standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for the active automated procedure for Sending Distress, resulting in one AP1 and AO1 sentences. If there are no existing automated procedures for Sending Distress, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such active procedures".

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP1, AO1 and AC1 shall have matching values in both of these fields if they are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

If NMEA TAG Blocks are used, the AO1 sentence is also linked to the associated AP1 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications.



Use of fields:

1) This field provides the unique Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP1 sentence and AC1 sentence. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. Revision counter is unique to each Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP1 sentence and AC1 sentence. This field shall not be null.

3) The "Number of Allowed Commands" informs the receiving device of the actual number of command options provided in this sentence, consisting of both the currently allowed procedure state and operative command options for the related AP1 sentence. This field is a variable length integer field. When this field is set to zero the "Allowed command option" field shall be set to null.

4) The Allowed command option field may contain any of the following values, representing either an allowed procedure state or operative command option. Below is the complete list of optional commands for AP1. An AO1 sentence will only contain the allowed commands that are relevant to the current automated procedure state.

   List of possible allowed procedure state command options. State commands are controls for the automated procedure:

   2 = Put the active procedure on hold

   3 = Activate the on hold procedure List of the possible allowed operative command options

   Operative commands are operations that can be applied to an automated procedure:

   10 = Self cancel distress

   11 = Pause countdown timer to resending own distress

   12 = Resume countdown timer to resending own distress

   13 = Resend distress

   14 = Next channel for voice cancel

   15 = Change selected band for HF alert attempt

   16 = Completed self-cancel distress (This means the repeat of self-cancel distress will not be performed, and the procedure can be terminated)

   29 = Repeat Self cancel distress

5) The "Allowed command option" field 4 shall be repeated for the number of times specified in field 3 "Number of allowed commands", while keeping within sentence length limits".

   For example, if the "Number of Allowed Commands" is equal to 4, then there will be 4 "Allowed command option" fields.

A.1.8 AO2 - Automated procedure Options - Receiving Distress

This sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AO2 sentence is only generated by the DSC Radio and shall be used with other sentences such as AP2 and AC2 to facilitate remote control operations of a black box DSC radio. This is not a command sentence.

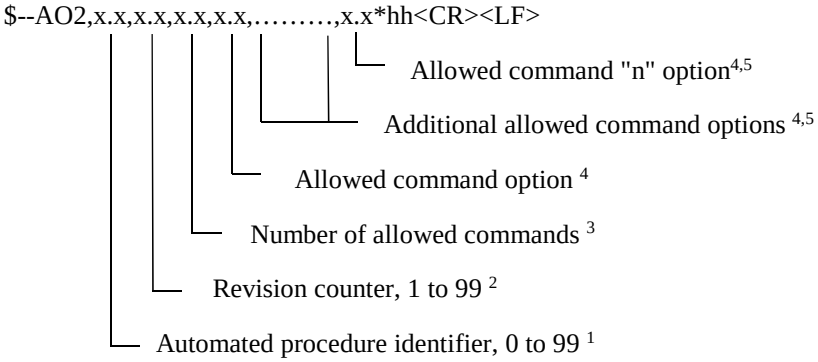
This sentence provides the available command options for any given state of the DSC Radio's Automated Procedure for Receiving Distress Messages as reported in an associated AP2 sentence. This sentence is broadcast to all upon any creation, state change or update of an automated procedure (AP2) from the DSC radio. Only the DSC radio can generate this sentence. When there are no available command options provided in this sentence, a remote control unit should inform the user there no available command options.

This sentence shall be transmitted in reply to the standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active automated procedure for Receiving Distress, resulting in one or more AP2 and AO2 sentences. If there are no existing automated procedures for Receiving Distress, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such automated procedures".

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP2, AO2 and AC2 shall have matching values in both of these fields if they are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

If NMEA TAG Blocks are used, the AO2 sentence is also linked to the associated AP2 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface, and is recommended for DSC radio applications.



Use of fields:

1) This field provides the unique Automated Procedure Identifier. This field shall not be null. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP2 sentence and AC2 sentence.

2) The Revision counter is the main method to follow up-to-date status. Revision counter is unique to each Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP2 sentence and AC2 sentence. This field shall not be null.

3) The "Number of Allowed Commands" informs the receiving device of the actual number of command options provided in this sentence, consisting of both the currently allowed procedure state and operative command options for the related AP2 sentence. This field is a variable length integer field. When this field is set to zero the "Allowed command option" field shall be set to null.

4) The Allowed command option field may contain any of the following values, representing either an allowed procedure state or operative command option. Below is the complete list of optional commands for AP2. An AO2 sentence will only contain the allowed commands that are relevant to the current automated procedure state.

List of possible allowed procedure state command options. State commands are controls for the automated procedure:

1= End the procedure

2 = Put the active procedure on hold

3 = Activate the on hold procedure

4 = Pause any change to the DSC controller configuration (TX/RX or change of frequency)

5 = Allow (un-pause) change to the DSC controller configuration (TX/RX or change of frequency)

6 = Cancel Automatic termination

List of the possible allowed operative command options. Operative commands are operations that can be applied to an automated procedure:

17 = VHF-All Ship Distress Relay

18 = VHF individually addressed Distress Relay

19 = MF/HF individually addressed Distress Relay

20 = MF/HF geographically addressed Distress Relay

21 = VHF Distress Acknowledge

22 = MF/HF Distress Acknowledge (HF is a permitted call by Coast Stations)

30 = Confirmation of voice cancelled for current band (this the report back to the DSC controller that a voice cancel transmission has been received on the current band)

31 = VHF-All Ship Distress Relay acknowledgement

32 = MF/HF individually addressed Distress Relay acknowledgement

33 = VHF individually addressed Distress Relay acknowledgement

34 = VHF-Group Distress Relay acknowledgement MOB

35 = VHF individually addressed Distress Relay acknowledgement MOB

5) The "Allowed command option" field 4 shall be repeated for the number of times specified in field 3 "Number of allowed commands", while keeping within sentence length limits". For example, if the "Number of Allowed Commands" is equal to 4, then there will be 4 "Allowed command option" fields.

A.1.9 AO3 - Automated procedure Options - Sending Non-Distress

This sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AO3 sentence is only generated by the DSC Radio and shall be used with other sentences such as AP3 and AC3 to facilitate remote control operations of a black box DSC radio. This is not a command sentence.

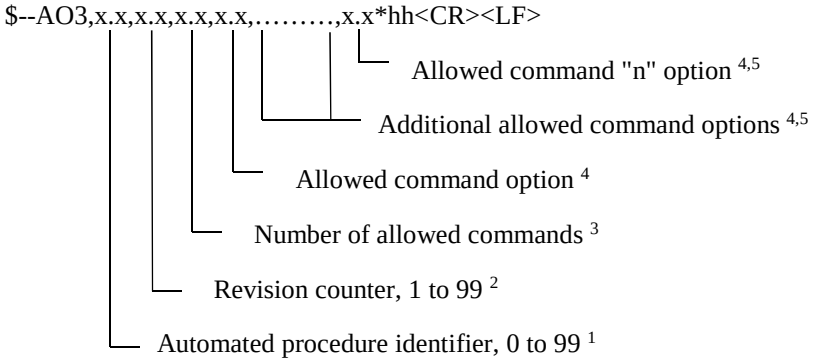
This sentence provides the available command options for any given state of the DSC Radio's Automated Procedure for Sending Non-Distress Messages as reported in an associated AP3 sentence. This sentence is broadcast to all upon any creation, state change or update of an automated procedure (AP3) from the DSC radio. Only the DSC radio can generate this sentence. When there are no available command options provided in this sentence, a remote control unit should inform the user there no available command options.

This sentence shall be transmitted in reply to the standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active automated procedure for Sending Non-Distress, resulting in one or more AP3 and AO3 sentences. If there are no existing automated procedures for Sending Non-Distress, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such automated procedures".

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP3, AO3 and AC3 shall have matching values in both of these fields if they are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

If NMEA TAG Blocks are used, the AO3 sentence is also linked to the associated AP3 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface and is recommended for DSC radio applications.



Use of fields:

1) This field provides the unique Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP3 sentence and AC3 sentence. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. Revision counter is unique to each Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP3 sentence and AC3 sentence. This field shall not be null.

3) The "Number of Allowed Commands" informs the receiving device of the actual number of command options provided in this sentence, consisting of both the currently allowed procedure state and operative command options for the related AP3 sentence. This field is a variable length integer field. When this field is set to zero the "Allowed command option" field shall be set to null.

4) The Allowed command option field may contain any of the following values, representing either an allowed procedure state or operative command option. Below is the complete list of optional commands for AP3. An AO3 sentence will only contain the allowed commands that are relevant to the current automated procedure state.

   List of possible allowed procedure state command options. State commands are controls for the automated procedure:

   1 = End the procedure

   2 = Put the active procedure on hold

   3 = Activate the on hold procedure

   6 = Cancel Automatic termination

   List of the possible allowed operative command options. Operative commands are operations that can be applied to an automated procedure:

   23 = resend the initial DSC message

5) The "Allowed command option" field 4 shall be repeated for the number of times specified in field 3 "Number of allowed commands", while keeping within sentence length limits". For example, if the "Number of Allowed Commands" is equal to 4, then there will be 4 "Allowed command option" fields.

A.1.10 AO4 - Automated procedure Options - Receiving Non-Distress

This sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AO4 sentence is only generated by the DSC Radio and shall be used with other sentences such as AP4 and AC4 to facilitate remote control operations of a black box DSC radio. This is not a command sentence.

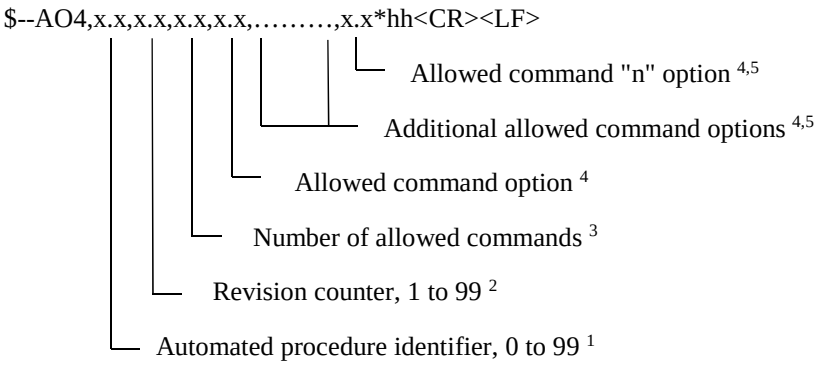
This sentence provides the available command options for any given state of the DSC Radio's Automated Procedure for Receiving Non-Distress Messages as reported in an associated AP4 sentence. This sentence is broadcast to all upon any creation, state change or update of an automated procedure (AP4) from the DSC radio. Only the DSC radio can generate this sentence. When there are no available command options provided in this sentence, a remote control unit should inform the user there no available command options.

This sentence shall be transmitted in reply to the standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active automated procedure for Receiving Non-Distress, resulting in one or more AP4 and AO4 sentences. If there are no existing automated procedures for Receiving Non-Distress, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such automated procedures".

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP4, AO4 and AC4 shall have matching values in both of these fields if they are related The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

If NMEA TAG Blocks are used, the AO4 sentence is also linked to the associated AP4 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface and is recommended for DSC radio applications.



Use of fields:

1) This field provides the unique Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP4 sentence and AC4 sentence. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. Revision counter is unique to each Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP4 sentence and AC4 sentence. This field shall not be null.

3) The "Number of Allowed Commands" informs the receiving device of the actual number of command options provided in this sentence, consisting of both the currently allowed procedure state and operative command options for the related AP4 sentence. This field is a variable length integer field. When this field is set to zero the "Allowed command option" field shall be set to null.

4) The Allowed command option field may contain any of the following values, representing either an allowed procedure state or operative command option. Below is the complete list of optional commands for AP4. An AO4 sentence will only contain the allowed commands that are relevant to the current automated procedure state.

   List of possible allowed procedure state command options. State commands are controls for the automated procedure:

   1= End the procedure

   2 = Put the active procedure on hold

   3 = Activate the on hold procedure

   4 = Pause any change to the DSC Radio configuration (TX/RX or change of frequency)

   5 = Allow (un-pause) change to the DSC Radio configuration (TX/RX or change of frequency)

   6 = Cancel Automatic termination

   List of the possible allowed operative command options. Operative commands are operations that can be applied to an automated procedure:

   24 = Accept call (able to comply)

   25 = Accept VHF call with change to VHF channel number (able to comply with channel change)

   26 = Accept MF/HF call with change to MF/HF frequencies (able to comply with frequency change)

   27 = Unable to comply (channel not available, proposed mode not available). The DSC Radio is responsible for populating the reason code (2^{nd} telecommand) for unable to comply in the DSC radio call

   28 = Resend previous acknowledgement

5) The "Allowed command option" field 4 shall be repeated for the number of times specified in field 3 "Number of allowed commands", while keeping within sentence length limits". For example, if the "Number of Allowed Commands" is equal to 4, then there will be 4 "Allowed command option" fields.

A.1.11 AO5 - Automated procedure Options - Communications

This sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AO5 sentence is only generated by the DSC Radio and shall be used with other sentences such as AP5 and AC5 to facilitate remote control operations of a black box DSC radio. This is not a command sentence.

This sentence provides the available command options for any given state of the DSC Radio's Automated Procedure for Communications Messages as reported in an associated AP5 sentence. This sentence is broadcast to all upon any creation, state change or update of an automated procedure (AP5) from the DSC radio. Only the DSC radio can generate this sentence. When there are no available command options provided in this sentence, a remote control unit should inform the user there no available command options.

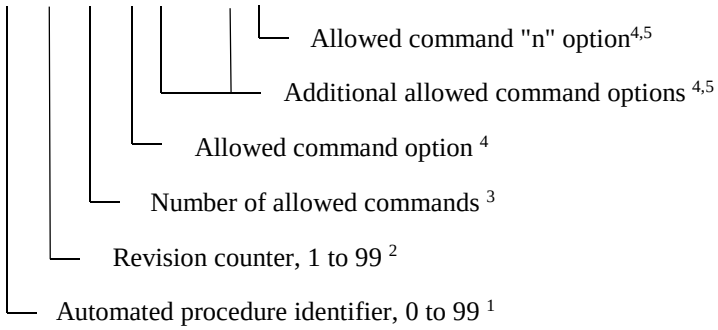
This sentence shall be transmitted in reply to the standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), with a response for each active automated procedure for Communications, resulting in one AP5 and AO5 sentences. If there are no existing automated procedures for Communications, then the response shall be a NAK sentence with the Unique Identifier field set to null, with reason code 49 and the descriptive text "no such automated procedures".

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP5, AO5 and AC5 shall have matching values in both of these fields if they are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

If NMEA TAG Blocks are used, the AO5 sentence is also linked to the associated AP5 sentence using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]). TAG Block "sentence-grouping" reliably links or associates "Data Fields" across different "Sentence Formatters" over any physical interface and is recommended for DSC radio applications.

$--AO5,x.x,x.x,x.x,x.x,……,x.x*hh<CR><LF>



Use of fields:

1) This field provides the unique Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP5 sentence and AC5 sentence. This field shall not be null.

2) The Revision counter is the main method to follow up-to-date status. Revision counter is unique to each Automated Procedure Identifier. This field is one of two fields used to link these "Allowed command options" in this sentence with the corresponding AP5 sentence and AC5 sentence. This field shall not be null.

3) The "Number of Allowed Commands" informs the receiving device of the actual number of command options provided in this sentence, consisting of both the currently allowed procedure state and operative command options for the related AP5 sentence. This field is a variable length integer field. When this field is set to zero the "Allowed command option" field shall be set to null.

4) The Allowed command option field may contain any of the following values, representing either an allowed procedure state or operative command option. Below is the complete list of optional commands for AP5. An AO5 sentence will only contain the allowed commands that are relevant to the current automated procedure state.

   List of possible allowed procedure state command options. State commands are controls for the automated procedure:

   1 = End the procedure

   2 = Put the active procedure on hold

   3 = Activate the on hold procedure

   4 = Pause any change to the DSC Radio configuration (TX/RX or change of frequency)

   5 = Allow (un-pause) change to the DSC Radio configuration (TX/RX or change of frequency)

   6 = Cancel Automatic termination

   7 = Begin Communications call (manual request by user, as opposed to an automatically generated subsequent communications procedure)

   List of the possible allowed operative command options. Operative commands are operations that can be applied to an automated procedure.

   There are currently no operative command options for the Communication Automated Procedure.

5) The "Allowed command option" field 4 shall be repeated for the number of times specified in field 3 "Number of allowed commands", while keeping within sentence length limits". For example, if the "Number of Allowed Commands" is equal to 4, then there will be 4 "Allowed command option" fields.

A.1.12 AC0 - Command Radio Settings

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AC0 sentence shall be used to send commands to the DSC controller, based on the related AP0 sentence to facilitate remote control operations of a black box DSC controller. The AP0 sentence may be queried at any time by any controller for current settings.

The AC0 sentence will only be accepted by the DSC controller to alter settings under two required conditions:

- the DSC controller is in standby mode, i.e. no active automated procedures; and
- the ACO is sent from the Priority (on the Bridge) Controller.

This sentence is used to send commands from a remote controller unit. The configuration options current settings are identified by the DSC Controller's Automated Procedure Configuration Status as reported in an AP0 sentence.

This sentence cannot be queried.

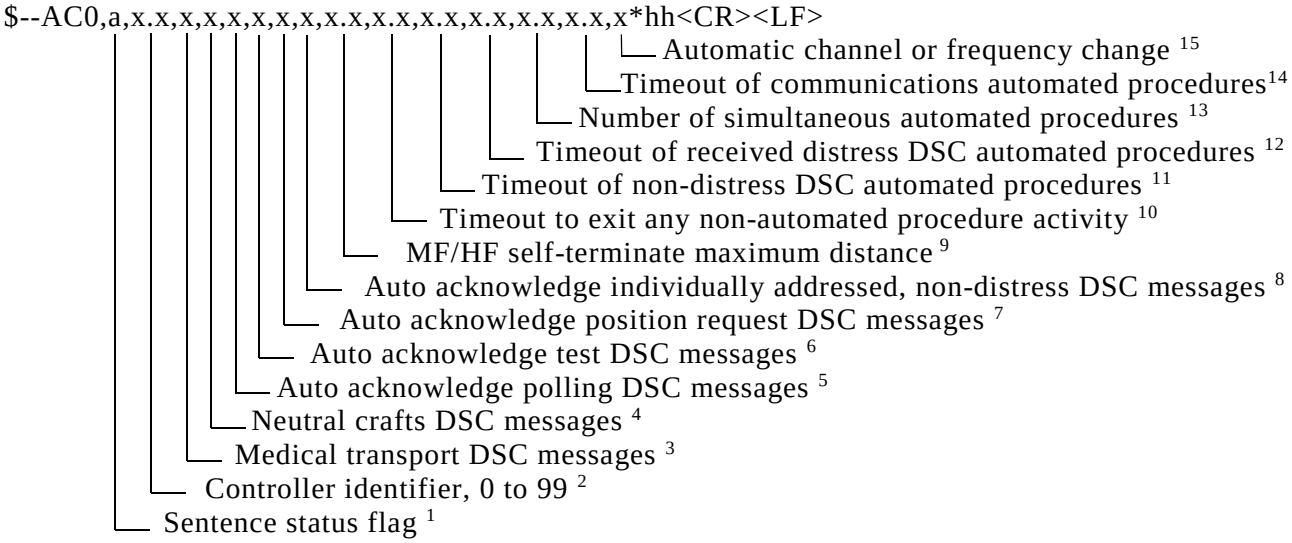
If the AC0 Command Sentence is accepted, the DSC Controller shall do all of the following:

- broadcast the received AC0 sentence with the Sentence status flag set to "R" to indicate this is a report of the command accepted, informing all controller units of the pending change;
- perform the commanded configuration operation; and
- generate and broadcast a new AP0 with the updated information.

If the AC0 Command Sentence is NOT accepted by the DSC controller, The DSC Controller shall generate a NAK Sentence. A list of some possible reasons for not accepting the AC0 and the NAK response content includes but is not limited to the following:

Table A.1: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
DSC controller is not in Standby mode, there are one or more Automated procedures	49	"Not in Standby - configuration not allowed"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"



Use of fields

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A. 21 - Special Format Fields for additional information on the sentence status flag field.

2) Controller identifier is a variable length integer field. This represents the individual controller unit that is sending the AC0 command sentence. The range for the controller identifier value is 0 - 99. Only the Priority (on the Bridge) Controller with a controller identifier of 0 will be accepted for configuration changes by the DSC controller. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

3) The send "Medical transport DSC messages" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

   0 = Off (default)

   1 = On

4) The send "Neutral crafts DSC messages" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

   0 = Off (default)

   1 = On

5) The "Auto acknowledge polling DSC messages" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

6) The "Auto acknowledge test DSC messages" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

7) The "Auto acknowledge position request DSC messages" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

   0 = Off (default)

   1 = On

8) The "Auto acknowledge individually addressed, non-distress DSC messages" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

   0 = Off

   1 = On (default)

9) The "MF/HF self-terminate maximum distance" option configuration is reported in this data field. The option on MF/HF equipment to set the maximum distance for sounding a two-tone alarm that does not self-terminate upon initiation of a received distress automated procedure to some value greater than or equal to 500 nautical miles. Any value from 1 to 500 shall be interpreted as 500. This is a variable length integer field and may contain the following values:

   0 = never self-terminate

   Range 500 - 9999 miles (default is 500)

10) The activity "Timeout to exit any non-automated procedure activity" option configuration is reported in this data field. This is a variable length integer field and may contain the following values:

   0 = no timeout

   Range 1 - 999 minutes (default is 10)

11) The activity "Timeout of non-distress DSC automated procedures" option configuration is reported in this data field. This is a variable length integer field and may contain the following values:

   0 = no timeout

   Range 1 - 999 minutes (default is 15)

12) The activity "Timeout of received distress DSC automated procedures" option configuration is reported in this data field. This is a variable length integer field and may contain the following values:

   0 = no timeout (default)

   Range 1 - 999 minutes

13) The maximum "Number of simultaneous automated procedures" option configuration is reported in this data field. All DSC radios are required to support a minimum of seven (7) simultaneous Automated Procedures. DSC radios may be designed to support more than the minimum. This is a variable length integer field and may contain the following values:

   0 = no timeout (default)

   Range 7 - 99

14) The no activity "Timeout of communications automated procedures" option configuration is reported in this data field. This is a variable length integer field and may contain the following values:

   Range 10 - 500 seconds (default 30 seconds)

15) The "automatic channel or frequency change" option configuration is reported in this data field. This single digit numeric field shall contain the following possible values:

0 = Off

1 = On (default)

A.1.13 AC1 - Automated procedure Command - Sending Own Distress

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AC1 sentence shall be used to send commands to the DSC radio, based on related AP1 and AO1 sentences to facilitate remote control operations of a black box DSC radio.

This sentence is used to send commands from a priority (typically on the Bridge) controller or a remote controller unit. The contents are based on the available command options provided by the AO1 sentence for any given state of the DSC Radio's Automated Procedure for Sending Distress Messages as reported in an associated AP1 sentence.

This sentence cannot be queried.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP1, AO1 and AC1 shall have matching values in both of these fields if the sentences are related. This the Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*. When a valid AC1 Command Sentence is received, the DSC Radio shall do all of the following:

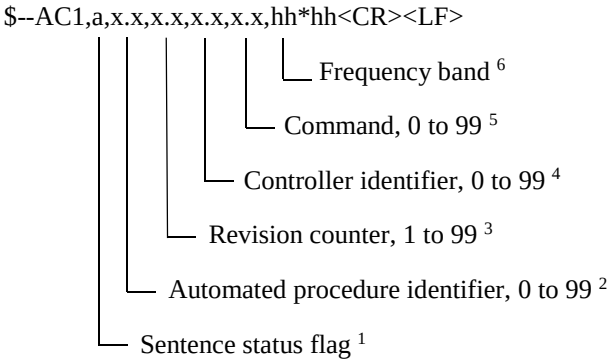
- broadcast the received AC1 sentence with the Sentence status flag set to "R" to indicate this is a report of the command accepted, informing all remote controller units;
- perform the commanded operation; and
- update the state of the Automated Procedure and generate a new AP1 and AO1 with the updated information.

If the AC1 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AC1 and the NAK response content includes but is not limited to the following:

Table A.2: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Automated procedure identifier field does not match an active Automated Procedure	49	"Invalid Automated procedure identifier"
Revision counter field does not match the current Revision of the identified Automated Procedure	49	"Invalid Revision counter"
Remote controller unit (Remote controller identifier field) value is not recognized as valid controller identifier and not allowed to command this Automated Procedure	49	"Command not accepted from unrecognized Remote Controller Unit x" *Where x is the value for the provided Remote controller identifier from the AC1 sentence.*
Command field value is not valid for the current state of this Automated Procedure	49	"Invalid Command"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	12	
Automated procedure identifier field does not match an active Automated Procedure	100	"Invalid Automated procedure identifier"
Revision counter field does not match the current Revision of the identified Automated Procedure	101	"Invalid Revision counter"
Remote controller unit (Remote controller identifier field) value is not recognized as valid controller identifier and not allowed to command this Automated Procedure	49	"Command not accepted from unrecognized Remote Controller Unit x" *Where x is the value for the provided Remote controller identifier from the AC1 sentence.*
Command field value is not valid for the current state of this Automated Procedure	49	"Invalid Command"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null.

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This variable length integer field provides the unique automated procedure identifier. This should match with the same field in the current AP1 and AO1 related sentences. This field shall not be null.

3) The Revision counter, a variable length integer field, is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. This should match with the same field in the current AP1 and AO1 related sentences. This field shall not be null.

4) Controller identifier is a variable length integer field. This represents the individual controller unit that is sending the AC1 command sentence. All remote controller shall be allowed to modify the "Sending Own Distress Automated Procedure". The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard.

5) The Command field is a variable length integer field and provides for one of the available numeric commands from the AO1 sentence. This field shall not be null. When the Command field contains any value other than 15, all the frequency bands fields shall be null.

Self-cancelling a distress, the command should be sent using a value of 10 for self-cancel. After receiving an updated AP1 sentence with the sub-stage procedure indicating "C" for self-cancelled, the next command sent should be a value of 14 for Next voice cancel frequency or band. This will report back to the DSC controller that a voice cancel transmission has been made on the current band. The Command 14 should be repeated for all frequency bands used, until all the DSC frequency band fields are either null or contain a "V" for Voice Cancelled in the AP1.

When all channels have been voice cancelled, the command 29 for "repeat self-cancel distress" may be sent to perform the self-cancel distress again as described above. Otherwise, a command 16 "Completed self-cancel distress" should be sent to terminate the procedure.

When the Command field contains a value of 15, all the frequency band fields are required, see Command Field note 6.

6) Frequency band. This is a fixed 2-digit Hexadecimal field that represents each frequency band (for distress, urgency and safety purposes) as an individual bit-field inside an 8-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null.

Selection values:

0 = Frequency band not selected

1 = Frequency band selected

0xxx xxx0 = VHF - Shall always be set to 0

0xxx xx1x = 2 MHZ (MF)

0xxx x1xx = 4 MHZ

0xxx 1xxx = 6 MHZ

0xx1 xxxx = 8 MHZ

0x1x xxxx = 12 MHZ

01xx xxxx = 16 MHZ

1xxx xxxx = Reserved bit shall always be set to 0

If VHF is not selected, then the 2 MHz and 8 MHz bands shall be set to "1" (selected) by default in addition to any other HF band selections. If VHF is selected, then each of the MF/HF bands shall be set to "0" (not selected).

A.1.14 AC2 - Automated procedure Command - Receiving Distress

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AC2 sentence shall be used to send commands to the DSC radio, based on related AP2 and AO2 sentences to facilitate remote control operations of a black box DSC radio.

This sentence cannot be queried.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP2, AO2 and AC2 shall have matching values in both of these fields if the sentences are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

This sentence is used to send commands from a controller unit. The contents are based on the available command options provided by the AO2 sentence for any given state of the DSC Radio's Automated Procedure for Receiving Distress Messages as reported in an associated AP2 sentence.

If the AC2 Command Sentence is accepted, the DSC Radio shall do all of the following:

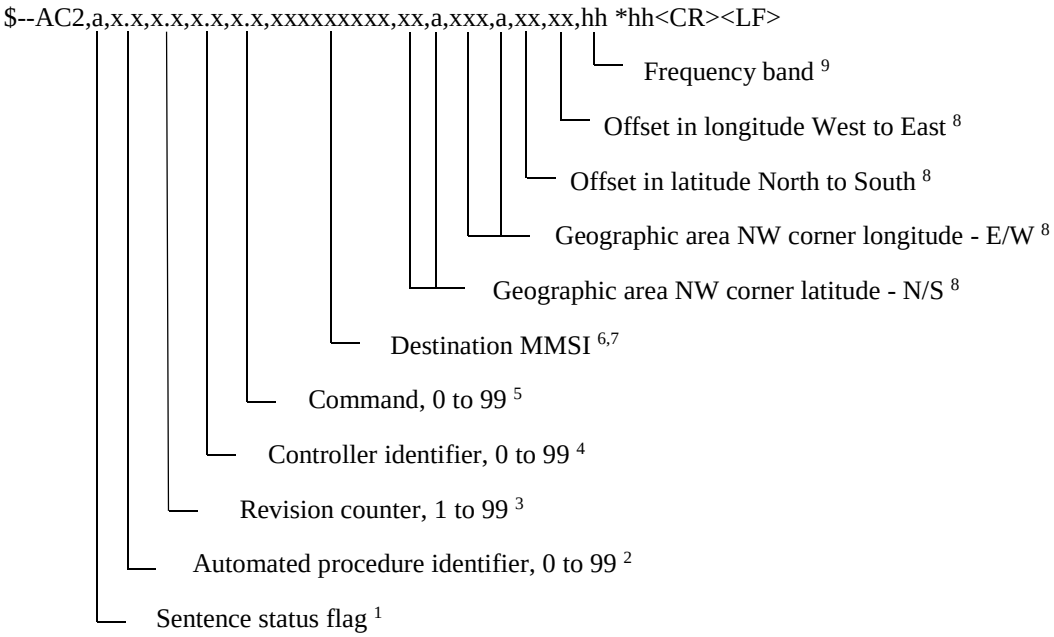
- broadcast the received AC2 sentence with the Sentence status flag set to "R" to indicate this is a report of the command accepted, informing all controller units;
- perform the commanded operation; and
- update the state of the Automated Procedure and generate a new AP2 and AO2 with the updated information.

If the AC2 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AC2 and the NAK response content includes but is not limited to the following:

Table A.3: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Automated procedure identifier field does not match an active Automated Procedure	49	"Invalid Automated procedure identifier"
Revision counter field does not match the current Revision of the identified Automated Procedure	49	"Invalid Revision counter"
Remote controller unit (Remote controller identifier field) value is not recognized as valid controller identifier and not allowed to command this Automated Procedure	49	"Command not accepted from unrecognized Remote Controller Unit x" *Where x is the value for the provided Remote controller identifier from the AC2 sentence.*
Command field value is not valid for the current state of this Automated Procedure	49	"Invalid Command"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21. - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. This should match with the same field in the current AP2 and AO2 related sentences. This field shall not be null.

3) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. This should match with the same field in the current AP2 and AO2 related sentences. This field shall not be null.

4) Controller identifier. This represents the individual controller unit that is sending the AC2 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

5) The Command field is a variable length integer field and provides for one of the available numeric commands from the AO2 sentence. The remaining data fields in this sentence may be required depending on the value of the Command. This field shall not be null. Requirements for each Command value are as follows:

   1 = End the procedure - All data fields following the Command field shall be null

   2 = Put the active procedure on hold - All data fields following the Command field shall be null

   3 = Activate the on hold procedure - All data fields following the Command field shall be null

   4 = Pause any change to the DSC Radio configuration (TX/RX or change of frequency) - All data fields following the Command field shall be null

   5 = Allow (un-pause) change to the DSC Radio configuration (TX/RX or change of frequency) - All data fields following the Command field shall be null

   6 = Cancel Automatic termination - All data fields following the Command field shall be null

   17 = VHF-All Ship Distress Relay - All data fields following the Command field shall be null

   18 = VHF individually addressed Distress Relay - see Command Field note 6. All data fields following the Destination MMSI field shall be null

   19 = MF/HF individually addressed Distress Relay - see Command Field notes 6 and 9

   20 = MF/HF geographically addressed Distress Relay - see Command Field notes 8 and 9

   21 = VHF Distress Acknowledge - All data fields following the Command field shall be null

   22 = MF/HF Distress Acknowledge (HF is a permitted call by Coast Stations)

   30 = Confirmation of voice cancelled for current band (This the report back to the DSC controller that a voice cancel transmission has been received on the current band.) - All data fields following the Command field shall be null

   31 = VHF-All Ship Distress Relay acknowledgement - All data fields following the Command field shall be null

   32 = MF/HF individually addressed Distress Relay acknowledgement.

   33 = VHF individually addressed Distress Relay acknowledgement.

   34 = VHF-Group Distress Relay acknowledgement MOB.

35 = VHF individually addressed Distress Relay acknowledgement MOB. The Destination MMSI, typically that of a Coast Station, shall be provided when the Command field contains any of the following values and cannot be null:

18 = VHF individually addressed Distress Relay

19 = MF/HF individually addressed Distress Relay

6) The Destination MMSI, the MMSI of the station that sent the Distress Relay, shall be provided when the Command field contains any of the following values and cannot be null:

32 = MF/HF individually addressed Distress Relay acknowledgement

33 = VHF individually addressed Distress Relay acknowledgement

34 = VHF-Group Distress Relay acknowledgement MOB

35 VHF individually addressed Distress Relay acknowledgement MOB

7) A Geographically addressed Distress Relay requires a defined geographic area. See Figure A.1 below from "Recommendation ITU-R M.493-15 [1], figure 6" for a graphical representation of a defined area. There are six data fields that are required to define a geographic area:

Geographic area NW corner latitude, 2 fixed digits of degrees (9º shall be 09º)

N/S indicator (N or S)

Geographic area NW corner longitude, 3 fixed digits of degrees (72º shall be 072º)

- E/W indicator (E or W)

8) Offset in latitude North to South 2 fixed digits of degrees (5º shall be 05º)
Offset in longitude West to East 2 fixed digits of degrees (7º shall be 07º)

All of the Geographic area fields above shall be provided when the Command field contain the following value:

20 = MF/HF geographically addressed Distress Relay

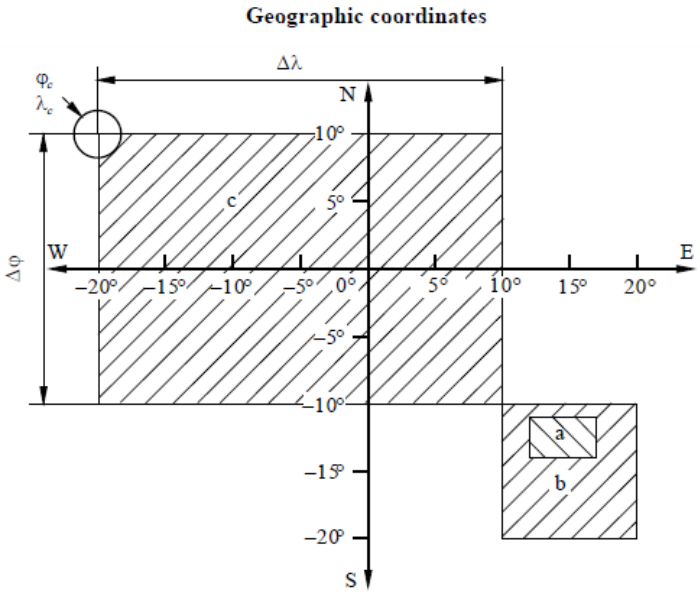


Figure A.1: Geographic coordinates

9) Frequency band. This is a fixed 2-digit Hexadecimal field that represents each frequency band (for distress, urgency and safety purposes) as an individual bit-field inside an 8-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null.

Selection values:

0 = Frequency band not selected

1 = Frequency band selected

0xxx xxx0 = VHF - Shall always be set to 0

0xxx xx1x = 2 MHZ (MF)

0xxx x1xx = 4 MHZ

0xxx 1xxx = 6 MHZ

0xx1 xxxx = 8 MHZ

0x1x xxxx = 12 MHZ

01xx xxxx = 16 MHZ

1xxx xxxx = Reserved bit shall always be set to 0

A.1.15 AC3 - Automated procedure Command - Sending Non-Distress

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AC3 sentence shall be used to send commands to the DSC radio, based on related AP3 and AO3 sentences to facilitate remote control operations of a black box DSC radio.

This sentence cannot be queried.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP3, AO3 and AC3 shall have matching values in both of these fields if the sentences are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

This sentence is used to send commands from a remote control unit. The contents are based on the available command options provided by the AO3 sentence for any given state of the DSC Radio's Automated Procedure for Sending Non-Distress Messages as reported in an associated AP3 sentence.

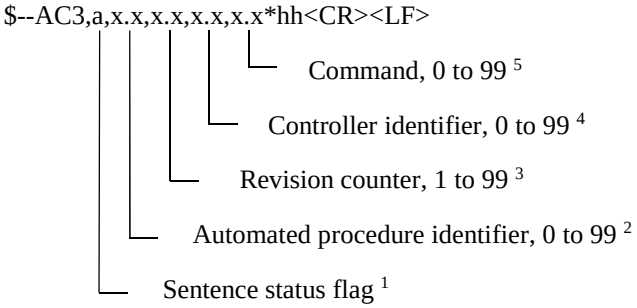
If the AC3 Command Sentence is accepted, the DSC Radio shall do all of the following:

- broadcast the received AC3 sentence with the Sentence status flag set to "R" to indicate this is a report of the command accepted, informing all remote controller units;
- perform the commanded operation; and
- update the state of the Automated Procedure and generate a new AP3 and AO3 with the updated information.

If the AC3 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AC3 and the NAK response content includes but is not limited to the following:

Table A.4: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Automated procedure identifier field does not match an active Automated Procedure	49	"Invalid Automated procedure identifier"
Revision counter field does not match the current Revision of the identified Automated Procedure	49	"Invalid Revision counter"
Remote controller unit (Remote controller identifier field) value is not recognized as valid controller identifier and not allowed to command this Automated Procedure	49	"Command not accepted from unrecognized Remote Controller Unit x" *Where x is the value for the provided Remote controller identifier from the AC3 sentence.*
Command field value is not valid for the current state of this Automated Procedure	49	"Invalid Command"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null.

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. This should match with the same field in the current AP3 and AO3 related sentences. This field shall not be null.

3) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. This should match with the same field in the current AP3 and AO3 related sentences. This field shall not be null.

4) Controller identifier. This represents the individual controller unit that is sending the AC3 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

5) The Command field is a variable length integer field and provides for one of the available numeric commands from the AO3 sentence. This field shall not be null.

   Cancel Automatic termination - All data fields following the Command field shall be null

A.1.16 AC4 - Automated procedure Command - Receiving Non-Distress

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AC4 sentence shall be used to send commands to the DSC radio, based on related AP4 and AO4 sentences to facilitate remote control operations of a black box DSC radio.

This sentence cannot be queried.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP4, AO4 and AC4 shall have matching values in both of these fields if the sentences are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

This sentence is used to send commands from a remote control unit. The contents are based on the available command options provided by the AO4 sentence for any given state of the DSC Radio's Automated Procedure for Receiving Non-Distress Messages as reported in an associated AP4 sentence.

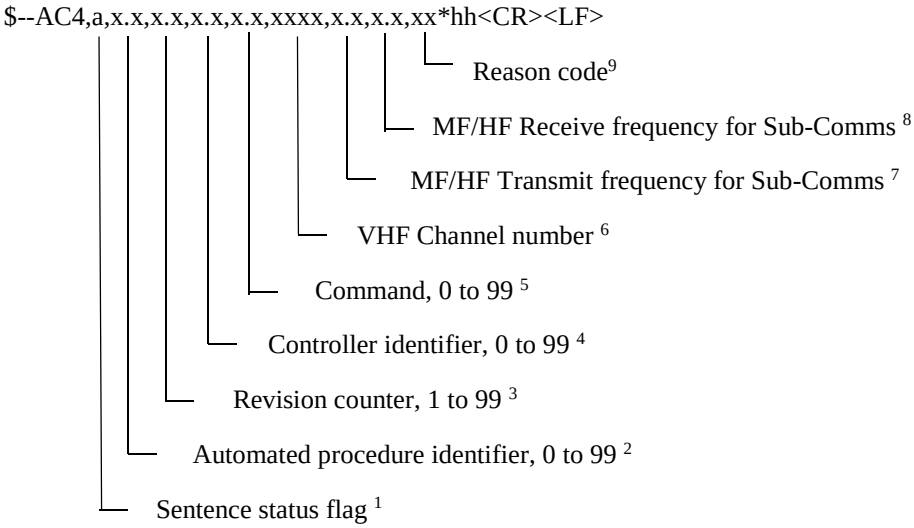
If the AC4 Command Sentence is accepted, the DSC Radio shall do all of the following:

- broadcast the received AC4 sentence with the Sentence status flag set to "R" to indicate this is a report of the command accepted, informing all remote controller units;
- perform the commanded operation; and
- update the state of the Automated Procedure and generate a new AP4 and AO4 with the updated information.

If the AC4 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AC4 and the NAK response content includes but is not limited to the following:

Table A.5: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Automated procedure identifier field does not match an active Automated Procedure	49	"Invalid Automated procedure identifier"
Revision counter field does not match the current Revision of the identified Automated Procedure	49	"Invalid Revision counter"
Remote controller unit (Remote controller identifier field) value is not recognized as valid controller identifier and not allowed to command this Automated Procedure	49	"Command not accepted from unrecognized Remote Controller Unit x" *Where x is the value for the provided Remote controller identifier from the AC4 sentence.*
Command field value is not valid for the current state of this Automated Procedure	49	"Invalid Command"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. This should match with the same field in the current AP4 and AO4 related sentences. This field shall not be null.

3) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. This should match with the same field in the current AP4 and AO4 related sentences. This field shall not be null.

4) Controller identifier. This represents the individual controller unit that is sending the AC4 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

5) The Command field is a variable length integer field and provides for one of the available numeric commands from the AO4 sentence. The remaining data fields in this sentence may be required depending on the value of the Command. This field shall not be null. Requirements for each Command value are as follows:

   1 = End the procedure - All data fields following the Command field shall be null.

   2 = Put the active procedure on hold - All data fields following the Command field shall be null.

   3 = Activate the on hold procedure - All data fields following the Command field shall be null.

   4 = Pause any change to the DSC Radio configuration (TX/RX or change of frequency) - All data fields following the Command field shall be null.

   5 = Allow (un-pause) change to the DSC Radio configuration (TX/RX or change of frequency) - All data fields following the Command field shall be null.

   6 = Cancel Automatic termination - All data fields following the Command field shall be null.

   24 = Accept call (able to comply) - All data fields following the Command field shall be null.

   25 = Accept VHF call with change to VHF channel number (able to comply with channel change26 = Accept MF/HF call with change to MF/HF frequencies (able to comply with frequency change).

27 = Unable to comply (channel not available, proposed mode not available) - All data fields following the Command field shall be null.

28 = Resend previous acknowledgement- All data fields following the Command field shall be null.

6) This VHF Channel number is represented as a fixed 4-digit field with leading zeros as necessary. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of typical value from the referenced table is "0016" for channel 16, 156,800 MHz, Calling, distress & safety.

7) The MF/HF Transmit frequency for Sub-Comms field is a variable length number in units of KHz. The value shall contain no more than 2 decimal digits when decimal digits are provided. This field shall be null when not applicable. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00".

Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".

Frequency 16 615,25 KHz may only be represented as "16615.25".

8) The MF/HF Receive frequency for Sub-Comms field is a variable length number in units of KHz. The value shall contain no more than 2 decimal digits when decimal digits are provided. This field shall be null when not applicable. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00".

Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".

Frequency 16 615,25 KHz may only be represented as "16615.25".

9) Reason Code. This field supports command 27 with the reason for Unable to comply. If command 27 is not selected, this field is null. The reason code consist of:

00 = No reason given

02 = Busy

03 = Queue indication (No longer in use)

04 = Station barred (No longer in use)

05 = No operator available

06 = Operator temporarily unavailable

07 = Equipment Disabled

08 = Cannot use the proposed channel/frequency

09 = Cannot used the proposed mode

If reason code 08 is selected, a new VHF Channel Number or MF/HF Frequency may be provided.

A.1.17 AC5 - Automated procedure Command - Communications

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AC5 sentence shall be used to send commands to the DSC radio, based on related AP5 and AO5 sentences to facilitate remote control operations of a black box DSC radio.

This sentence cannot be queried.

There are two linking data fields used in all DSC Radio remote control sentences. These are the Automated Procedure Identifier and the Revision Counter fields. Each of the remote control sentences, AP5, AO5 and AC5 shall have matching values in both of these fields if the sentences are related. The Automated Procedure Identifier value is independent of the number of automated procedures that are active or on hold in parallel.

NOTE: Recommendation ITU-R M.493-15 [1] specifies *"Facilities should be provided to handle a minimum of seven simultaneous automated procedures including a reserve of one"*.

This sentence is used to send commands from a remote controller unit. The contents are based on the available command options provided by the AO5 sentence for any given state of the DSC Radio's Automated Procedure for Communications Messages as reported in an associated AP5 sentence.

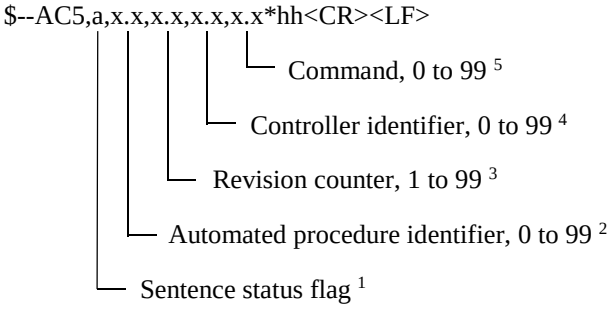
If the AC5 Command Sentence is accepted, the DSC Radio shall do all of the following:

- broadcast the received AC5 sentence with the Sentence status flag set to "R" to indicate this is a report of the command accepted, informing all remote controller units;
- perform the commanded operation; and
- update the state of the Automated Procedure and generate a new AP5 and AO5 with the updated information.

If the AC5 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AC5 and the NAK response content includes but is not limited to the following:

Table A.6: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Automated procedure identifier field does not match an active Automated Procedure	49	"Invalid Automated procedure identifier"
Revision counter field does not match the current Revision of the identified Automated Procedure	49	"Invalid Revision counter"
Remote controller unit (Remote controller identifier field) value is not recognized as valid controller identifier and not allowed to command this Automated Procedure	49	"Command not accepted from unrecognized Remote Controller Unit x" *Where x is the value for the provided Remote controller identifier from the AC5 sentence.*
Command field value is not valid for the current state of this Automated Procedure	49	"Invalid Command"
Required data field(s) necessary to support Command not provided	11	"Missing required data fields"
Required data field(s) necessary to support Command are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. This should match with the same field in the current AP5 and AO5 related sentences. This field shall not be null.

3) The Revision counter is the main method to follow up-to-date status. The Revision counter is unique for each automated procedure identifier. This should match with the same field in the current AP5 and AO5 related sentences. This field shall not be null.

4) Controller identifier. This represents the individual controller unit that is sending the AC5 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

5) The Command field is a variable length integer field and provides for one of the available numeric commands from the AO5 sentence. This field shall not be null.

A.1.18 AI1 - Automated procedure Initiate - Sending Own Distress

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AI1 sentence shall be used to initiate an own-ship distress command to the DSC controller.

This sentence supports the process necessary for the DSC controller to broadcast an own-ship distress message, from a controller unit (in compliance with Resolution A.803(19) [i.11], clauses 2.6, 2.7, 2.8 - distress initiation requirements and with A.804(19) [i.12] and A.806(19) [i.13]. The process to initiate sending an own-ship distress alert is as follows.

There are two required transactions between the DSC controller and the controller unit. Each of these transactions are performed by two physical actions by the user:

1) The controller unit, upon operator input (physical action #1) to begin a distress alert, will send a standard query sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences") to the DSC controller for the AI1 sentence. This is a dedicated button in accordance with IMO MSC Circular 862 [i.14].

2) The response (an AI1 sentence) to this Query sentence shall be within 1 second upon reception of the Query sentence. Upon receipt of the query for the AI1 sentence, the DSC controller will generate an AI1 sentence containing default values for all fields. The sentence status flag shall be set to "R". The controller unit will provide the operator with the default contents of the AI1 sentence allowing the operator to edit the following fields if necessary or continue with the values provided by the DSC controller:

   Nature of distress

   - Frequency band
   - Type of distress call

   UTC of Position

   - Enhanced Longitude
   - Enhanced Latitude

3) The controller unit upon operator input (physical action #2) to confirm the distress alerts contents will send the AI1 sentence to the DSC controller with the sentence status flag set to "C" to initiate the distress alert. This is second user action necessary to initiate an own-ship distress. This is a dedicated button in accordance with IMO MSC Circular 862 [i.14].

4) The DSC controller upon the receipt of a valid AI1 sentence will initiate the distress radio call and begin the automated procedure, issuing the AP1 and AO1 sentences.

If the AI1 Sentence is accepted, the DSC Controller shall do all of the following:

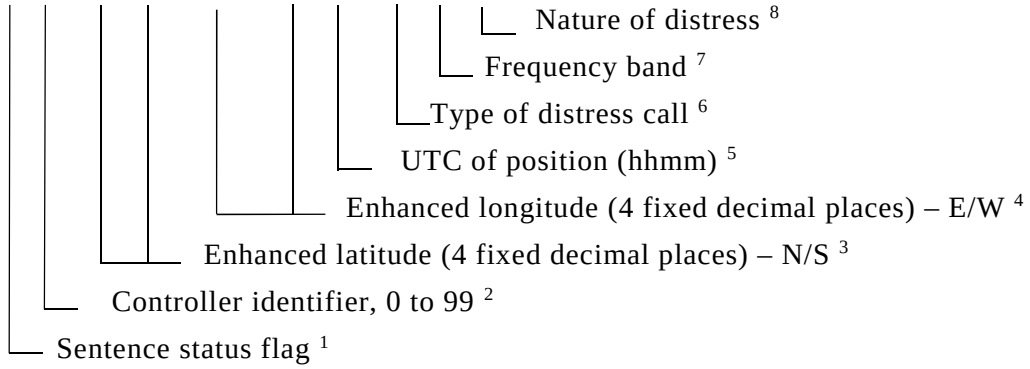
- perform the commanded operation; and
- update the state of the Automated Procedure and generate a new AP1 and AO1 with the updated information.

If the AI1 Command Sentence is NOT accepted by the DSC controller, The DSC Controller shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI1 and the NAK response content includes but is not limited to the following:

Table A.7: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"

$--AI1,a,x.x,llll.ll,a,yyyyy.yy,a,xxxx,xx,hh,x.x*hh<CR><LF>



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) Controller identifier. This represents the individual controller unit that is sending the AI1 command sentence. All remote controllers shall be allowed to modify the "Sending Own Distress Automated Procedure". The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

3) Enhanced Latitude. This is a fixed 9-digit field (ddmm.ffff) made up of a 4-digit degrees and minutes field (of 00 to 90 degrees and 00 to 59 minutes), a decimal point and a 4-digit decimal-fraction of minutes value (of 0000 to 9999). Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the North ("N") or South ("S") hemisphere. When this sentence is sent as a command, a null field indicates the DSC controller should use the position information it has access to for the distress call.

4) Enhanced Longitude. This is a fixed 9-digit field (ddmm.ffff) made up of a 5-digit degrees and minutes field (of 000 to 180 degrees and 00 to 59 minutes), a decimal point and a 4-digit decimal-fraction of minutes value (of 0000 to 9999). Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the East ("E") or West ("W") hemisphere. When this sentence is sent as a command, a null field indicates the DSC controller should use the position information it has access to for the distress call.

5) UTC of position represents the time when the position was generated by position source of the vessel. This is a fixed 4-digit field (hhmm, where hh is 00 to 23 hours and mm is 00 to 59 minutes). Leading zeros are used to keep field lengths fixed. When this sentence is sent as a command, a null field indicates the DSC controller should use the UTC time of position information it has access to for the distress call.

6) The Type of distress call field represents the mode of communication. This field is two fixed digits and cannot be null. See Recommendation ITU-R M.493.15 [1] Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 100, 109, and 113 correspond to the valid values 00, 09 and 13 respectively as shown below:

   00 = VHF Voice Communications

   09 = MF/HF Voice Communications

   13 = Telex Teletype

7) Frequency band. This is a fixed 2-digit Hexadecimal field that represents each frequency band (for the distress message transmission) as an individual bit-field inside an 8-bit mask value. The bit-field definitions are detailed below.

   When Choosing HF, 8 MHz shall be selected and one or more of the bands from 4 MHz to 16 MHz may be selected and the VHF and 2 MHz bands shall be set to 0.

   When choosing MF/HF, 8 MHz and 2 MHz shall be selected and one or more bands from 4 MHz to 16 MHZ may be selected and the VHF shall be set to 0.

   When choosing MF only, 2 MHz shall be selected and all other bands shall be set to 0.

   When choosing VHF, all other bands shall be set to 0.

   Selection values:

   0 = Frequency not in use

   1 = Frequency band in use

   0xxx xxx1 = VHF

   0xxx xx1x = 2 MHz

   0xxx x1xx = 4 MHz

   0xxx 1xxx = 6 MHz

   0xx1 xxxx = 8 MHz

   0x1x xxxx = 12 MHz

   01xx xxxx = 16 MHz

   1xxx xxxx = Reserved bit shall always be set to 0

8) The Nature of distress field provides the reason for the distress. This is a variable length integer field. This field cannot be null. The values are:

   0 = fire, explosion

1 = flooding

2 = collision

3 = grounding

4 = listing, endangering of capsizing

5 = sinking

6 = disabled and adrift

7 = undesignated distress (Default selection)

8 = abandoning ship

9 = piracy/armed robbery attack

10 = Man Overboard (MOB)

A.1.19 AI2 - Initiate All ships urgency and safety (VHF) - Frequency

This command sentence supports DSC Radio remote control and is applicable to all VHF DSC radios. The AI2 sentence shall be used to initiate All ships urgency and safety (VHF) - Frequency command to the DSC radio.

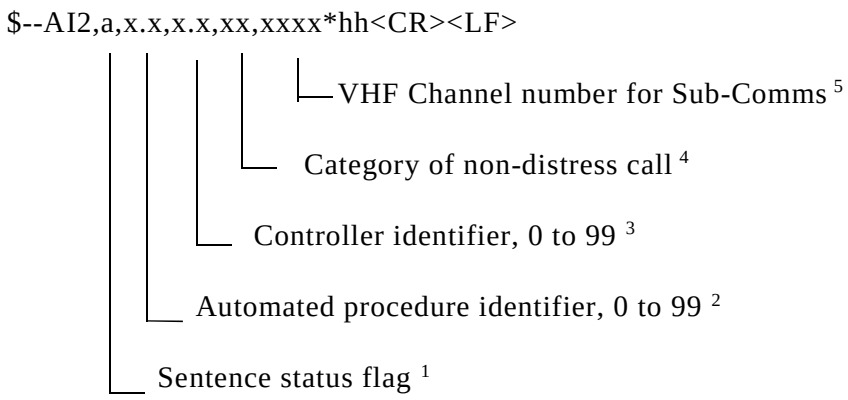
If the AI2 Sentence is accepted, the DSC Radio shall do all of the following:

- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC radio, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI2 sentence. For example: where the DSC radio will populate the DSC 2nd Telecommand field in the radio message based on its own configuration, i.e. installed on medical transport ship;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and
- generate a new AP3 and AO3 with the updated information.

If the AI2 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI2 and the NAK response content includes but is not limited to the following:

Table A.8: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC radio assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences:

   This field shall be null when this sentence is sent as a command from a controller to the DSC radio.

   When the DSC radio sends this sentence back as a report, this field shall contain the DSC radio assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI2 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard.

4) Category of non-distress call. There are two types of non-distress DSC calls that may be initiated by the mariner using this sentence. Guidance as to what the categories are used for should be provided on the controller unit to aid in appropriate selection. This field shall not be null:

   10 = Safety - Typically used to report or advise of a navigation hazard.

   08 = Urgency - Typically when danger is not imminent but assistance is required because of a serious problem.

5) VHF Channel Number for Subsequent Communications. This is a fixed 4-digit field that represents the VHF channel number. Leading zeros are used to keep field length fixed. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of typical value from the referenced table is "0016" for channel 16, 156,800 MHz, Calling, distress and safety. Default value should be channel 16.

A.1.20 AI3 - Automated procedure Initiate - Geographical area urgency and safety (MF/HF) - Frequency

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AI3 sentence shall be used to initiate non-distress command to the DSC controller.

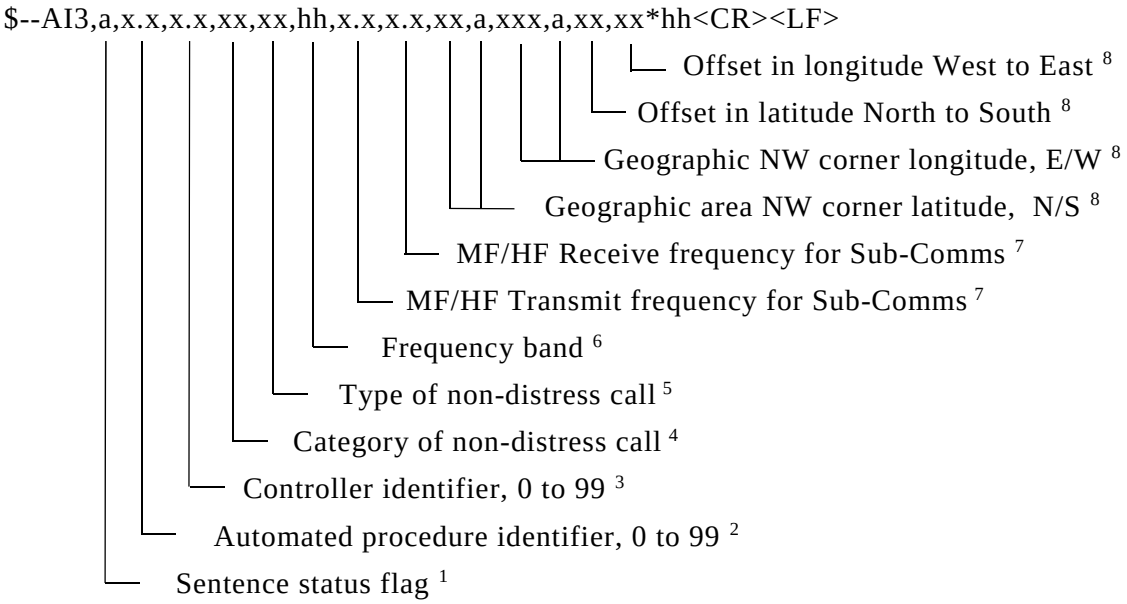
If the AI3 Sentence is accepted, the DSC Controller shall do all of the following:

- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC controller, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI3 sentence;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and
- generate a new AP3 and AO3 with the updated information.

If the AI3 Command Sentence is NOT accepted by the DSC controller, The DSC Controller shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI3 and the NAK response content includes but is not limited to the following:

Table A.9: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC Radio assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences:

   This field shall be null when this sentence is sent as a command from a controller to the DSC controller.

   When the DSC controller sends this sentence back as a report, this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI3 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

4) Category of non-distress call. There are three types of non-distress DSC calls that may be initiated by the mariner. Guidance as to what the categories are used for should be provided on the remote controller unit to aid in appropriate selection. This field shall not be null:

   10 = Safety - Typically used to report or advise of a navigation hazard.

   08 = Urgency - Typically when danger is not imminent but assistance is required because of a serious problem.

5) The Type of non-distress call field represents the mode of communication. This is a two digit fixed length field. This field shall not be null. See Recommendation ITU-R M.493.15 [1], Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 109 and 113 correspond to the valid values 9 and 13 respectively as shown below:

   09 = MF/HF Voice Communications

   13 = Telex Teletype

6) Frequency band. This is a fixed 2-digit Hexadecimal field that represents each frequency band (for distress, urgency and safety purposes) as an individual bit-field inside an 8-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null. Selection values:

   0 = Frequency band not selected

   1 = Frequency band selected

   0xxx xxx0 = VHF - Shall always be set to 0

   0xxx xx1x = 2 MHZ (MF)

   0xxx x1xx = 4 MHZ

   0xxx 1xxx = 6 MHZ

   0xx1 xxxx = 8 MHZ

   0x1x xxxx = 12 MHZ

   01xx xxxx = 16 MHZ

   1xxx xxxx = Reserved bit shall always be set to 0

7) The MF/HF Transmit/Receive frequency for Sub-Comms fields are a variable length number in units of KHz. See ITU Radio Regulations (2020), Volume II (Appendix 17, Annex II) for frequency values [i.8]. These fields shall not be null. As an example, consider the following examples:

   a) Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00".

   b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".

   c) Frequency 16 615,25 KHz may only be represented as "16615.25".

8) A Geographically addressed call requires a defined geographic area. See Figure A.2 below from "Recommendation ITU-R M.493-15 [1], figure 6" for a graphical representation of a defined area. There are six data fields that are required to define a geographic area:

- Geographic area NW corner latitude, 2 fixed digits of degrees (9º shall be 09º).
- N/S indicator, (N or S).
- Geographic area NW corner longitude, 3 fixed digits of degrees (72º shall be 072º).
- E/W indicator, (E or W).
- Offset in latitude North to South, 2 fixed digits of degrees (5º shall be 05º).
- Offset in longitude West to East, 2 fixed digits of degrees (7º shall be 07º).

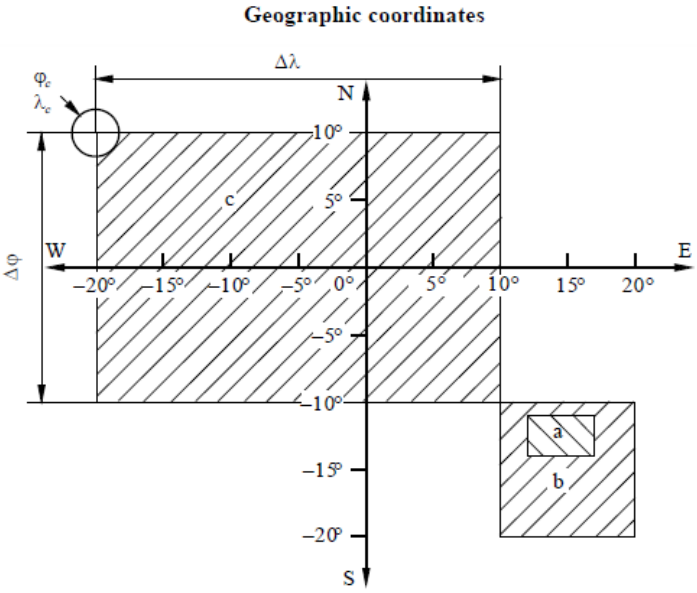


Figure A.2: Geographic coordinates

A.1.21 AI4 - Initiate Individual Urgency and safety (VHF/MF/HF) - Frequency

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AI4 sentence shall be used to initiate non-distress command to the DSC controller.

For MF/HF communication calls, either frequency or position information (but not both) is provided to the DSC controller to instruct the DSC controller how to construct the actual DSC radio call message.

For VHF voice communication calls, VHF Channel number is provided, and both frequency and position information are not provided.

If the AI4 Sentence is accepted, the DSC Controller shall do all of the following:

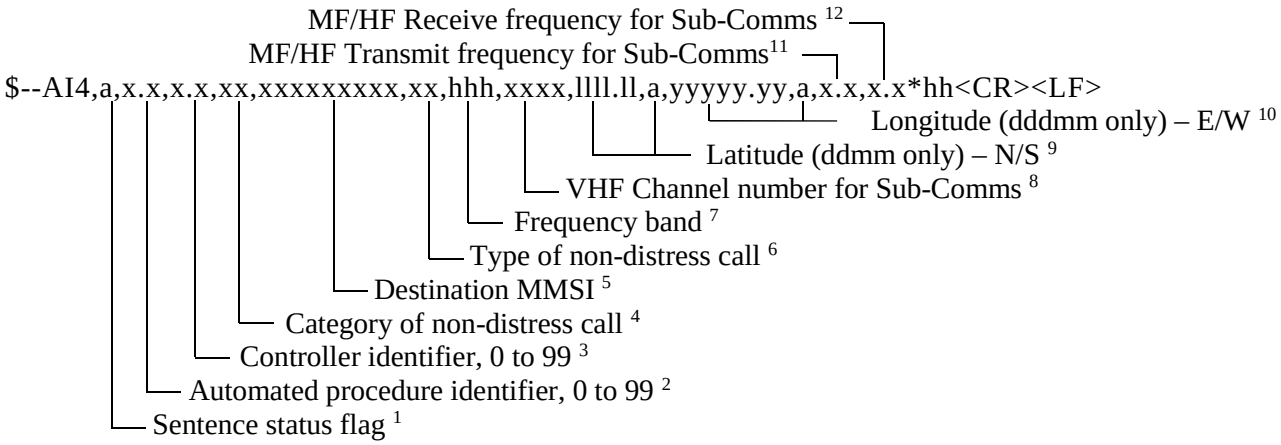
- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC controller, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI4 sentence;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and

- generate a new AP3 and AO3 with the updated information.

If the AI4 Command Sentence is NOT accepted by the DSC controller, The DSC Controller shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI4 and the NAK response content includes but is not limited to the following:

Table A.10: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC controller assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences:

   This field shall be null when this sentence is sent as a command from a controller to the DSC controller.

   When the DSC controller sends this sentence back as a report this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI4 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

4) Category of non-distress call. There are three types of non-distress DSC calls that may be initiated by the mariner. Guidance as to what the categories are used for should be provided on the remote controller unit to aid in appropriate selection. This field shall not be null:

   10 = Safety - Typically used to report or advise of a navigation hazard.

08 = Urgency - Typically when danger is not imminent but assistance is required because of a serious problem.

5) Destination MMSI. This is the 9-digit number that uniquely identifies the destination station that will receive the non-distress call.

6) Type of non-distress call. The Type of non-distress call field represents the mode of communication. This is a two digit fixed length field. This field shall not be null. See Recommendation ITU-R M.493-15 [1], Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 100, 109, 113 and 115 correspond to the valid values 00, 09, 13 and 15 respectively as shown below:

00 = VHF Voice Communications

09 = MF/HF Voice Communications

13 = Telex Teletype (radio message utilizes forward error correction)

15 = Telex [ARQ] (radio message requires retransmission on error)

For VHF voice communication calls ("00"), VHF Channel number is provided and the MF/HF Transmit frequency, MF/HF Receive frequency, Latitude and Longitude fields shall be null.

For MF/HF communication calls ("09", "13", "15"), either:

- The MF/HF Transmit frequency and MF/HF Receive frequency are provided and Latitude and Longitude fields shall be null.
- The Latitude and Longitude fields are provided and the MF/HF Transmit frequency and MF/HF Receive frequency fields shall be null.

These fields inform the DSC controller how to construct the actual DSC radio call message.

7) Frequency band. This is a fixed 3-digit Hexadecimal field that represents each frequency band as an individual bit-field inside a 12-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null. Selection values:

0 = Frequency band not selected

1 = Frequency band selected

00xx xxxx xxx1 = VHF

00xx xxxx xx1x = 2 MHz (MF)

00xx xxxx x1xx = 4 MHz

00xx xxxx 1xxx = 6 MHz

00xx xxx1 xxxx = 8 MHz (Recommended default selection)

00xx xx1x xxxx = 12 MHz

00xx x1xx xxxx = 16 MHz

00xx 1xxx xxxx = 18 MHz

00x1 xxxx xxxx = 22 MHz

001x xxxx xxxx = 25 MHz

11xx xxxx xxxx = Reserved bits shall always be set to 0

8) VHF Channel No. This is a fixed 4-digit field that represents the VHF channel number. Leading zeros are used to keep field length fixed. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of typical value from the referenced Table is "0016" for channel 16, 156,800 MHz, Calling, distress and safety.

9) Latitude. This is a fixed 4-digit field (ddmm) made up of a 4-digit degrees and minutes field (of 00 to 90 degrees and 00 to 59 minutes). No decimal point or decimal digits are allowed in this field. Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the North ("N") or South ("S") for hemisphere. This field shall be null when not applicable.

10) Longitude. This is a fixed 5-digit field (dddmm) made up of a 4-digit degrees and minutes field (of 00 to 90 degrees and 00 to 59 minutes). No decimal point or decimal digits are allowed in this field. Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the East ("E") or West ("W") hemisphere. This field shall be null when not applicable.

11) The MF/HF Transmit frequency for Sub-Comms field is a variable length number in units of KHz. This field shall be null when not applicable. See ITU Radio Regulations (2020), Volume II (Appendix 17, Annex II) for frequency values [i.8]. As an example, consider the following examples:

    a) Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00"

    b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"

    c) Frequency 16 615,25 KHz may only be represented as "16615.25"

12) The MF/HF Receive frequency for Sub-Comms field is a variable length number in units of KHz. This field shall be null when not applicable. See ITU Radio Regulations (2020), Volume II (Appendix 17, Annex II) for frequency values [i.8]. As an example, consider the following examples:

    a) Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00"

    b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"

    c) Frequency 16 615,25 KHz may only be represented as "16615.25"

A.1.22 AI5 - Initiate Individual Urgency and safety - Position/Test

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AI5 sentence is used to initiate non-distress command to the DSC controller, for a DSC Test call.

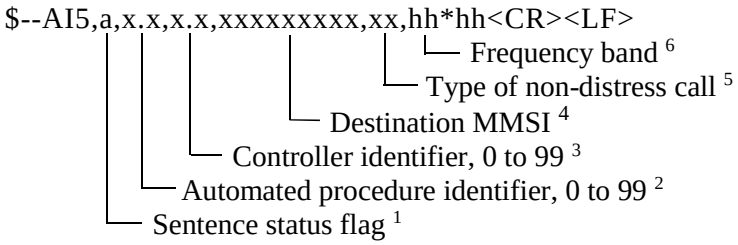
If the AI5 Sentence is accepted, the DSC Controller shall do all of the following:

- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC controller, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI5 sentence;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and
- generate a new AP3 and AO3 with the updated information.

If the AI5 Command Sentence is NOT accepted by the DSC controller, The DSC Controller shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI5 and the NAK response content includes but is not limited to the following:

Table A.11: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC controller assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences:

   This field shall be null when this sentence is sent as a command from a controller to the DSC controller.

   When the DSC controller sends this sentence back as a report this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI5 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

4) Destination MMSI. This is the 9-digit number that uniquely identifies the destination station that will receive the non-distress call.

5) Type of non-distress call. The Type of non-distress call field represents the mode of communication. This is a two digit fixed length field. This field shall not be null. See Recommendation ITU-R M.493.15 [1], Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 118 and 121 correspond to the valid values 18 and 21 respectively as shown below:

   18 = Radio DSC Test Call

   21 = Position request from destination MMSI

6) Frequency band. This is a fixed 2-digit Hexadecimal field that represents each frequency band (for the distress message transmission) as an individual bit-field inside an 8-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null. Selection values:

0 = Frequency band not selected

1 = Frequency band selected

0xxx xxx0 = VHF - Shall always be set to 0

0xxx xx1x = 2 MHz (MF)

0xxx x1xx = 4 MHz

0xxx 1xxx = 6 MHz

0xx1 xxxx = 8 MHz

0x1x xxxx = 12 MHz

01xx xxxx = 16 MHz

1xxx xxxx = Reserved bit shall always be set to 0

A.1.23 AI6 - Initiate Routine Group - Frequency

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AI6 sentence is used to initiate non-distress command to the DSC radio, for a DSC Frequency request.

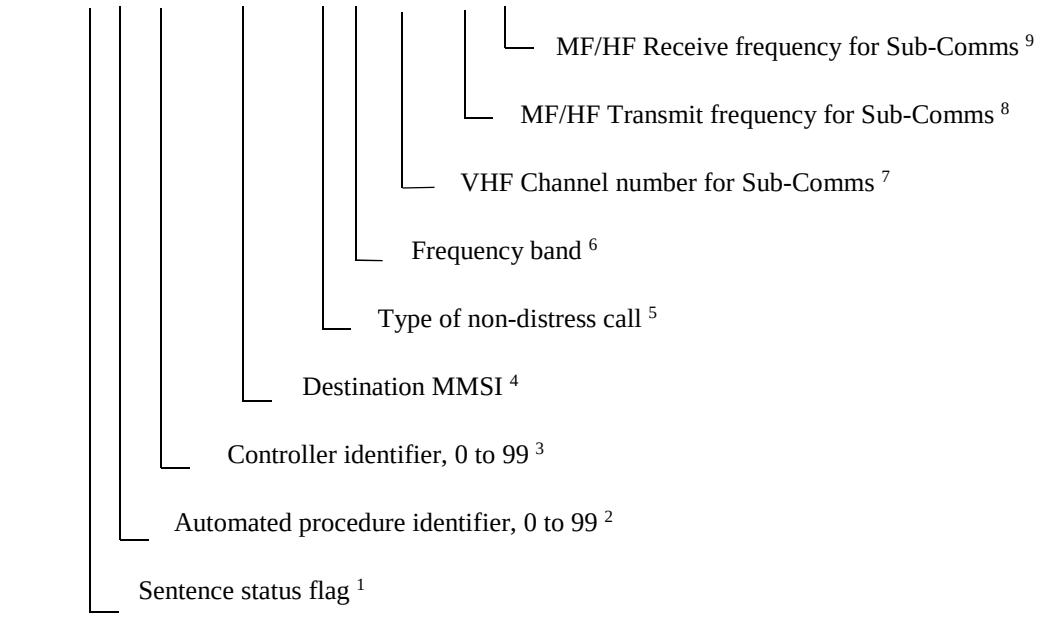
If the AI6 Sentence is accepted, the DSC Radio shall do all of the following:

- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC radio, based on its own configuration, is responsible for populating all necessary fields in the DSC radio call message that are not included in the AI6 sentence;
- perform the commanded operation;
- output the related data sentence representing the DSC radio own ship broadcast; and
- generate a new AP3 and AO3 with the updated information.

If the AI6 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI6 and the NAK response content includes but is not limited to the following:

Table A.12: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC Radio assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences:

   This field shall be null when this sentence is sent as a command from a controller to the DSC controller.

   When the DSC controller sends this sentence back as a report this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI6 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

4) Destination MMSI. This is the 9-digit number that uniquely identifies the destination station that will receive the non-distress call. The first digit shall always be set to "0" which is required to denote a Group Identity per Recommendation ITU-R M.585 "Assignment and use of identities in the maritime mobile service".

5) Type of non-distress call. The Type of non-distress call field represents the mode of communication. This is a two digit fixed length field. This field shall not be null. See Recommendation ITU-R M.493.15 [1], Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 100, 109 and 113 correspond to the valid values 00, 09 and 13 respectively as shown below:

   00 = VHF Voice Communications

   09 = MF/HF Voice Communications

   13 = Telex Teletype (radio message utilizes forward error correction)

6) Frequency band. This is a fixed 3-digit Hexadecimal field that represents each frequency band as an individual bit-field inside a 12-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC Radio will decide which frequency to use when multiple bands are selected. This field shall not be null. Selection values:

   0 = Frequency band not selected

   1 = Frequency band selected

   00xx xxxx xxx1 = VHF

   00xx xxxx xx1x = 2 MHz (MF)

   00xx xxxx x1xx = 4 MHz

   00xx xxxx 1xxx = 6 MHz

   00xx xxx1 xxxx = 8 MHz (Recommended default selection)

   00xx xx1x xxxx = 12 MHz

   00xx x1xx xxxx = 16 MHz

   00xx 1xxx xxxx = 18 MHz

   00x1 xxxx xxxx = 22 MHz

   001x xxxx xxxx = 25 MHz

   11xx xxxx xxxx = Reserved bits shall always be set to 0

7) This is a fixed 4-digit field that represents the VHF channel number. Leading zeros are used to keep field length fixed. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of typical value from the referenced Table is "0016" for channel 16, 156,800 MHz, Calling, distress and safety.

8) The MF/HF Transmit frequency for Sub-Comms field is a variable length number in units of KHz. See ITU Radio Regulations (2020), Volume II (Appendix 17, Annex II) for frequency values [i.8]. As an example, consider the following examples:

   a) Frequency 16 682 KHz may be represented as "16682", "16682.0" or "16682.00"

   b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"

   c) Frequency 16 615,25 KHz may only be represented as "16615.25"

9) The MF/HF Receive frequency for Sub-Comms field is a variable length number in units of KHz. See ITU Radio Regulations (2020), Volume II (Appendix 17, Annex II) for frequency values [i.8]. As an example, consider the following examples:

   a) Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00"

   b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"

   c) Frequency 16 615,25 KHz may only be represented as "16615.25"

A.1.24 AI7 - Initiate Routine Individual- Frequency/Data

This command sentence supports DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF. The AI7 sentence is used to initiate non-distress command to the DSC radio, for either a DSC Frequency, DSC Position or DSC Data request.

For MF/HF communication calls, either frequency or position information (but not both) is provided to the DSC radio to instruct the DSC radio how to construct the actual DSC radio call message.

For VHF voice communication calls, VHF Channel number is provided and both frequency and position information are not provided.

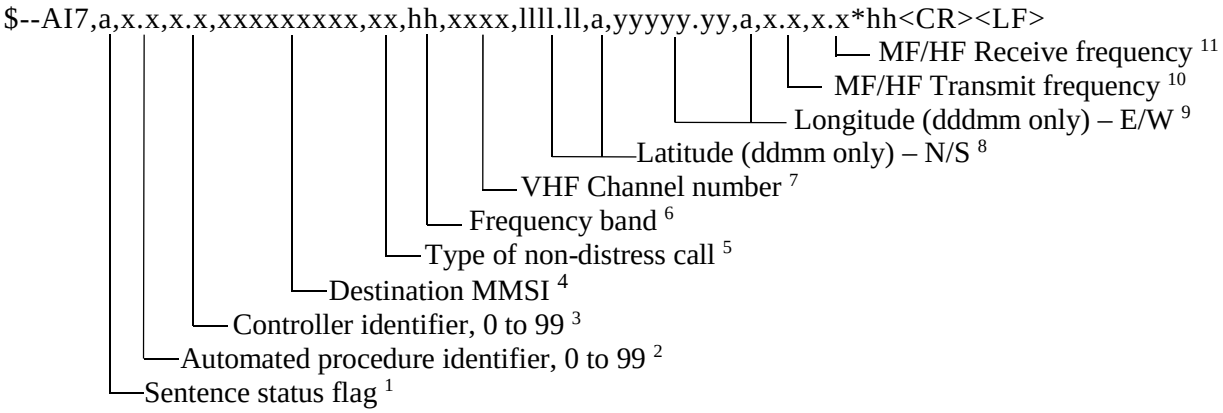
If the AI7 Sentence is accepted, the DSC Radio shall do all of the following:

- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC controller, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI7 sentence;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and
- generate a new AP3 and AO3 with the updated information.

If the AI7 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI7 and the NAK response content includes but is not limited to the following:

Table A.13: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC radio assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences.

   This field shall be null when this sentence is sent as a command from a controller to the DSC controller.

   When the DSC controller sends this sentence back as a report, this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI7 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

4) Destination MMSI. This is the 9-digit number that uniquely identifies the destination station that will receive the non-distress call.

5) Type of non-distress call. The Type of non-distress call field represents the mode of communication. This is a two digit fixed length field. This field shall not be null. See Recommendation ITU-R M.493.15 [1] Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 100, 106, 109, 113 and 115 correspond to the valid values 00, 06, 09, 13 and 15 respectively as shown below:

   00 = VHF Voice Communications

   06 = Data

   09 = MF/HF Voice Communications

   13 = Telex Teletype (radio message utilizes forward error correction)

   15 = Telex [ARQ] (radio message requires retransmission on error)

   For VHF voice communication calls ("00", "06"), VHF Channel number is provided, and the MF/HF Transmit frequency, MF/HF Receive frequency, Latitude and Longitude fields shall be null.

   For MF/HF communication calls ("06", "09", "13", "15"), either:

   - The MF/HF Transmit frequency and MF/HF Receive frequency are provided and Latitude and Longitude fields shall be null.
   - The Latitude and Longitude fields are provided and the MF/HF Transmit frequency and MF/HF Receive frequency fields shall be null.

   These fields inform the radio how to construct the actual DSC radio call message.

6) Frequency band. This is a fixed 3-digit Hexadecimal field that represents each frequency band as an individual bit-field inside a 12-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null. Selection values:

   0 = Frequency band not selected

   1 = Frequency band selected

   00xx xxxx xxx1 = VHF

   00xx xxxx xx1x = 2 MHz (MF)

   00xx xxxx x1xx = 4 MHz

   00xx xxxx 1xxx = 6 MHz

   00xx xxx1 xxxx = 8 MHz (Recommended default selection)

   00xx xx1x xxxx = 12 MHz

   00xx x1xx xxxx = 16 MHz

   00xx 1xxx xxxx = 18 MHz

00x1 xxxx xxxx = 22 MHz

001x xxxx xxxx = 25 MHz

00xx xxxx xxxx = Reserved bits shall always be set to 0

7) The VHF Channel number is a fixed 4-digit field that represents the VHF channel number. Leading zeros are used to keep field length fixed This field shall be null when not applicable.
See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of typical value from the referenced Table is "0016" for channel 16, 156,800 MHz, Calling, distress and safety.

8) Latitude. This is a fixed 4-digit field (ddmm) made up of a 2-digit degrees & minutes field (of 00 to 90 degrees and 00 to 59 minutes). No decimal point or decimal digits are allowed in this field. Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the North ("N") or South ("S") This shall include the character ("N" or "S") for hemisphere. This field shall be null when not applicable.

9) Longitude. This is a fixed 5-digit field (dddmm) made up of a 5-digit degrees & minutes field (of 000 to 180 degrees and 00 to 59 minutes). No decimal point or decimal digits are allowed in this field. Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the East ("E") or West ("W") hemisphere. This field shall be null when not applicable.

10) The MF/HF Transmit frequency field is a variable length number in units of KHz. This field shall be null when not applicable. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

    a) Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00"

    b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"

    c) Frequency 16 615,25 KHz may only be represented as "16615.25"

11) The MF/HF Receive frequency field is a variable length number in units of KHz. This field shall be null when not applicable. See ITU Radio Regulations (2020) [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

    a) Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00"

    b) Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"

    c) Frequency 16 615,25 KHz may only be represented as "16615.25"

A.1.25 AI8 - Automated procedure Initiate DROBOSE

This command sentence supports Distress Relay On Behalf Of Someone Else (DROBOSE) DSC Radio remote control and is applicable to all DSC radios, including VHF, MF and HF.

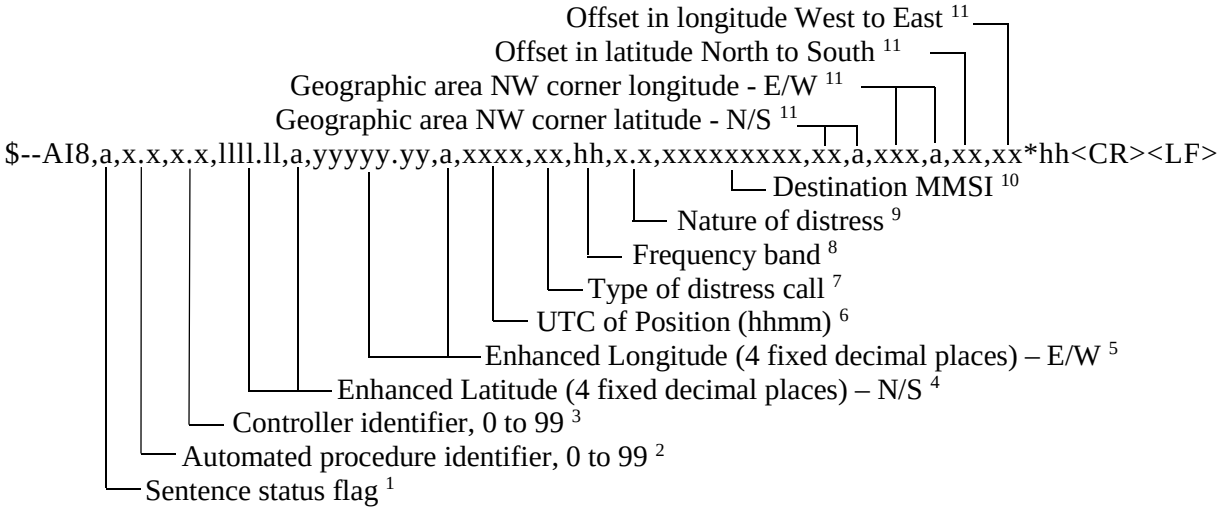
If the AI8 Sentence is accepted, the DSC Radio shall do all of the following:

- respond by sending back this sentence as a report (the sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC radio, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI8 sentence;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and
- generate a new AP2 and AO2 with the updated information. Note that operator interaction with the automated procedure will be done with the AC2 sentence.

If the AI8 Command Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI8 and the NAK response content includes but is not limited to the following:

Table A.14: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC radio assigns a value to this field, it shall be used across the AP2, AO2 and AC2 related sentences:

   This field shall be null when this sentence is sent as a command from a controller to the DSC controller.

   When the DSC controller sends this sentence back as a report, this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI1 command sentence. All remote controllers shall be allowed to modify the "Sending Own Distress Automated Procedure". The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard. This field shall not be null.

4) Enhanced Latitude. This is a fixed 9-digit field (ddmm.ffff) made up of a 4-digit degrees & minutes field (of 00 to 90 degrees and 00 to 59 minutes), a decimal point and a 4-digit decimal-fraction value (of 0000 to 9999). Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the North ("N") or South ("S") hemisphere. When this sentence is sent as a command, a null field indicates the DSC controller should use the position information it has access to for the DROBOSE call.

5) Enhanced Longitude. This is a fixed 10-digit field (dddmm.ffff) made up of a 5-digit degrees & minutes field (of 000 to 180 degrees and 00 to 59 minutes), a decimal point and a 4-digit decimal-fraction value (of 0000 to 9999). Leading zeros are used to keep field lengths fixed. The subsequent character field shall indicate the East ("E") or West ("W") hemisphere. When this sentence is sent as a command, a null field indicates the DSC controller should use the position information it has access to for the DROBOSE call.

6) UTC of position represents the time when the position was generated by position source of the vessel. This is a fixed 4-digit field (hhmm, where hh is 00 to 23 hours and mm is 00 to 59 minutes). Leading zeros are used to keep field length fixed. When this sentence is sent as a command, a null field indicates the DSC controller should use the UTC time of position information it has access to for the DROBOSE call.

7) The Type of distress call field represents the mode of communication. This field is two fixed digits and cannot be null. See Recommendation ITU-R M.493-15 [1] Table A1-3 "Use of Symbol numbers. 100 to 127". ITU Symbol numbers 100, 109 and 113 correspond to the valid values 00, 09 and 13 respectively as shown below:

   00 = VHF Voice Communications

   09 = MF/HF Voice Communications

   13 = Telex Teletype

8) Frequency band. This is a fixed 2-digit Hexadecimal field that represents each frequency band (for the distress message transmission) as an individual bit-field inside an 8-bit mask value. The bit-field definitions are detailed below. Select one or more of the VHF/MF/HF bands, the DSC controller will decide which frequency to use when multiple bands are selected. This field shall not be null. Selection values:

   0 = Frequency band not selected

   1 = Frequency band selected

   0xxx xxx0 = VHF - Shall always be set to 0

   0xxx xx1x = 2 MHz (MF)

   0xxx x1xx = 4 MHz

   0xxx 1xxx = 6 MHz

   0xx1 xxxx = 8 MHz

   0x1x xxxx = 12 MHz

   01xx xxxx = 16 MHz

   1xxx xxxx = Reserved bit shall always be set to 0

9) The Nature of distress field provides the reason for the distress. This is a variable length integer field. This field cannot be null. The values are:

   0 = fire, explosion

   1 = flooding

   2 = collision

   3 = grounding

   4 = listing, endangering of capsizing

   5 = sinking

6 = disabled and adrift

7 = undesignated distress (Default selection)

8 = abandoning ship

9 = piracy/armed robbery attack

10 = Man Overboard (MOB)

12 EPIRB emission

10) The Destination MMSI, typically that of a Coast Station. When the Destination MMSI field is provided, the Geographic area and offset fields, shall be null.

11) A Geographically addressed Distress Relay requires a defined geographic area. See Figure A.3 below from "Recommendation ITU-R M.493-15 [1], figure 6" for a graphical representation of a defined area. There are six data fields that are required to define a geographic area:

- Geographic area NW corner latitude, 2 fixed digits of degrees (9º shall be 09º).
- N/S indicator (N or S).
- Geographic area NW corner longitude, 3 fixed digits of degrees (72º shall be 072º).
- E/W indicator (E or W).
- Offset in latitude North to South, 2 fixed digits of degrees (5º shall be 05º).
- Offset in longitude West to East, 2 fixed digits of degrees (7º shall be 07º).

When the Geographic area and offset fields are provided, the Destination MMSI field shall be null.

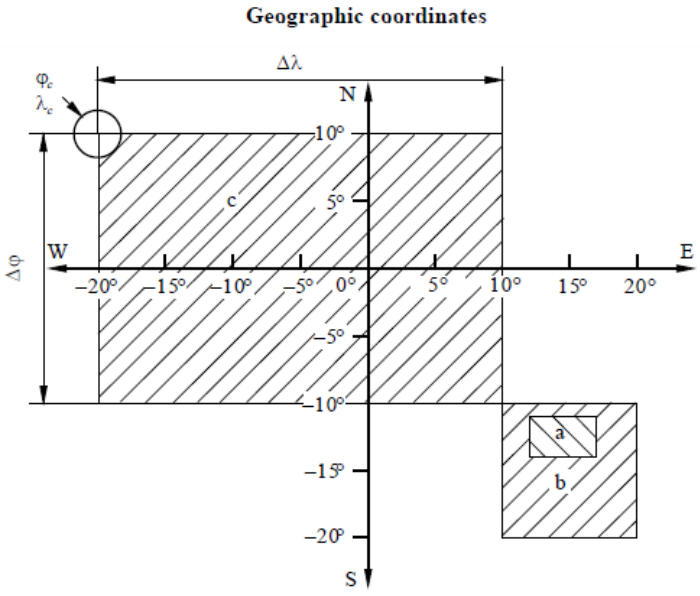


Figure A.3: Geographic coordinates

A.1.26 AI9 - Initiate Communications Call

This command sentence supports DSC Radio remote control and is applicable to all VHF DSC radios. The AI9 sentence shall be used to initiate a communication call command to the DSC controller.

If the AI9 Sentence is accepted, the DSC Controller shall do all of the following:

- respond by sending back this sentence as a report (The sentence status flag shall be set to "R"), with the automated procedure identifier provide;
- the DSC controller, based on its own configuration, is responsible for populating all necessary fields in the radio call message that are not included in the AI9 sentence. For example: where the DSC controller will populate the DSC 2nd Telecommand field in the radio message based on its own configuration, i.e. installed on medical transport ship;
- perform the commanded operation;
- output the related data sentence representing the DSC radio's own ship broadcast; and
- generate a new AP5 and AO5 with the updated information.

If the AI9 Command Sentence is NOT accepted by the DSC controller, The DSC Controller shall generate a NAK Sentence. A list of some possible reasons for not accepting the AI9 and the NAK response content includes but is not limited to the following:

Table A.15: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) necessary to support an own-ship distress not provided	11	"Missing required data fields"
Required data field(s) necessary to support an own-ship distress are invalid	11	"Invalid data fields"

$--AI9,a,x.x,x.x,hh*hh<CR><LF>

- Frequencies used[4]
- Controller identifier, 0 to 99 [3]
- Automated procedure identifier, 0 to 99 [2]
- Sentence status flag [1]

Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

2) This field provides the unique automated procedure identifier. When the DSC controller assigns a value to this field, it shall be used across the AP3, AO3 and AC3 related sentences:

   - This field shall be null when this sentence is sent as a command (see Command Field note 1) from a controller to the DSC controller.

- When the DSC controller sends this sentence back as a report (see Command Field note 1), this field shall contain the DSC controller assigned automated procedure identifier.

3) Controller identifier. This represents the individual controller unit that is sending the AI2 command sentence. The range for the controller identifier value shall be 0 - 99. This identifier is unique to each controller on the vessel as defined in the equipment or installation standard.

4) Frequencies Used.

The first two hex characters represent the Frequency bands supported. The field is used as a bit mask to identify one or more frequency. The field is defined as a 8-bit hex field where the Least Significant Bit (LSB) represents the first band, the next bit represents the second band and so on up to the Most Significant Bit (MSB). Only the active frequency used is reported:

Selection values:

0 = Frequency band not supported

1 = Frequency band supported

0xxx xxx1 = VHF

0xxx xx1x = 2 MHz (MF)

0xxx x1xx = 4 MHz (HF)

0xxx 1xxx = 6 MHz (HF)

0xx1 xxxx = 8 MHz (HF)

0x1x xxxx = 12 MHz (HF)

01xx xxxx = 16 MHz (HF)

1xxx xxxx = Reserved bit shall always be set to 0

A.1.27 AUQ - Automatic Procedure Query

This Automated Procedure Query sentence is designed to support remote control of DSC radios. This sentence provides specified query types include automated procedures and related DSC radio messages, distress, received and transmit logs.

The AUQ sentence is not related to or used with the general Query method described in IEC 61162-1 [3], clause 7.3.5 Query Sentences and in NMEA 0183 [i.4], section 5.3.5 Query Sentences.

If the AUQ Sentence is NOT accepted by the DSC radio, The DSC Radio shall generate a NAK Sentence. A list of some possible reasons for not accepting the AUQ and the NAK response content includes but is not limited to the following:

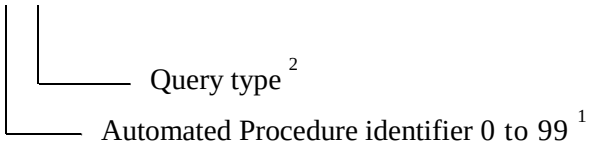
Table A.16: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Specified Automated procedure identifier field does not exist.	49	"No such Automated procedure"
When Query type = 1 and Automated procedure identifier = null and no Automated procedures exist.	49	"No automated procedures exist" [DSC Radio in Standby]
When Query type = 2 and distress log is empty.	49	"Distress log is empty"
If Query type = 3 or 4 or 6 or 8 is not supported	0	N/A
When Query type = 3 is supported and the non-distress received log is empty	49	"Non-distress received log is empty"

Error Condition	NAK Reason Code	NAK Text
When Query type = 4 is supported and the Non-distress transmitted log is empty	49	"Non-distress transmitted log is empty"
When Query type = 5 or 7 and the Automated procedure identifier is not an active distress Automated procedure identifier	49	"Distress automated procedure x is not active" *where x equals the automated procedure identifier from the AUQ sentence*
When Query type = 5 or 7 and the Automated procedure identifier is a non-distress Automated procedure identifier	49	"Automated procedure x is non-distress" *where x equals the automated procedure identifier from the AUQ sentence*
When Query type = 5 or 7 and the Automated procedure identifier = null and there are no active distress Automated procedures	49	"No active distress automated procedures"
When Query type = 6 or 8 and the Automated procedure identifier is not an active non-distress Automated procedure identifier	49	"Non-distress automated procedure x is not active" *where x equals the automated procedure identifier from the AUQ sentence*
When Query type = 6 or 8 and the Automated procedure identifier is a distress Automated procedure identifier	49	"Automated procedure x is distress" *where x equals the automated procedure identifier from the AUQ sentence*
When Query type = 6 or 8 and the Automated procedure identifier = null and there are no active non-distress Automated procedures	49	"No active non-distress automated procedures"
Query type field necessary to support Query not provided	11	"Missing Query type field"
Query type data field is invalid	11	"Invalid data fields"

This sentence cannot be queried.

$--AUQ,x.x,a*hh<CR><LF>



Use of fields:

1) This field provides the unique Automated Procedure Identifier. In a query the identifier may be given as a parameter, or null in response to query with respect to null in this field.

2) Below are eight possible query types. This field shall not be null:

   1 = This Query is for all automated procedure states and allowed commands for a specific automated procedure identifier:

   When the automated procedure identifier is provided, this query shall return with the related APx and AOx sentences.

   When the automated procedure identifier is null, this query shall return APx and AOx sentences for all automated procedures. If there are no automated procedures i.e. the DSC Radio is in Standby, a NAK sentence shall be returned.

2 = This Query is for distress log. This Query shall return all DSC data sentences for the DSC radio messages contained in the distress log. The automated procedure identifier (Field 1) is not used for this query and shall be null. If the distress log is empty, a NAK shall be returned.

3 = This Query is for non-distress received log. This Query shall return all DSC data sentences for the DSC radio messages contained in the non-distress received log. If this query type is not supported, a NAK sentence shall be returned. The automated procedure identifier (Field 1) is not used for this query and shall be null. If the non-distress received log is empty, a NAK shall be returned.

4 = This Query is for non-distress transmitted log. This Query shall return all DSC data sentences for the DSC radio messages contained in the non-distress transmitted log. If this query type is not supported, a NAK sentence shall be returned. The automated procedure identifier (Field 1) is not used for this query and shall be null. If the non-distress transmitted log is empty, a NAK shall be returned.

5 = This Query is for any active distress automated procedure. This provides a history of ALL DSC data sentences related to the automated procedure identifier:

> When the automated procedure identifier is provided, this query shall return with the related APx, AOx and DSC data sentences. If the automated procedure is not active, a NAK sentence shall be returned. If the specified automated procedure is a non-distress automated procedure, a NAK sentence shall be returned.
>
> When the automated procedure identifier is null, this query shall return with the APx, AOx and DSC data sentences for all active distress procedures. If there are no active distress automated procedures, a NAK sentence shall be returned.

6 = This Query is for active non-distress automated procedures. This Query provides a history of ALL DSC data sentences related to the specified active automated procedure. If this query type is not supported, a NAK sentence shall be returned:

> When the automated procedure identifier is provided, this query shall return with the related APx, AOx and DSC data sentences. If the automated procedure is not active, a NAK sentence shall be returned. If the specified automated procedure is a distress automated procedure, a NAK sentence shall be returned.
>
> When the automated procedure identifier is null, this query shall return with the APx, AOx and DSC data sentences for all active non-distress procedures. If there are no active non-distress automated procedures, a NAK sentence shall be returned.

7 = This Query is for active distress automated procedures. This provides the LAST received DSC radio message related to the automated procedure:

> When the automated procedure identifier is provided, this query shall return with the related APx, AOx and DSC data sentences for the last received DSC radio message. If the automated procedure is not active, a NAK sentence shall be returned. If the specified automated procedure is a non-distress automated procedure, a NAK sentence shall be returned.
>
> When the automated procedure identifier is null, this query shall return with the APx, AOx and DSC data sentences for the last received DSC radio message, for all active distress procedures. If there are no active distress automated procedures, a NAK sentence shall be returned.

8 =This Query is for active non-distress automated procedures. This Query provides the LAST received DSC radio message related to the automated procedure. If this query type is not supported, a NAK sentence shall be returned:

> When the automated procedure identifier is provided, this query shall return with the related APx, AOx and DSC data sentences for the last received DSC radio message. If the automated procedure is not active, a NAK sentence shall be returned. If the specified automated procedure is a distress automated procedure, a NAK sentence shall be returned.
>
> When the automated procedure identifier is null, this query shall return with the APx, AOx and DSC data sentences for the last received DSC radio message, for all active non-distress procedures. If there are no active non-distress automated procedures, a NAK sentence shall be returned.

A.1.28 AAS - Audible Alert Sound Status and Control

This command sentence provides information on specific audible frequency and duration settings used for Alerts. This is a multi-sentence message, where each sentence contains information for a single audible alert sound.

When this sentence is transmitted as a report, autonomously or on request via the standard query function, the number of sentences transmitted will be as many as necessary to convey all audible alert sound settings in a device.

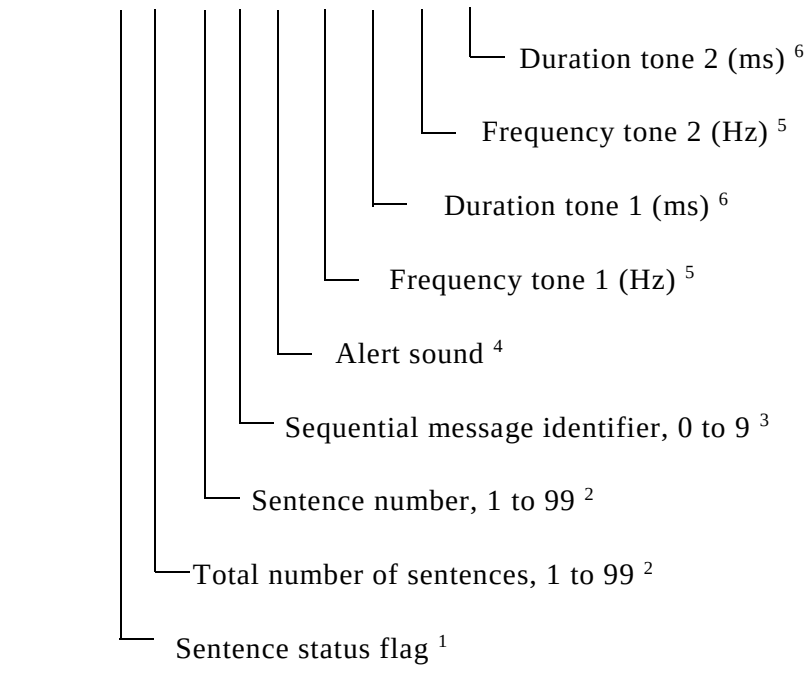
The sentence may be used to command and configure specific audible frequencies and their duration for equipment designed receive and process Audible Alert Sound command sentences. When this sentence is transmitted as a command to configure an audible alert sound, as many sentences as needed will be sent to configure specific audible alert sounds. If there are four sounds being configured, there will be a multi-sentence message consisting of four sentences. Sentences need not be included for configuring audible alert sounds that do not need to be changed. If a device supports ten audible alert sounds and only one needs to be configured, then a single AAS command sentence would be sent.

When an AAS command sentence is received by a device that supports generation of the AAS report sentence, the device shall issue a NAK sentence for any AAS command sentence that cannot be processed. A list of some possible reasons for not accepting the AAS command sentence and the NAK response content includes but is not limited to the following:

Table A.17: Use of NAK codes

Error Condition	NAK Reason Code	NAK Text
Sentence Status Flag is not set to "C"	49	"Sentence Status Flag is not set to "C"
Required data field(s) not provided	11	"Missing required data fields"
Required data field(s) are invalid	11	"Invalid data fields"

If NMEA TAG Blocks are used, all AAS sentences belonging to a single multi-sentence message are linked using TAG Block "sentence-grouping" (see section 7.7 in NMEA 0183 [i.4]).



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null:

   R = Sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated.

   C = Sentence is a configuration command to change settings. A sentence without "C" in this field is not a command.

   See Table A.21 - Special Format Fields for additional information on the sentence status flag field.

   This field provides the unique automated procedure identifier. This field shall not be null.

2) If there are more than one Audible Alert Sound to be reported or commanded, multiple sentences to convey the set of Audible Alert Sounds are necessary, as each AAS sentence can only carry one audible alert sound.

   - The first field specifies the total number of sentences, minimum value 1.
   - The second field identifies the order of this sentence (sentence number), minimum value 1.

   The "Sentence Number" field may be null when there is only one sentences per message, as when the "Total number of sentences" field is set to a value of 1.

3) The sequential message identifier is a number, 0 to 9, used to identify different messages. This field may be null when there is only one sentence per message, as when the "Total number of sentences" is set to a value of 1.

4) Alert sound.

   For Alert sounds used for DSC, see Annex H of IEC 61097-3 [i.2] for the latest information:

   1 = two-tone

   2 = distress ack

   3 = urgency

   4 = urgency ack

   5 = routine, safety

   6 = routine, safety ack

   7 = self-terminating

   8 = discrete

   9 = warning

   10 = count

   11 - 99 = Reserved for future assignment for DSC or other equipment

   Default non-configurable alarm sounds for compliance with IEC 61097-3 [i.2]. The accuracy of the tones and durations specified in the table are not critical since they are for the human ear and not electronic detection. Nevertheless, the error shall not be more than 5 % in frequency and time. The waveforms may be sinusoidal, square, triangular, saw tooth, or any other form as long as the fundamental tone is clearly recognizable. The two-tone and 'urgency' alarms of Table A.18 shall initially be of a power that is clearly distinguishable, but not interfere with, radiotelephone communications. If not manually cancelled within 10 s, the power shall start to rise to a level of at least 80 dB(A) within the next 10 s at a distance of 1 m from the equipment. The operator shall be unable to customize the two-tone, distress acknowledgment, urgency and urgency acknowledgement alarms of Table A.18, or use these alarms for other purposes. The "**Alert Sound**" column contains the numerical enumeration value for this field.

Table A.18: Non-configurable alarm sounds

Alert Sound	Fixed Alarm sounds (see note)	Frequency Hz Tone 1	Frequency Hz Tone 2	Duration ms Tone 1	Duration ms Tone 2
1	two-tone	2 200	1 300	250	250
2	distress ack	2 200	1 300	500	500
3	urgency	2 200	silence	250	250
4	urgency ack	2 200	silence	500	500
NOTE: The two-tone, distress ack, urgency, and urgency ack alarms shall not be able to be customized.					

Recommended configurable alarm sounds for compliance with IEC 61097-3 [i.2]: The '**count**' alarm of Table A.19 shall have a power level of at least 80 dB(A) at a distance of 1m from the equipment. All other alarms in Table A.19 shall be of a power (or of a final power when appropriate) that is clearly distinguishable, but does not interfere with, radiotelephone communications. The alarms of Table A.19 are recommended as factory defaults, however, the manufacturer may implement their own sounds. If the manufacturer does not use the defaults recommended in Table A.19, the manufacturer shall provide a set up option where the operator may customize the characteristics of the alarms. This set up option is not required if the manufacturer implements the characteristics recommended NOT in Table A.19.

Table A.19: Recommended configurable alarm sounds

Alert Sound	Customizable Alarm sound	Frequency Hz Tone 1	Frequency Hz Tone 2	Duration ms Tone 1	Duration ms Tone 2
5	routine, safety	350	300	1 000	500
6	routine, safety ack	350	300	1 000	1 000
9	warning	2 000	silence	250	500
10	count	2 000	silence	500	500
8	discrete	450	300	500	1 000
7	self-terminating	500	360	50	50

5) Frequency tone1 and Frequency tone 2 are represented in integer units of Hertz. A value of 0 indicates no tone, i.e. silence. This field shall not be null.

6) Duration tone 1 and Duration tone 2 are represented in units of milliseconds. A value of 0 indicates no duration time. This field shall not be null.

A.1.29 DCR - Device Capability Report

This sentence is a generic NMEA 0183 [i.4] sentence used to report the capabilities of a device. It is the response to a standard NMEA 0183 [i.4] query for DCR data. The identification of the device's capabilities is specified below, or in the appropriate equipment documentation.

The binary-states are coded using a mask represented as a hexadecimal field (hhhh…). Each bit position of a hexadecimal character is assigned to a specific capability. This provides four capabilities per hexadecimal character.

Generally, the association of capability to bit position begins with the Least Significant Bit (LSB) of the hexadecimal field.

[For IEC 61162-1 [3] consideration - The assignment of bit positions to capabilities is not contained here. The association of a capability to a bit position should be specified in the equipment's standard.]

The capabilities are provided below. A capability is indicated using a binary-state (0 or 1). For example, the following devices support DCR capabilities:

- AIS AtoN Stations (IEC 62320-2 [i.15])
- DSC radios

Assignment and usage of hex bit fields for DSC radio capabilities are specified below.

This sentence shall be broadcast on power up of the DSC radio.

This sentence can be queried using the standard Query method (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences"), as shown below.

This example uses a NMEA 0183 [i.4] Talker identifier of IN for integrated navigation and CD for DSC radio.

$INCDQ,DCR*28<CR<LF>

$--DCR,c--c,hhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhh*hh<CR><LF>

└─ Unique Identifier [1]

└─ Capabilities [2]

Use of fields:

1) The Unique Identifier is a variable length character field with maximum size of 15 characters, used for system level identification. When provided, this is the Unique Identifier of the device.

   For AIS AtoN Stations:

   The Unique Identifier is the AtoN Station's Real MMSI. See IEC 62320-2 [i.15] for additional information on AIS application of the Unique Identifier data field.

   For DSC radios, the DSC radio type determines the Unique Identifier:

Table A.20: DSC Identifiers

DSC Radio Type	Unique Identifier text
Class A	DSC Class A
Class D	DSC Class D
Class E	DSC Class E

2) The Capabilities mask is defined as a 128 bit hex field where the least significant bit (LSB) represents the first capability, the next bit represents the second capability and so on up to bit 128 (The Most Significant Bit (MSB)) which is the 128th capability. Unused bit positions or bit positions with no predefined meaning shall always be set to "0". This data field is fixed length containing 32 hexadecimal characters.

   Selection values:

   0 = Capability not supported or not defined

   1 = Capability supported

   Usage of the bit fields for DSC radio capabilities using the standard DCR sentence:

Table A.21: AIS AtoN Station DCR Sentence Functionality Capabilities

Capabilities BIT Position	IEC 62320-2 [i.15] AIS AtoN Station Capabilities
0 (LSB)	Type 1
1	Type 2
2	Type 3
3	FATDMA
4	RATDMA
5	CSTDMA
6	Direct VDL Configuration Message 6
7	Direct VDL Configuration Message 25
8	referenceChaining VDL Configuration
9	UTC Indirect
10	Message 6/7
11	Message 8
12	Message 12/13
13	Message 14
14	Message 25
15	Message 26
16	Dual Channel
17	Virtual AtoN
18	EPFS
19-99	Reserved for future use
100-127 (MSB)	Manufacturer Defined

Usage of hex bit fields for DSC radio capabilities using the standard DCR sentence.

Frequencies Supported:

The first two hex characters represent the Frequency bands supported. The field is used as a bit mask to identify one or more frequency. The field is defined as a 8-bit hex field where the Least Significant Bit (LSB) represents the first band, the next bit represents the second band and so on up to the Most Significant Bit (MSB). All supported VHF/MF/HF bands shall be selected.

Selection values:

0 = Frequency band not supported

1 = Frequency band supported

0xxx xxx1 = VHF (LSB)

0xxx xx1x = 2 MHz (MF)

0xxx x1xx = 4 MHz

0xxx 1xxx = 6 MHz

0xx1 xxxx = 8 MHz

0x1x xxxx = 12 MHz

01xx xxxx = 16 MHz

1xxx xxxx = Reserved bit shall always be set to 0. (MSB)

VHF Channeling:

The third hex character represents the Channeling available in the VHF radio:

Selection values:

0 = Frequency channel not supported

1 = Frequency channel supported

0xx1 = 25 kHz channels (LSB)

0x1x = 12,5 kHz channels

01xx = 6,25 kHz channels

1xxx = N/A (Always set to 0) (MSB)

MF/HF Telex Support:

The fourth hex character represents the type of Telex supported by the radio:

Selection values:

0 = Telex not supported

1 = Telex supported

00x1 = FEC Telex (LSB)

001x = ARQ Telex

01xx = N/A (Always 0)

10xx = N/A (Always 0) (MSB)

Table A.21

Special Format Field	Symbol	Definition
Sentence Status Flag	a	This field is a required field for any sentence designated as a command sentence. The field distinguishes the contents of command sentence as being commands intended to change settings or as being status information only. This field shall not be null. This field shall contain an "R" when the sentence is a status report of current settings. This may occur when the sentence is provided in response to a query or is autonomously generated. This field shall contain a "C" when the sentence is a configuration command to change settings. A sentence without a "C" in this field is not a command. If a designated command sentence cannot be queried, as stated in the sentence's definition, this field shall always be set to "C". When data fields are null in a command sentence (sentence status flag = C), there is no change in their setting. When a configuration data field is null in a status report sentence (sentence status flag = R), this data field is not configured
Status	A	A = Yes, Data Valid, Warning Flag Clear V = No, Data Invalid, Warning Flag Se
Latitude	llll.ll	Fixed/Variable length field: degreesminutes.decimal - 2 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimalfraction of minutes. Leading zeros always included for degrees and minutes to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
Longitude	yyyyy.yy	Fixed/Variable length field: degreesminutes.decimal - 3 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimalfraction of minutes. Leading zeros always included for degrees and minutes to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
Time	hhmmss.ss	Fixed/Variable length field: hoursminutesseconds.decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds and a variable number of digits for decimal-fraction of seconds. Leading zeros always included for hours, minutes and seconds to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
Defined field		Some fields are specified to contain pre-defined constants, most often alpha characters. Such a field is indicated in the present document by the presence of one or more valid characters. Excluded from the list of allowable characters are the following that are used to indicate field types within the present document "A", "a", "c", "hh", "hhmmss.ss", "llll,ll", "x", "yyyy.yy".

A.1.30 FSC - Frequency Status and Command

This command sentence is used to report frequencies, mode and power and to acknowledge commands and to set frequency, channel, mode of operation and transmitter power level of a radiotelephone.

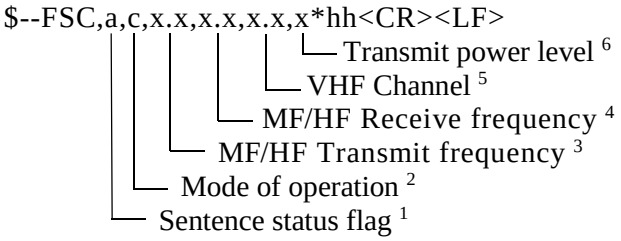
This sentence replaces the FSI and FSS sentences.

This sentence is broadcasted as a report upon any command change frequency, channel, mode of operation and transmitter power level in the equipment.

Furthermore, the sentence shall be transmitted in reply to a standard Query Sentence (see NMEA 0183 [i.4], section titled "Query Sentences" or IEC 61162-1 [3], section titled "Query Sentences").

When sent as a Command Sentence, if the FSC Command Sentence is not accepted by the radiotelephone, the radiotelephone shall generate a NAK Sentence with an appropriate Reason Code and optional descriptive text.

The response to a FSC Command Sentence, accepted or not, is always a FSC Report Sentence. Field 1, "Sentence Status Flag" determines if the FSC sentence is being sent as a Report or a Command.



Use of fields:

1) This field is used to indicate a sentence that is a status report of current settings or a configuration command changing settings. This field shall not be null.

   R = Sentence is a status report of current settings (use for a report/reply to a query)

   C = Sentence is a configuration command to change settings. A sentence without "C" is not a command

2) Mode of operation:

   d = F3E/G3E simplex, telephone

   e = F3E/G3E duplex, telephone

   m = J3E, telephone

   o = H3E, telephone (No longer in use)

   q = F1B/J2B FEC NBDP, Telex/teleprinter

   s = F1B/J2B ARQ NBDP, Telex/teleprinter

   t = F1B/J2B receive only, teleprinter/DSC

   w = F1B/J2B, teleprinter/DSC

   x = A1A Morse, tape recorder

   { = A1A Morse, Morse key/head set (ASCII 123)

   | = F1C/F2C/F3C, FAX-machine (ASCII 124)

   null for no information

3) The MF/HF Transmit frequency field is a variable length number in units of KHz. See ITU Radio Regulations [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

   - Frequency 16 682 KHz may be represented as "16682", "16682.0", or "16682.00"
   - Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50"
   - Frequency 16 615,25 KHz may only be represented as "16615.25"

4) The MF/HF Receive frequency field is a variable length number in units of KHz. See ITU Radio Regulations [i.8], Volume II (Appendix 17, Annex II) for frequency values. As an example, consider the following examples:

   - Frequency 16 682 KHz may be represented as "16682" or "16682.0" or "16682.00".
   - Frequency 22 297,5 KHz may be represented as "22297.5" or "22297.50".
   - Frequency 16 615,25 KHz may only be represented as "16615.25"

5) This VHF Channel number is represented as 4 fixed digits with leading zeros as necessary. This field shall be null when not applicable. See Recommendation ITU-R M.1084-5 [i.10], Annex 4, table titled "Assignment of channel numbers to interleaved channels and simplex operation of duplex channels in the VHF maritime band" for VHF Channel numbers. An example of a typical value from the referenced Table is "0016" for channel 16, 156,800 MHz, Calling, distress & safety.

6) The Transmit power level has the lower and upper bound settings defined as lowest and highest. Values in between the Lowest and Highest may be supported, i.e. 5 = Medium. This field may be null when sent in a Command Sentence (when the Sentence status flag = C) if no change to the current Transmit power level is needed. This field shall not be null when the Sentence status flag = R.

   0 = Standby: The use of Standby is for legacy equipment, as most newer radio equipment will consist of an integrated transceiver, where "standby" = Receive.

   1 to 9 = a range of values from 1 to 9 are defined to be:

      1 = Lowest power level supported

      9 = Highest power level supported

   Other values within the range may be possible, depending on the radio equipment.

The following sentences show typical applications for remote control of radiotelephones:

$EIFSC,C,m,2023,2614,,1*47<CR><LF>

Command Sentence from ECDIS to the radiotelephone: Sets Sentence status Flag **C**, Mode of operation **m** for J3E, telephone, MF/HF Transmit frequency **2 023 kHz**, MF/HF Receive frequency **2 614 kHz**, Transmit power level **Low**;

$CTFSC,R,m,2023,2614,,1*4D<CR><LF>

Report Sentence from radiotelephone: Sentence status flag **R**, Mode of operation **m** for J3E, telephone, MF/HF Transmit frequency **2 023 kHz**, MF/HF Receive frequency **2 614 kHz**, Transmit power level **Low**;

$INFSC,C,m,2023.0,2614.0,,5*48<CR><LF>

Command Sentence from Integrated Navigation System to the radiotelephone: Sentence status flag **C**, Mode of operation **m** for J3E, telephone, MF/HF Transmit frequency **2 023 kHz**, MF/HF Receive frequency **2 614 kHz**, Transmit power level **5.**

$ECFSC,C,o,,2182.00,,*5B<CR><LF>

Command Sentence from Electronic Chart System to the radiotelephone: Sentence status flag **C**, Mode of operation **o** for H3E, telephone, MF/HF Receive frequency **2 182 kHz.**

$INFSC,C,d,,,0016,9*48<CR><LF>

Command Sentence from Integrated Navigation System to the radiotelephone: Sentence status flag **C**, Mode of operation **d** for F3E/G3E, simplex, telephone, VHF channel **16**, Transmit power level **9.**

Annex B (informative): Traffic simulation

B.1 General guide

The minimum number of active automated procedures are 6, but the manufacturer is allowed to implement the handling of even more automated procedures in parallel. Potential traffic will increase with the number of simultaneous procedures and guidance may be needed.

The interfaces should not be overloaded with information that does not reflect actual state changes in the equipment. For example, elapsed time information (in seconds), which is supported in the APn sentence, should not be emitted each second to keep a remote controller up to date. The remote control traffic received by the DSC EQUIPMENT under normal operation should be limited to:

- Control sentences to the active automated procedure (ACn grouped with related sentences).
- Query for procedure status (AUQ).

The DSC EQUIPMENT should under normal operation only transmit status sentences on the following events:

- Received DSC call pertinent to an ongoing automated procedure or initiating a new procedure (active or on hold).
- Time-out that will make an automated procedure changing its operational status.
- Status/information sentences in reply to a query sentence (using AUQ).
- Status sentence for an operational status change in the automated procedure that is a direct result of a received control sentence (ACn) or manual operation on the DSC EQUIPMENT HMI.

Furthermore the following information should be transmitted on a timely base:

- CUL sentence for tracking if information from the DSC EQUIPMENT has been lost during signalling to the remote client (30 seconds).
- Status sentences that are not related to operational changes in automated procedures (e.g. simple reporting of elapsed time). The periodic transmission time should be programmable in a range including "never" (transmission on events or query only).

The DSC EQUIPMENT should be designed in such way that limitation in the receive direction will not occur during normal operation (guaranteed responsiveness) under the following preconditions:

- Relevant messages are only to initiate a new procedure or addressing the active automated procedure.
- No commands (ACn) are addressed to automated procedures on hold, unless it is activating that procedure (putting the current active procedure on hold).
- The manufacturer should specify the maximum input rate under which the equipment can still perform all functions required by its performance standards (see also IEC 61162-450 [5]).

If traffic limitations apply in the DSC EQUIPMENT transmit direction the following priority guidelines should be used:

1) Status information as a direct result of a command (manual operation on the DSC EQUIPMENT or remote sentence ACn).
2) Status information as a direct result of a received DSC call pertinent to an ongoing automated procedure or initiating a new procedure.
3) Status information as a direct result of a query sentence (AUQ).

Other priorities (or configuration of priorities) should be clearly explained in the manufacturers documentation.

Furthermore, for IEC 61162-1 [3] or IEC 61162-2 [4] serial interfaces (selections of SNGF description in IEC 61162-460 [i.3]):

- The manufacturer should specify the maximum output buffer capacity for each port. The maximum capacity may be configurable at installation.
- The buffer should be implemented as a FIFO (first in, first out) buffer. In case of a full buffer, newly arrived sentences should be discarded, unless these sentences are specified as prioritized (see above). Newly arrived sentences will be inserted into the buffer when buffer space is available.
- Priority of sentences if a sentence does not immediately fit into the buffer:

4) Only one sentence with identical talker identifier and sentence formatter should exist in the buffer. Exception is a multi-sentence message or a TAG block group of sentences: they should only be replaced in their entirety.

5) If a single sentence, multi sentence message or a TAG block grouped sentences, with identical talker identifier and sentence formatter exists in the buffer, the new sentence or sentences will replace the existing sentence or sentences at its position in the queue. This replacing should not cause logging of an error nor sending anything to syslog. When prioritizing TAG block grouped sentences, several fields within the TAG block need to be compared as well as the sentence comparisons. All of the compared components should match those of the current TAG block group in order to the replace TAG block group in the queue. The components to compare are: the TAG block source parameter code value, the "number of lines" portion of the TAG block group parameter code and the sentences within the TAG block group.

6) Otherwise, the new sentence should follow the FIFO principle as described above.

- If a sentence is discarded from the queue, this event should be logged as an error internally in syslog.

NOTE: Where expansion sentences are used, e.g. APn, ECI, DSE these should be considered as an entity and should be treated as TAG block grouped sentences if a TAG block is not preceding the sentence immediately (see NMEA 0183 [i.4]).

B.2 Traffic load scenarios

B.2.1 6 simultaneous procedures

The worst case scenario for calculation transmit traffic from DSC EQUIPMENT would be the following use case:

- 6 simultaneous procedures are available in DSC EQUIPMENT
- 6 distress relay calls are received simultaneously from 6 different ships
- All received calls contain the expansion for enhanced position
- A TAG block of 25 characters for grouped sentences
- CUL sentence transmitted

Table B.1: Worst case transmit traffic simulation on a serial interface

Description of the sentences to transmit	Size of sentence (approximate in bytes [+TAG])	Number of sentences	Total number transmitted (bytes)
CUL synchronization sentence to be transmitted	70	1	70
APn sentences transmitted upon forced termination of existing procedures	45	6	270
Groups of APn, ECI and DSE	APn: 67 [+25] ECI: 70 [+25] DSE: 40 [+25]	6	1 512
Total			1 852

- 6 distress relay calls cannot be made simultaneously in practice

The fastest scenario is with VHF (1 200 bit/s). The reception of on distress relay call requires 205 information bits. Receiving 6 distress relay calls (back-to-back) takes at least 1,025 seconds.

B.2.2 61162-1 4800 baud interfaces

The worst case scenario calculated in Table B.1 shows that an output buffer size of 2 KB (2 048 bytes) is sufficient to contain all transmit information (with overhead).

It will take approximately 3,9 seconds to transmit all information on a serial 4 800 baud line.

By the reception of the last distress relay call (i.e. after 800 milliseconds) the buffer will already be emptied by all transmit information for at least one automated procedure.

B.2.3 61162-450 traffic shaping

There are no special limitations for this type of event based sentences in a IEC 61162-450 [5] compliant network function.

History

Document history			
V1.0.0	November 2021	EN Approval Procedure	AP 20220213: 2021-11-15 to 2022-02-14
V1.1.1	February 2022	Publication	