TECHNICAL MANUAL

Tron UAIS TR-2500

JOTRON

www.jotron.com

Abbreviations and definitions

ACU, Antenna Changeover Unit

AIS -Automatic Identification System.
A shipborne broadcast transponder system in which ships continually transmit their position, course, speed and other data to other nearby ships and shoreline authorities on a common VHF radio channel.

ALARM
Message by which the navigator signals the occurrence of an event. The alarm is indicated by an audible tone and/or a message (or icon) on the display.

ALTITUDE, The height of the antenna over mean sea level.

AMBIENT, Surrounding or encompassing environment.

ANTENNA HEIGHT, The height (over the waterline) in which the antenna is installed.

ASM, AIS Service Management – Controlling entity for the whole AIS service

AUX
Auxiliary Port -A communication port on the AIS transponder, which can be used for NMEA or RTCM, input.

BAUD, Transmission rate unit of measurement for binary coded data (bit per second).

BIT, Short form of Binary Digit. The smallest element of data in a binary-coded value.

Bps, Bits Per Second.

BSC, Base Station Controller

CHARACTER STRING, Continuous characters (other than spaces) in a message.

CHECKSUM
The value sent with a binary-coded message to be checked at the receiving end to verify the integrity of the message.

CLICK (KEYBOARD)
The audible tone generated when a key is activated

CLOCK
A precisely-spaced, stable train of pulses generated within an electronic system to synchronize the timing of digital operations within the system.

CLOCK OFFSET
The differences between the times at the CDU/processor tracking a satellite, the satellite itself, and GPS system time.

COG, See COURSE OVER GROUND

COURSE OVER GROUND, Course made good relative to the sea bed.

CURSOR
A flashing rectangle superimposed on a character position in the display window, indicating that a character may be entered in that position, or that the existing character may be changed via the keyboard.

DEFAULT
A condition that the navigator assumes automatically if no other condition is initiated by the operator.

DGPS, See DIFFERENTIAL GPS.

DIFFERENTIAL GPS (OOPS)
A method of refining GPS position solution accuracy by modifying
the locally computed position solution with correction signals from an external reference GPS CDU (monitor).

ECDIS, Electronic Chart Display and Information System

EPFS, Electronic Position Fixing System (GPS is mostly used)

ETA
Estimated Time of Arrival. Calculated on basis of the distance to the destination and the current (or estimated) speed.

FATDMA
Fixed Access Time Division Multiple Access -Data link access protocol used by base station transponders to allocate transmission slots on the data link. These slots are fixed and will not change until the base station transponder is re-configured.

FM
Frequency Modulation -The method by which a signal offsets the frequency in order to modulate it on a data link. position (latitude, longitude, altitude, and time). See DILUTION OF PRECISION.

GFSK
Gaussian-Filtered-Shift-Keying -A standardised method of modulating digital data prior to transmission on a data link.

GMSK
Gaussian-Minimum-Shift-Keying -GFSK using BT -products and modulation index, which optimises the modulated signal.

GNSS
Global Navigation Satellite System -A common label for satellite navigation systems (such as GPS and GLONASS).

GLOBAL POSITIONING SYSTEM (GPS)
The NAVSTAR Global Positioning System, which consists of or- biting satellites, a network of ground control stations, and user positioning and navigation equipment. The system has 24 satellites plus 3 active spare satellites in six orbital planes about 20,200 kilometres above the earth.
GLONASS
A satellite navigation system developed and operated by Russia.

GMT, Greenwich Mean Time. See also UNIVERSAL TIME COORDINATED.

GPS SYSTEM TIME
Time corrected to Universal Time Coordinated (UTC) and used as the time standard by the user segment of the GPS system.

HEADING
The direction in which the vessel is pointed, expressed as angular distance from north clockwise through 360 degrees. HEADING should not be confused with COURSE. The HEADING is constantly changing as the vessel yaws back and forth across the course due to the effects of sea, wind, and steering error.

IALA, International Association of Marine Aids to Navigation ans Lighthouse Authorities

IEC, International Electro-technical Commission.

IEC 61162-1 Maritime navigation and radiocommunication equipment and systems – Digital interfaces
Single Talker- Multiple listeners: Closely related to NMEA0183 version 2.3, communication at 4800 baud. Definitio of both electrical and protocol to be used.

IEC 61162-2 Maritime navigation and radiocommunication equipment and systems – Digital interfaces
Single Talker- Multiple listeners, High speed transmission: Closely related to NMEA0183HS
version 2.3, communication at 34800 baud. Definition of both electrical and protocol to be used.

IEC 61993-2 Maritime navigation and radiocommunication equipment and systems – Automatic Information Systems (AIS) Definitions of the sentences used for AIS in addition to those mentioned in IEC 61162-1 and IEC 61162-2.

IMO, International Maritime Organisation

INTERFACE
Electronic circuits that permit the passage of data between different types of devices; For example, the speed and heading interface circuit permits data from a speed log and compass to pass to the navigator processor.

IP
Internet Protocol (**IP**) is the central, unifying protocol in the TCP/IP suite. It provides the basic delivery mechanism for packets of data sent between all systems on an internet, regardless of whether the systems are in the same room or on opposite sides of the world. All other protocols in the TCP/IP suite depend on IP to carry out the fundamental function of moving packets across the internet.

ITDMA
Incremental Time Division Multiple Access -Access protocol for pre-announced transmissions of temporary or non-repeatable character. It is also used during data link network entry.

ITU International Telecommunication Union.

LED, Light Emitting Diode.

LSS
Logical AIS Shore Station. A LSS is a software process, which transform the AIS data flow associated with one or more PSS into different AIS-related data flow. The SW process of a logical AIS station can run on any appropriate computer at any appropriate place.
MMI Man Machine Interface

NMEA

National Marine Electronics Association. The NMEA electronics interface specifications have been developed under the auspices of the Association. The NMEA 0183 is an internationally recognized specification for interfacing marine electronics. NMEA 0183 version 2.3 is identical to lEC 61162-1.

POLLED MODE
A transponder is in a polled mode during a request-response session only. Distinguish this from a station, which is polled into certain slots. This station is first polled and then enters assigned mode.

POSITION UPDATE
The redefining of position by analysis of satellite orbital data as referenced to time.
PROCESSOR
The processor circuit card in the console that controls system operations and computes the positioning/navigation solutions.

PROMPT, A message on the display instructing the operator to make a keyboard entry.

PSS
Physical AIS Shore Station. The PSS is the most basic AIS-related entry, which can exist on its own in a real physical environment, as opposed to an AIS base station or AIS repeater station.

PULSE SPEED SENSOR, Speed log whose speed output signal is defined by a pulse mte output.

RATDMA
Random Access Time Division Multiple Access -Access protocol for transmissions which have not been pre-announced. This is used for the first transmission during data link network entry or for messages of non-repeatable character.

REFERENCE COMPASS
The compass against which the steering compass (see STEERING COMPASS) may be calibrated.

REFERENCE ELLIPSOID
A mathematical description of the Earth's ellipsoidal shape (see ELLIPSOID), which is the reference frame for positioning computation.

RESET, To return stored values to either the default value or zero in memory.

RMS, See ROOT MEAN SQUARED.

ROOT MEAN SQUARED (RMS)

A statistical measure of probability, stating that an expected event
will happen 68% of the time. In terms of position update accuracy, 68 position updates out of 100 will be accurate to within specified system accuracy.

SENSOR, A device that detects a change in a physical stimulus and turns it into a signal that can be measured.

SET AND DRIFT, The direction and the speed of the water over ground (current).

SIGNAL- TO-NOISE RATIO (SIN)
Quantitative relationship between the useful and non-useful part of the received satellite signal. A high SIN indicates a good receiving condition.

S/N, See SIGNAL- TO-NOISE RATIO

SOFTWARE
Values programmed and preloaded into memory. The values represent a permanent set of instructions for running the automatic functions (computations) of the navigator.

SOG, See SPEED OVER GROUND

SOTMA

Self Organised Time Division Multiple Access -An access protocol, which allows autonomous operation on a data link while automatically resolving transmission conflicts.

SPEED OVER GROUND, Speed in relation to the seabed.

TCP
Transmission Control Protocol (**TCP**) provides a reliable byte-stream transfer service between two endpoints on an internet. TCP depends on IP to move packets around the network on its behalf.

TCP/IP
TCP/IP is a name given to the collection (or *suite*) of networking protocols that have been used to construct the global Internet. The protocols are also referred to as the **DoD** (*dee-oh-dee*) or **Arpanet** protocol suite because their early development was funded by the Advanced Research Projects Agency (**ARPA**) of the US Department of Defense (**DoD**).

TDMA
Time Division Multiple Access. An access scheme for multiple access to the same data link.

UDP
User Datagram Protocol provides a packetized data transfer service between endpoints on an internet. UDP depends on IP to move packets around the network on its behalf.

UNIVERSAL TIME COORDINATED (UTC)
Greenwich mean time corrected for polar motion of the Earth and seasonal variation in the Earth's rotation.

UPDATE, See POSITION UPDATE.

UTC, See UNIVERSAL TIME COORDINATED.

VDL, VHF Data Link.

VHF, Very High Frequency -A set of frequencies in the MHz region.

VSWR, Voltage standing wave ratio

Amendment Record

AMENDMENT NO.	INCORP. BY	DATE	PAGE(S)	VERSION	REASON FOR CHANGE
1	FIT	5.11.2003	21 (All)	A	
2	FIT	27.2.2004	1,4,7,8,17	B	
3	FIT	3.3.2004	5, 7, 8	C	
4	FIT	1.4.2004	1,4	D	
5	ES	07.11.2006	25	E	Kontroll med manualer.doc
6	ES	08.04.2007	Total: 26	F	New company name New logo
7	ES	04.01.2008	3-9	G	Talker identifier
8	ES	24.02.2009	1-2	H	New GPS module
9	ES	29.01.10	3-3	I	Change in chapt. 3.1.6
10					
11					
12					
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The information in this book has been carefully checked and is believed to be accurate. However, no responsibility is assumed for inaccuracies.

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to any products or modules described herein to improve reliability, function or design.
Jotron AS does not assume any liability arising
out of the application or use of the described product.

SAFETY INSTRUCTIONS

1. **Do not place liquid-filled containers on top of the equipment.**

2. **Immediately turn off the power if water or other liquid leaks into the equipment.** Continued use of the equipment can cause fire or electrical shock. Contact a Jotron AS agent for service.

3. **Immediately turn off the power if the equipment is emitting smoke or fire.**

4. **Do not operate the equipment with wet hands.**

5. **CAUTION!**
   This equipment contains CMOS integrated circuits. Observe handling precautions to avoid static discharges which may damage these devices.

LIST OF CONTENTS

1 SPECIFICATIONS

1.1 General

Supply voltage:	24 VDC +30% / -10%
Power consumption:	<100W
Operating temperature:	-15°C to +55°C
Environmental:	IP64

1.2 Transponder

Size:	244 x 108 x 146 mm	
Weight:	2.8 kg	
Color:	Slate Grey (RAL7015)/ Black (RAL 9004)	
Enclosure:	Polycarbonate/ Aluminium	
Compass safety distance:		
	Standard magnetic:	0.9 m
	Steering magnetic:	0.65 m

1.3 Junction Box

Size:	304 x 227.2 x 46.5 mm	
Weight:	1.6 kg	
Color:	Black (RAL 9005)	
Enclosure:	Coated steel	
Compass safety distance:		
	Standard magnetic:	2.30 m
	Steering magnetic:	1.05 m

1.4 Display/ Keyboard

Display:	Monochrome STN-LCD, 24 characters x 4 lines
Keyboard:	19 keys
LED:	4 LED for identification of: Alarm/ OK/ RX /TX

Keyboard and display have backlight that may be adjusted.

1.5 Integrated GPS

No of Channels:	16 channels parallel
Tracking:	16 channels simultaneously
Frequency:	L1 - 1575.42 MHz
RX code:	C/A code
Velocity:	> 500 m/s
Acceleration:	Up to 5G
Horizontal:	< 3 meters (CEP)
	5 meters 2dRMS
3D:	< 5 meters (SEP)
DGPS:	< 1 meter (CEP)
Timing:	< 100 ns (absolute)
	< 40 ns (1sigma)
Acquisition/ Reacquisition:	
	< 4 seconds with almanac, time, position
	< 40 seconds (Cold start)
DGPS interface:	RTCM SC-104

1.6 Interfaces

	Input sentences	Output sentences
Sensor 1, 2 and 3: (External GPS, Gyro and ROT/LOG)	DTM, GBS, GGA, GLL, GNS, HDT*, OSD, RMC, ROT, VBW, VTG	
External Display, Aux Display/ Pilot Port	ABM, ACA, ACK, AIR, BBM, DTM, GBS, GGA, GNS, GLL, HDT, LRF, LRI, OSD, RMC, ROT, SSD, VBW, VSD, VTG	ABK, ACA, ALR, LR1, LR2, LR3, LRF, LRI, TXT, VDM, VDO
Long Range Port	LRF, LRI	LR1, LR2, LR3, LRF, LRI

*) $HCHDT will be rejected. $HEHDT will be accepted.

All the above ports comply with IEC 61162-1 (Second edition, 2000-07) at 4800 baud and IEC 61162-2 (First edition, 1998-09) at 38400 baud

Alarm Output:	Contact closure
Lan:	IEC61162-4 (Future implementation)

1.7 Transmission Intervals

ABK, ALR, TXT:	At each event

ALR:	30 seconds during alarm, 1 minute otherwise (empty message)
ACA, LRF, LR1, LR2, LR3, VDM:	At RX
VDO	1 second

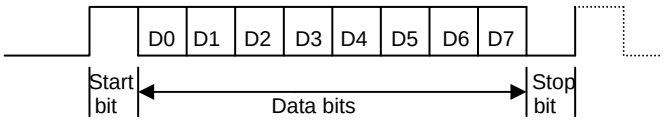
1.8 Load requirements as listener

Isolation:	Provided
Maximum voltage:	+/- 14 V to Isolated Ground
Maximum diff. Voltage (A-B):	+/- 15 V
Threshold:	+/- 0.2 V (A-B)
Input impedance:	232 ohm w/jumper (Termination Strap) 7680 ohm wo/ jumper

2 DATA TRANSMISSION

2.1 Data transmission

Data is transmitted in serial asynchronous form in accordance with the standards referenced in 2.1 of IEC 61162-1/2. The first bit is a start bit and is followed by data bits, least-significant-bit first, as illustrated by figure below.
The following parameters are used:
- baud rate: 4 800 / 38 400 [1]
- data bits: 8 (D7 = 0),
- parity: none;
- stop bits: 1.

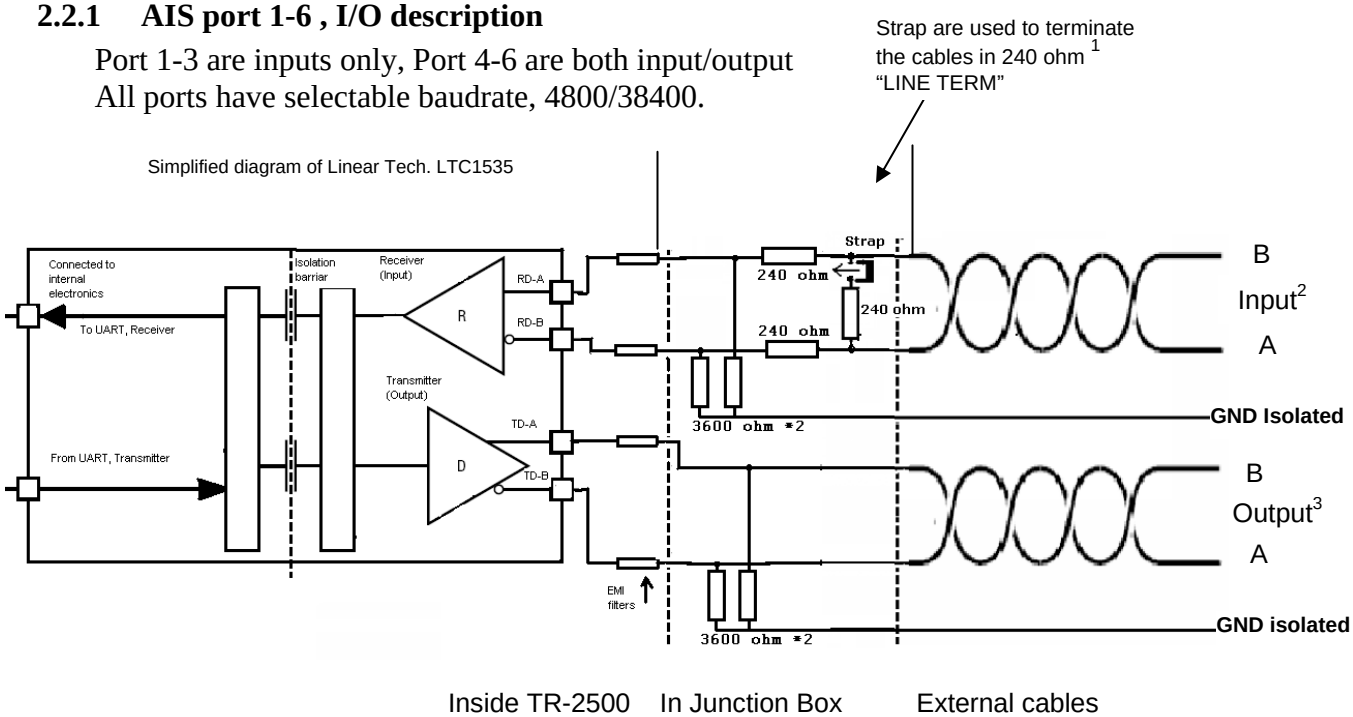


Note 1: Baudrate is 4800 on IEC 61162-1 interfac and 38400 on IEC 61162-2 interface

2.2 Serial interface description

2.2.1 AIS port 1-6 , I/O description

Port 1-3 are inputs only, Port 4-6 are both input/output
All ports have selectable baudrate, 4800/38400.



Note 1:
The cabling shall be designed in a way that stubs are avoided and kept as short as possible. If long cables are necessary, termination at the end of the line must be done by moving the "LINE TERM" strap from "OFF" to "ON".

Note 2: Input:

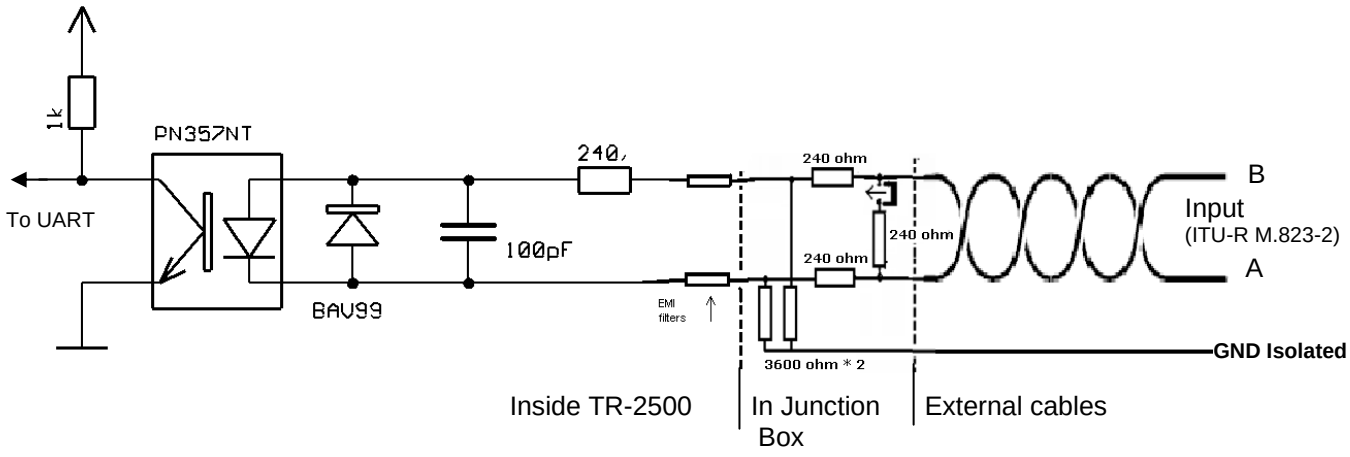
Input current: (at input voltage (A-B) between –15V to +15V
Without termination: < 2 mA
With -"- : < 64 mA
Logical high : A-B < -0.2V,
Logical low : A-B > +0.2V

Note 3: Output:

Logical high: A-B < -2.0V at output current 50mA (100 ohm load)
Logical low: A-B > +2.0V at output current 50mA (100 ohm load)
The outputs have current limiting at 100 mA.

2.2.2 AIS port 7 , Input port description

This port is used for DGPS data input (Beacon input). This port use Opto-coupler to isolate interface.



Input current: (when A-B= +5V)
Without termination strap: 4 mA
With -"- -"- : 28 mA

Logical high : A-B < (+0.5V to –15V
Logical low : A-B > (+2.0V to +15V)

3 DESCRIPTION OF SENTENCE FORMAT

The following provides a summary explanation of the approved sentence structure according to IEC 61162:

$aaccc, c---c*hh<CR><LF>

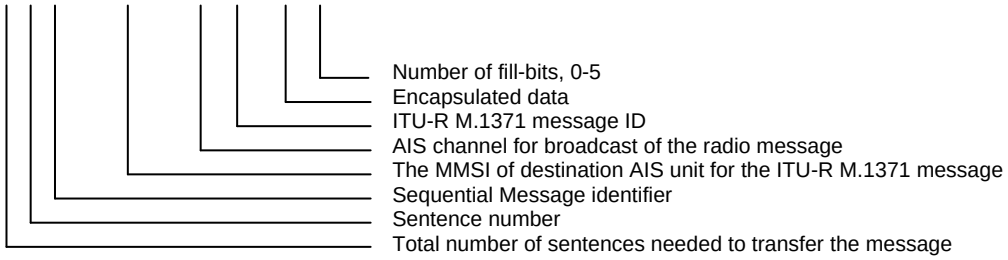
ASCII	HEX	Description
"$"	24	Start of sentence: starting delimiter
aaccc		Address field: alphanumeric characters identifying type of talker, and sentence formatter. The first two characters identify the talker. The last three are the sentence formatter mnemonic code identifying the data type and the string format of the successive fields. Mnemonics will be used as far as possible to facilitate read-outs by users.
","	2C	Field delimiter: starts each field except address and checksum fields. If it is followed by a null field, it is all that remains to indicate no data in a field.
c---c		Data sentence block: follows address field and is a series of data fields containing all of the data to be transmitted. Data field sequence is fixed and identified by the third and subsequent characters of the address field (the sentence formatter). Data fields may be of variable length and are preceded by delimiters ",".
"*"	2A	checksum delimiter: follows last data field of the sentence. It indicates that the following two alpha-numeric characters show the HEX value of the checksum.
hh		Checksum field: the absolute value calculated by exclusive-OR'ing the eight data bits (no start bits or stop bits) of each character in the sentence between, but excluding, "$" and "*". The hexadecimal value of the most significant and least significant four bits of the result are converted to two ASCII characters (0-9, A-F) for transmission. The most significant character is transmitted first. The checksum field is required in all cases.
<CR><LF>	0D 0A	End of sentence: sentence terminating delimiter.

3.1 Input

3.1.1 ABM - Addressed Binary and safety related Message

Support for ITU-R M.1371 messages 6 & 12.
Provides an external application with a means to exchange data using an AIS.

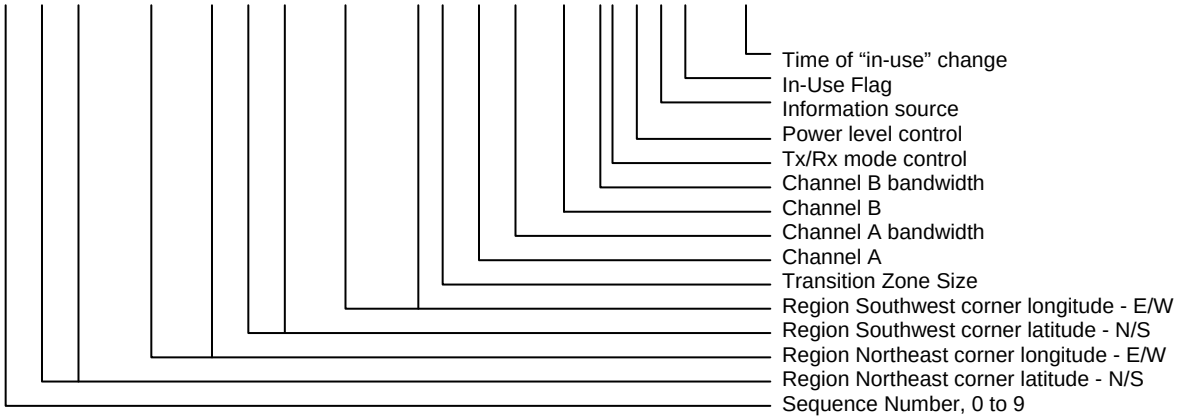
!--ABM,x,x,x,xxxxxxxxx,x,x.x,s--s,x*hh<CR><LF>



3.1.2 ACA - AIS Regional Channel Assignment Message

This sentence is used to both enter and obtain channel management information.

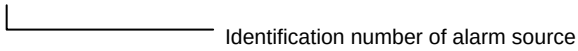
$--ACA,x,llll.ll,a,yyyyy.yy,a,llll.ll,a,yyyyy.yy,a,x,xxxx,x,xxxx,x,x,x,a,x,hhmmss.ss*hh<CR><LF>



3.1.3 ACK - Acknowledge alarm

This sentence is used to acknowledge an alarm condition reported by a device.

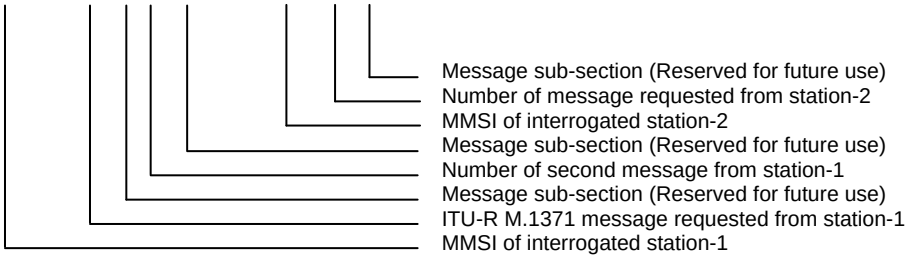
$--ACK,xxx,*hh<CR><LF>



3.1.4 AIR - AIS Interrogation Request

This sentence supports ITU-R M.1371 message 15. It provides an external application with the means to initiate a request for specific ITU-R M.1371 messages from distant mobile or base AIS stations.

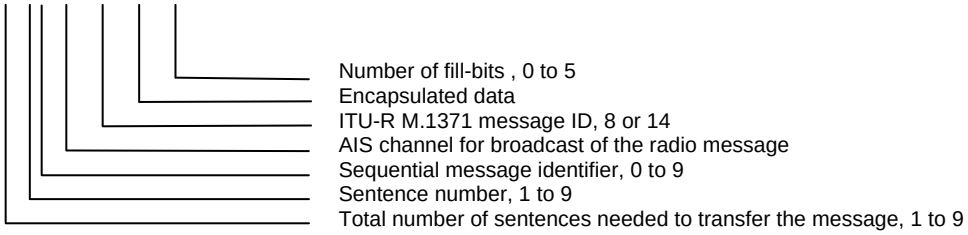
$--AIR,xxxxxxxxx,x.x,x,x.x,x,xxxxxxxxx,x.x,x*hh<CR><LF>



3.1.5 BBM - Broadcast Binary Message

This sentence supports generation of an ITU-R M.1371 Binary Broadcast Message (message 8) or Safety Related Broadcast Message (message 14). It provides an external application with a means to broadcast data, as defined by the application only - not the AIS.

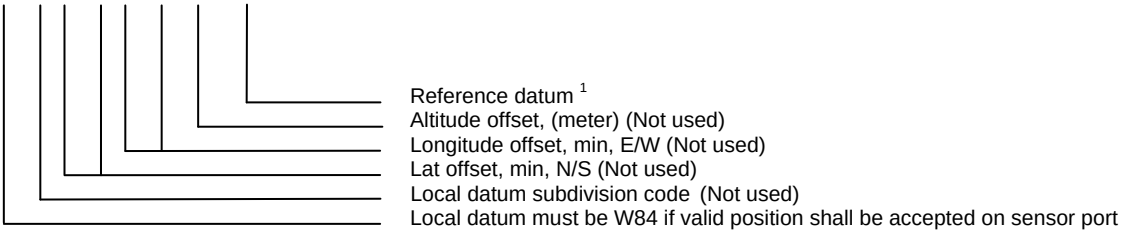
!--BBM,x,x,x,x,x.x,s--s,x*hh<CR><LF>



3.1.6 DTM Datum reference

Local geodetic datum and datum offsets from a reference datum

$--DTM,W84,a,x.x,a,x.x,a, x.x,ccc*hh<CR><LF>



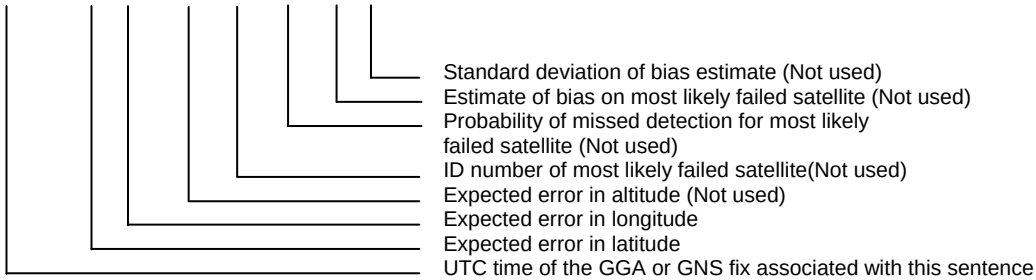
Note 1: WGS84 =W84
WGS72 = W72
SGS85 = S85
PE90 = P90
User defined =999 (only available for “Local datum”)
IHO datum code („ -„- „ -„- -„-)

Important: If a DTM sentence is received, it MUST contain “W84” as “Local Datum”, otherwise position information received in GGA,GLL,RMC or GNS on that sensor port will be rejected.

3.1.7 GBS - GNSS satellite fault detection

This message is used to support receiver autonomous integrity monitoring (RAIM). Given that a GNSS receiver is tracking enough satellites to perform integrity checks of the positioning quality of the position solution, a message is needed to report the output of this process to other systems to advise the system user. With the RAIM in the GNSS receiver, the receiver can isolate faults to individual satellites and not use them in its position and velocity calculations. Also, the GNSS receiver can still track the satellite and easily judge when it is back within tolerance.
This message shall be used for reporting this RAIM information. To perform this integrity function, the GPS receiver must have at least two observables in addition to the minimum required for navigation. Normally these observables take the form of additional redundant satellites.

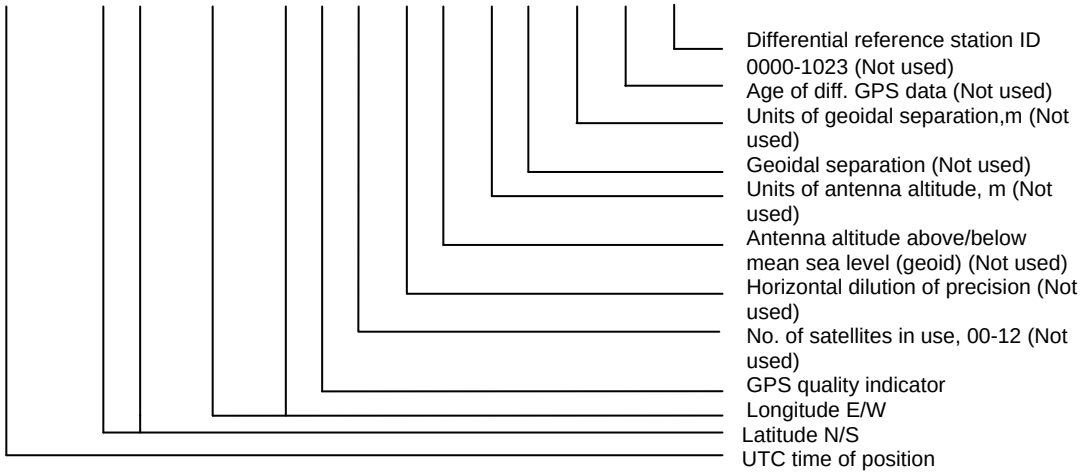
$--GBS, hhmmss.ss, x.x, x.x, x.x, xx, x.x, x.x, x.x *hh <CR><LF>



3.1.8 GGA - Global positioning system (GPS) fix data

Time, position and fix-related data for a GPS receiver.

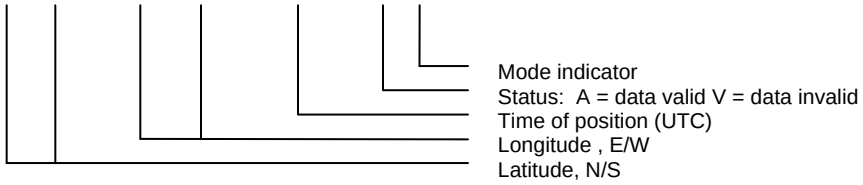
$--GGA, hhmmss.ss, llll.ll, a, yyyyy.yy, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx*hh<CR><LF>



3.1.9 GLL - Geographic position - latitude/longitude

Latitude and longitude of vessel position, time of position fix and status.

$--GLL, llll.ll, a, yyyyy.yy, a, hhmmss.ss, A, a *hh<CR><LF>



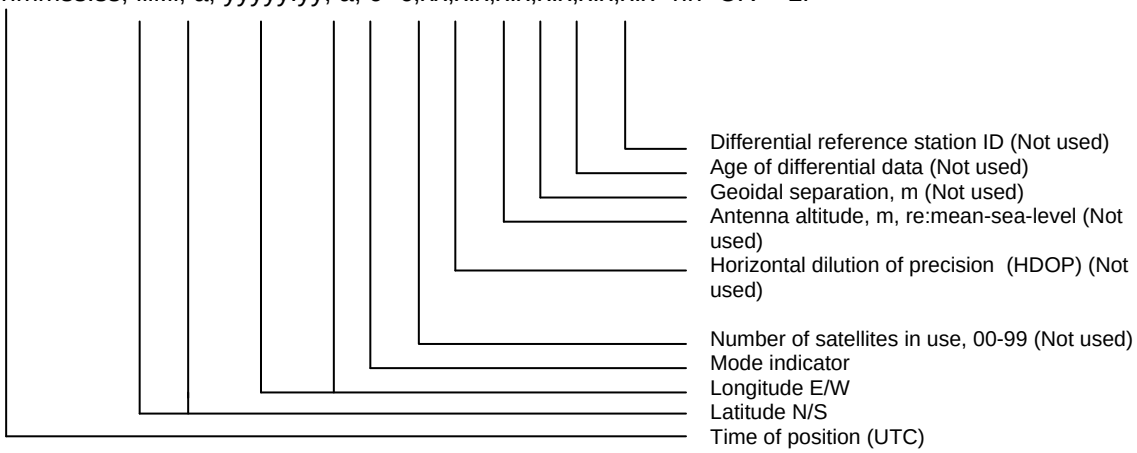
NOTE: Positioning system Mode indicator:

A = Autonomous
D = Differential
E = Estimated (dead reckoning)
M = Manual input
S = Simulator
N = Data not valid

3.1.10 GNS - GNSS fix data

Fix data for single or combined satellite navigation systems (GNSS). This sentence provides fix data for GPS, GLONASS, possible future satellite systems and systems combining these.

$-- GNS, hhmmss.ss, llll.ll, a, yyyyy.yy, a, c--c,xx,x.x,x.x,x.x,x.x,x.x,x.x *hh<CR><LF>



3.1.11 HDT - Heading true

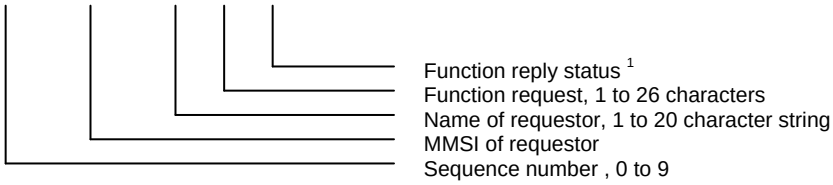
IMO Resolutions A.424 and A.821. Actual vessel heading in degrees true produced by any device or system producing true heading

$--HDT, x.x, T*hh<CR><LF>

3.1.12 LRF - Long Range Function

This sentence is used in both long-range interrogation requests and long-range interrogation replies.

$--LRF,x,xxxxxxxxx,c--c,c--c,c--c*hh<CR><LF>

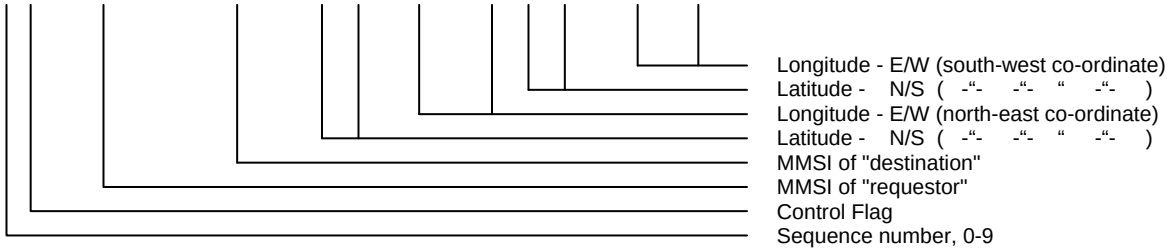


Note 1:
The "Function Reply Status" field provides the status characters for the "Function Request" information. When a long-range interrogation request is originated, the "Function Reply Status" field should be null. The "Function Reply Status" characters are organised in the same order as the corresponding function identification characters in the "Function Request" field. The following is a list of the "Function Reply Status" characters with the status they represent:
2 = Information available and provided in the following LR1, LR2, or LR3 sentence,
3 = Information not available from AIS unit,
4 = Information is available but not provided (i.e. restricted access determined by ship's master),

3.1.13 LRI - Long-Range Interrogation

The long-range interrogation of the AIS is accomplished through the use of two sentences. The pair of interrogation sentences, a LRI-sentence followed by a LRF-sentence, provides the information needed by an AIS to determine if it must construct and provide the reply sentences (LRF, LR1, LR2, and LR3)

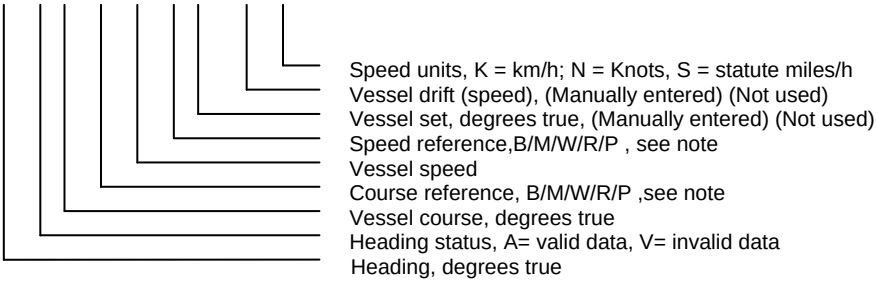
$--LRI,x,a,xxxxxxxxx,xxxxxxxxx,llll.ll,a,yyyyy.yy,a,llll.ll,a,yyyyy.yy,a*hh<CR><LF>



3.1.14 OSD Own ship data

IMO Resolution A.477 and MSC 64(67), Annex 1 and Annex 3. Heading, course, speed, set and drift summary. Useful for, but not limited to radar/ARPA applications. OSD gives the movement vector of the ship based on the sensors and parameters in use.

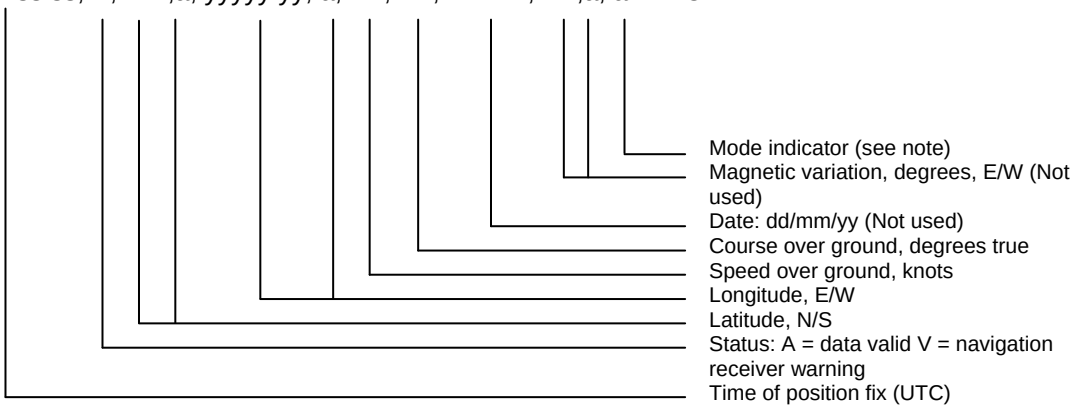
$--OSD, x.x,A,x.x, a,x.x,a,x.x,x.x,a*hh<CR><LF>



3.1.15 RMC Recommended minimum specific GNSS data

Time, date, position, course and speed data provided by a GNSS navigation receiver. This sentence is transmitted at intervals not exceeding 2 s. All data fields must be provided, null fields used only when
data is temporarily unavailable.

$--RMC, hhmmss.ss, A, llll.ll,a, yyyyy.yy, a, x.x, x.x, xxxxxx, x.x,a, a*hh<CR><LF>

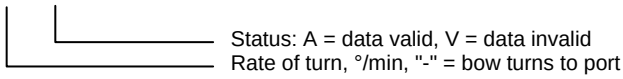


NOTE: Positioning system Mode indicator:
A = Autonomous mode
D = Differential mode
E = Estimated (dead reckoning) mode
M = Manual input mode
S = Simulator mode
N = Data not valid

3.1.16 ROT - Rate of turn

IMO Resolution A.526. Rate of turn and direction of turn.

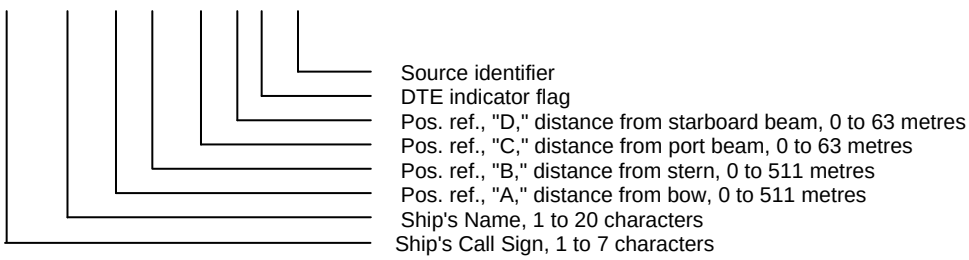
$--ROT, x.x, A*hh<CR><LF>



3.1.17 SSD - Station static data

This sentence is used to enter static parameters into a shipboard AIS. The parameters in this sentence support a number of the ITU-R M.1371 messages.

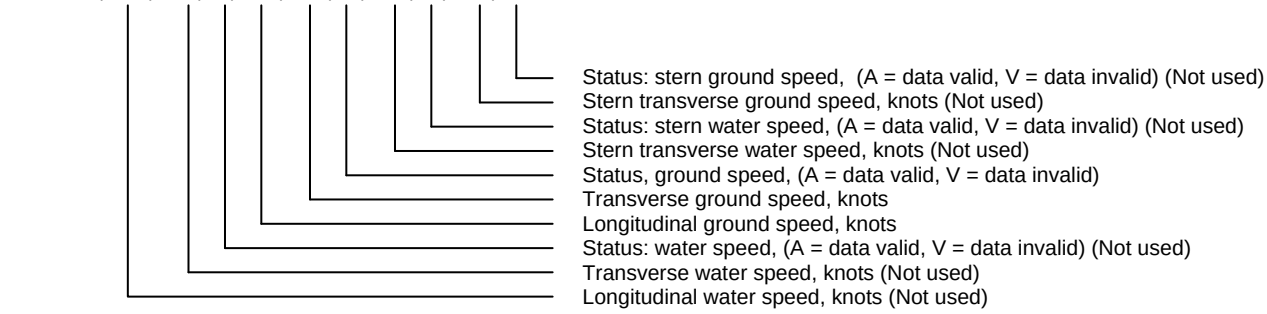
$--SSD,c--c,c--c,xxx,xxx,xx,xx,c,aa*hh<CR><LF>



3.1.18 VBW - Dual ground/water speed

Water-referenced and ground-referenced speed data

$--VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A*hh<CR><LF>

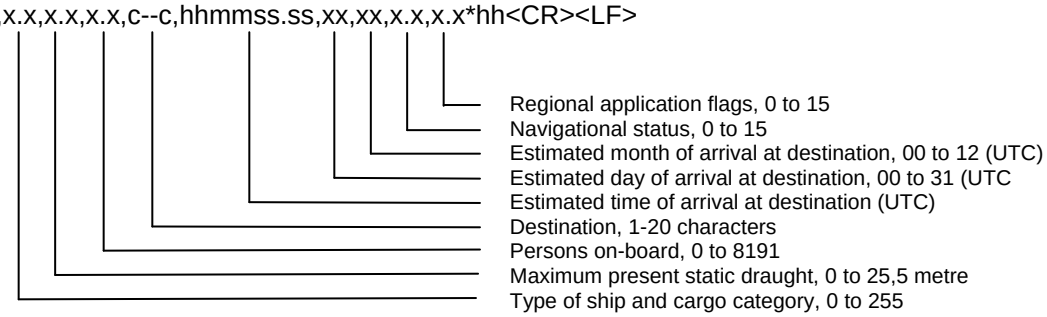


Note: Transverse speed: "-" = port, Longitudinal speed: "-" = astern.

3.1.19 VSD - Voyage Static Data

This sentence is used to enter information about a ship's voyage.

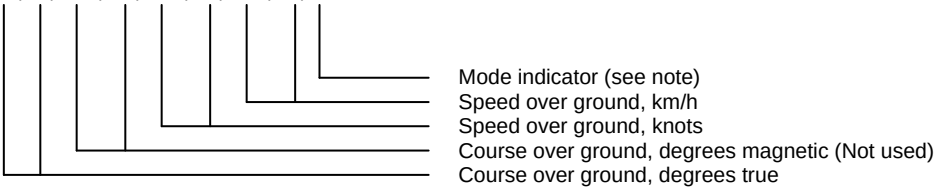
$--VSD,x.x,x.x,x.x,c--c,hhmmss.ss,xx,xx,x.x,x.x*hh<CR><LF>



3.1.20 VTG - Course over ground and ground speed

The actual course and speed relative to the ground.

$--VTG, x.x, T, x.x, M, x.x, N, x.x, K,a*hh<CR><LF>



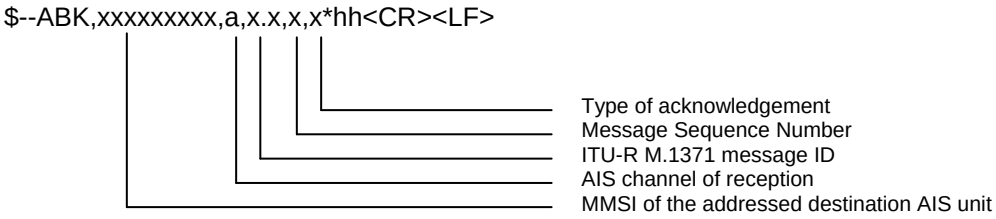
NOTE: Positioning system Mode indicator:
A = Autonomous mode
D = Differential mode
E = Estimated (dead reckoning) mode
M = Manual input mode
S = Simulator mode
N = Data not valid
The positioning system Mode indicator field shall not be a null field.

3.2 Output

All sentences starts with a delimiter that can be “$” or “!” followed by the talker identifier indicated by “- -“. The talker identifier is AI for AIS.

3.2.1 ABK - Addressed and binary broadcast acknowledgement

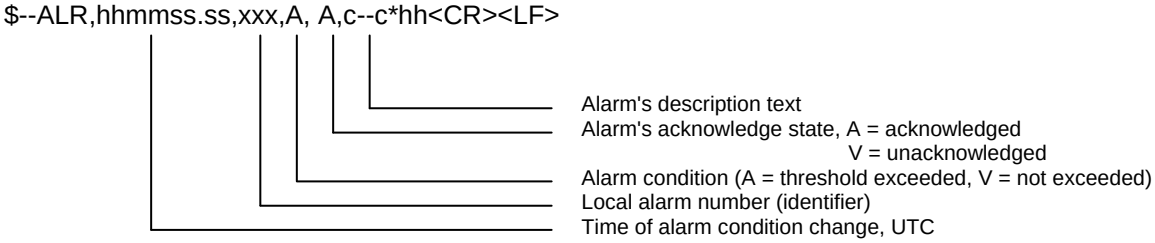
The ABK-sentence is generated when a transaction, initiated by reception of an ABM, AIR, or BBM sentence, is completed or terminated.



3.2.2 ACA - See “Input “chapter 3.1.2

3.2.3 ALR - Set alarm state

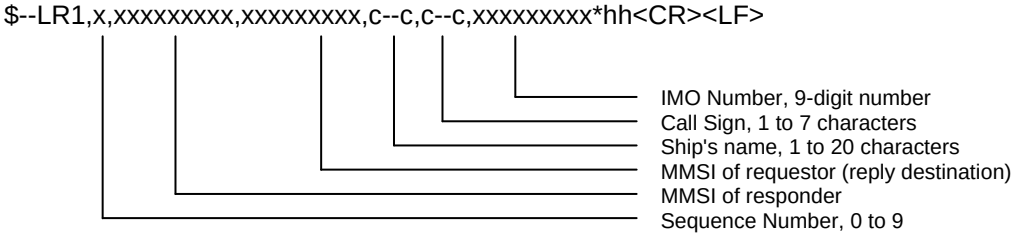
Local alarm condition and status. This sentence is used to report an alarm condition on a device and its current state of acknowledgement.



3.2.4 LRF - See “Input “chapter 3.1.12

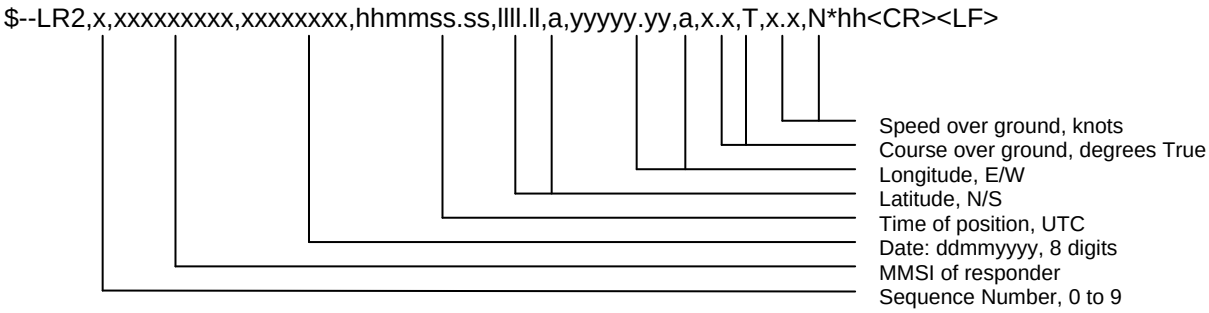
3.2.5 LR1 - Long-range Reply with destination for function request "A"

The LR1-sentence identifies the destination for the reply and contains the information requested by the "A" function identification character.



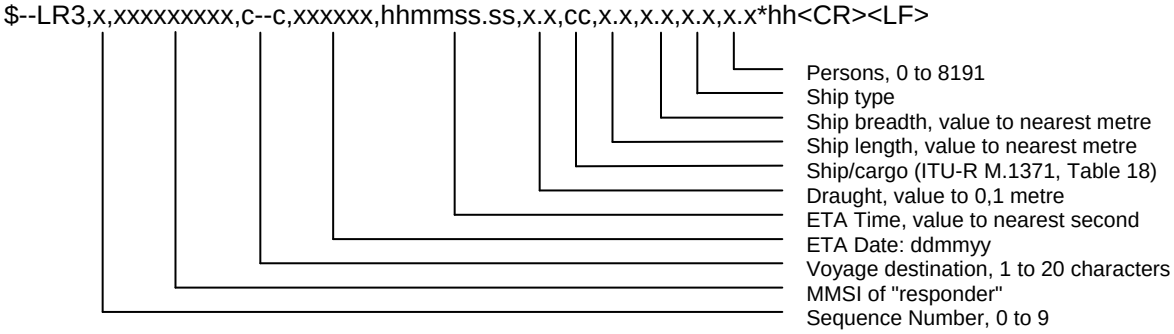
3.2.6 LR2 - Long-range Reply for function requests "B, C, E, and F"

The LR2-sentence contains the information requested by the "B, C, E, and F" function identification characters.



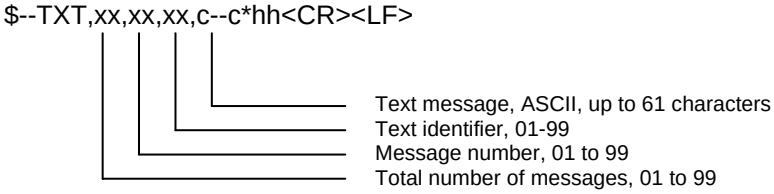
3.2.7 LR3 - Long-range Reply for function requests "I, O, P, U and W"

The LR3-sentence contains the information requested by the "I, O, P, U, and W" function identification characters



3.2.8 TXT - Text transmission

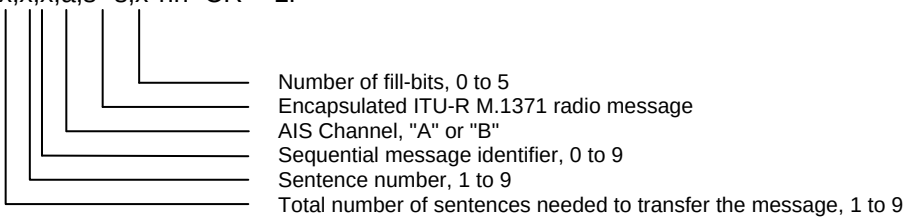
For the transmission of short text messages. Longer text messages may be transmitted by using multiple sentences.



3.2.9 VDM - VHF Data-link Message

This sentence is used to transfer the entire contents of a received AIS message packet, as defined in ITU-R M.1371 and as received on the VHF Data Link (VDL), using the "6-bit" field type.

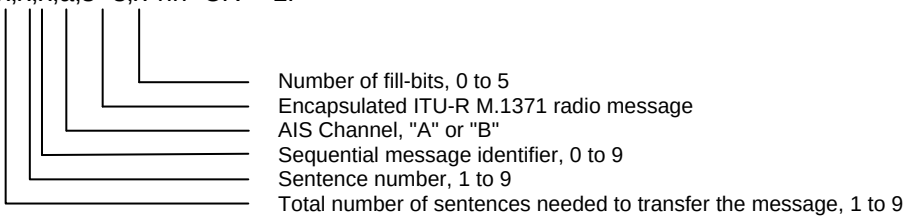
!--VDM,x,x,x,a,s--s,x*hh<CR><LF>



3.2.10 VDO - VHF Data-link Own-vessel message

This sentence is used to provide the information assembled for broadcast by the AIS. It uses the six-bit field type for encapsulation. The sentence uses the same structure as the VDM sentence formatter.

!--VDO,x,x,x,a,s--s,x*hh<CR><LF>



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