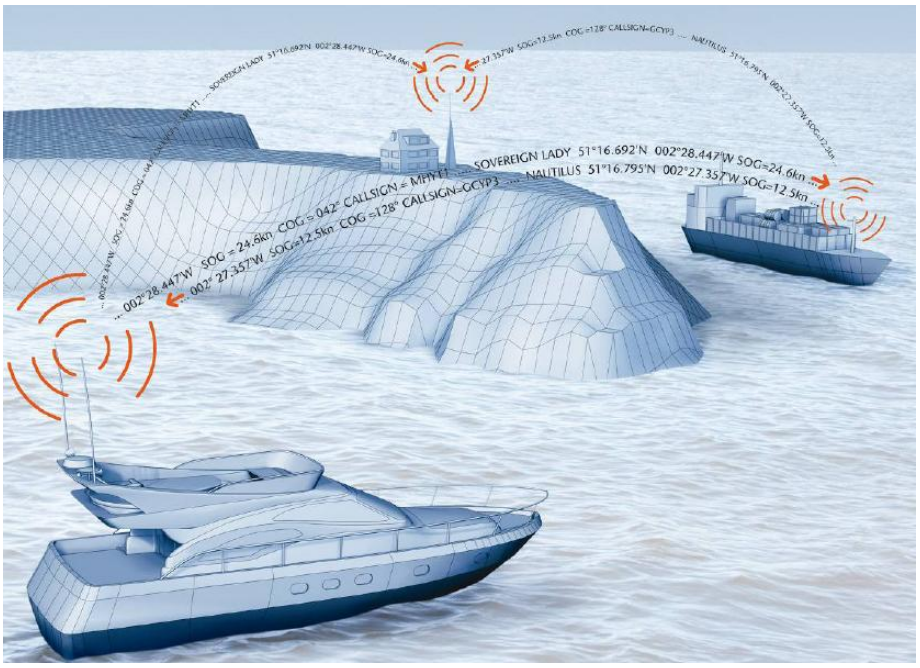
OHMEX INSTRUMENTATION

AIS TideMet v1.0

Tide and Metrological Data over AIS



Ohmex is a company formed to manufacture and distribute products designed by L.M.Technical Services. This company established in 1982 was founded on technological innovation and design. The company prides itself on being the first to produce products in the field of instrumentation and software used within the Earth Science sectors. Achievements to date include DGM ,the first digital ground modelling software to run a standard PC, SONARMITE, the first truly portable echo sounder, TIDALITE the first portable Tide Gauge, EDAS, Integrated tide and weather networked software for use by ports and harbours. WinSTRUMENTATION - The integration of Instrumentation, Wireless networks and modern portable computer equipment. TIDEMET, the first integrated AIS Tide and Metrological transponder station.

L.M.TECHNICAL

Introduction

Tide & Metrological data over AIS

In recent years the hydrographic survey profession has moved away from tide gauges in favour of using RTK GPS elevations as their preferred vertical datum. This is not a practical solution for the reliability and all weather requirements of a navigational user such as shipping or ports and harbours. At present the marine user is restricted to requesting local tide and weather value over speech channels from VTS or by reading some form of visible tide value such as a tide board, as they will certainly not have access to a survey quality receiver for deriving tidal heights from GPS. Some experiments have been tried for posting live values on websites which can be viewed using Internet access, however, the reliability of these services has not been adequate, access has been difficult for a live marine situation such as a vessel berthing and message latency is a commonplace issue on websites. The introduction of AIS has provided a radio frequency standard together with the provision of message structures to allow the reliable transmission of tide and met data within the local area of measurements. Furthermore, AIS allows the majority of vessels, of all sizes, to receive such data without the need to invest in any additional hardware, or (in the most basic of realisations) even any additional software.

Functional Description of an AIS AtoN

The AIS AtoN is box of electronics programmed to transmit three messages (type 21, 6 and 8) at predefined timings and sequence over the AIS frequencies. The transmit functions amd MMSI of the AtoN must be configured prior to installation. The configuration parameters specify what messages are transmitted over the air, how often the transmissions occur and sometimes the slot on the VHF data link (VDL) they are transmitted over. Message 6 is defined as an Addressed Binary Message, data from a message 6 may contain a status report on the health of the AtoN or other status information. Message 21 is defined as an Aids-to-Navigation Report and is usually transmitted every 3 minutes containing the origination MMSI, name of the AtoN (if applicable), type of AtoN (fixed or floating), position of the AtoN and the positional accuracy. Unlike the message 6, this report is broadcast and meant to be seen by all AIS transponders. Binary Message 8 is a broadcast message containing a binary payload which may vary depending on its parameters, in the case of the Tide and Metrological data message the packet is formed as in the table below ...

Hardware Components

Antenna Pod

A major component of the system is the antenna pod which mounts the VHF, GPS and Weather external elements and is suitable for mounting on a 48.3mm diameter scaffold tube …

VHF antenna

- Impedance: 5 ohms
- Frequency Range: 161.975 - 162.025 Mhz
- Gain: Unity
- V.S.W.R: 1.5:1 at Resonance
- Length@ 0.93m

GPS Antenna

- Gain 26dB
- VSWR <2.0
- Voltage 3.3V +/- 0.5V
- Current 12mA
- Weight 18g

Weather Sensor

The weather sensor is an Ohmex variant of the AirMar PB100 marine weather transducer …

- Wind Speed Range 0 knots to 80 knots (0 MPH to 92 MPH)
- Wind Speed Accuracy 5 knots (5.7 MPH) RMS
- Wind Direction Range 0° to 360°
- Wind Direction Resolution 0.1°
- Wind Direction Accuracy 6° RMS typical from 4 knots to 10 knots (4.6 MPH to 11.5 MPH);
- Compass Accuracy— 1° RMS when level
- Air Temperature Range -25°C to 55°C (-13°F to 131°F)
- Air Temperature Resolution 0.1°C (0.1°F)
- Barometric Pressure Range 850 hPa to 1150 hPa (850 mbar to 1150 mbar, 25 inHg to 34 inHg)
- Barometric Pressure Accuracy ±20 hPa (±20 mbar, ±0.59 inHg) when altitude correction is available
- Operating Temperature Range -25°C to 55°C (-13°F to 131°F)
- Weight 285 grams (0.7 lb)
- Certifications and Standards CE, IPX6, RoHS, IEC 60945

AtoN Transponder Unit

The L-3 Aid to Navigation (AtoN) is an Automatic Identification System (AIS) transmitter which is fully compliant to the technical specifications defined by the IMO and outlined in ITU.R.M 1371-1.

General

The transmitter is designed to be installed in weather and navigation buoys with no periodic maintenance required. The transmitter employs the latest radio frequency and FATDMA technology to provide a high performance, automated, and reliable identification system. The transmitter is a fully automated system which ties into the buoy's navigational and / or weather monitoring instrumentation to provide automatic transmission of navigational and meteorological data (dependent on the installation). The Transponder is a fully automated system. This means that once it is installed and turned on, no maintenance is required to keep it operational. The only time the user needs to perform any function on the transponder is to change the ship's Vessel/Voyage data as required.

System Overview

The L-3 AtoN is an Aid to Navigation System fully compliant with the IMO specifications defined in IMO MSC.74(69) Annex 3, IEC 61993-2, and ITU.R M.1371-1. With the addition of the FATDMA controllers, the L-3 AtoN provides a cost-effective AIS solution which will meet the needs of any waterway required to transmit AtoN data. The compact, single-box design allows the L-3 AtoN to be easily incorporated into any buoy layout thus simplifying installation and cabling requirements. The L-3 AtoN has been designed as maintenance-free unit which makes extensive use of surface mount technology (SMT). The repair of printed wiring assemblies (PWAs) containing SMT components requires specialized factory equipment, training, and techniques, therefore, such PWAs are not field-repairable. As a result, maintenance philosophy for the L-3 AtoN is replacement of failed ssemblies. In the case of the L-3 AtoN, the entire unit should be sent back to the factory in the unlikely case of a failure.

Attempts to repair the L-3 AtoN will void the warranty.

Standards

IMO MSC.74(69) Annex 3, IEC 61993-2 Ed. 1, ITU.R.M.1371-1, IALA A-126

TDMA Transmitter

- VHF Marine Band
- TX Frequency: 156.025 MHz - 162.025 MHz
- Transmitter Power: 12.5 W max.
- Channel Bandwidth: 25 kHz

Output

Message 6, Message 8, Message 21 as defined in ITU.R.M.1371-1

Environment

IEC 60945 Ed. 4 for Protected Environment

Power Supply

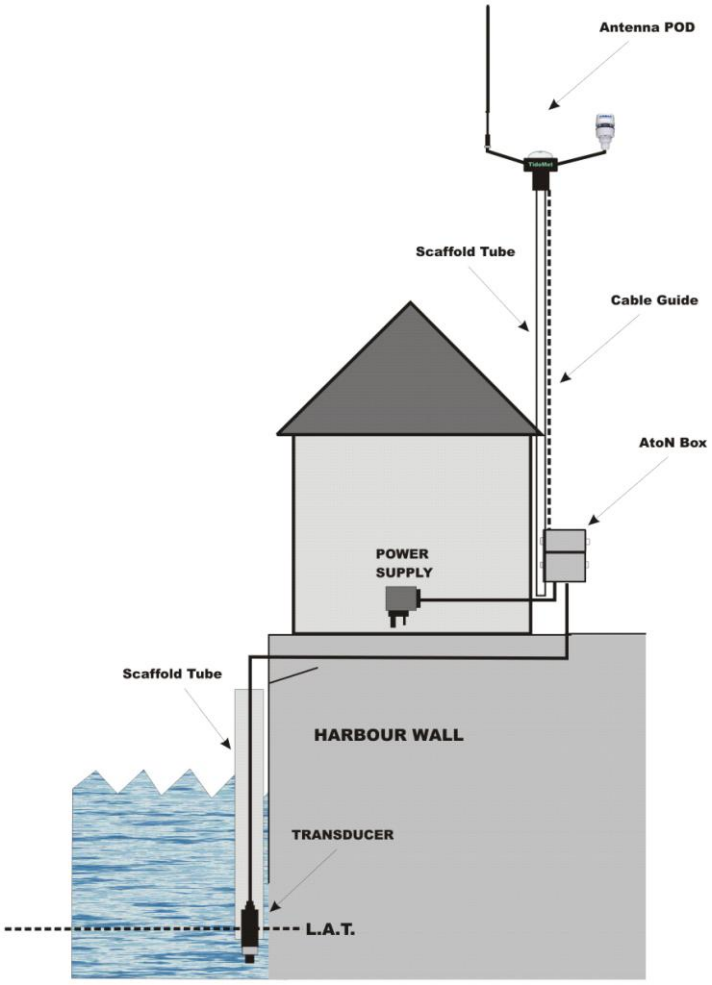
- 12 VDC 6 Watt nominal
- 10.5 VDC min 16 VDC max
- 460ma working 100ma standby

Tide Gauge

- TRANSDUCER RANGE - 1 Bar
- DEPTH RANGE – 0.00 to 10.30m
- BAROMETER – Internal absolute +/- 0.5mbar
- WATER TEMPERATURE (on sensor) - +/- 1 degree Celsius
- DEPTH ACCURACY - +/-0.013m (RMS)
- MEASUREMENT FREQUENCY - 2Hz
- OPERATING TEMPERATURE - 0 to 45 degree Centigrade
- TRANSDUCER WEIGHT – 1.0Kg

Installation

The following is the general installation layout …



Tide Gauge Transducer

The TideM8 system uses a sealed pressure transducer and cable assembly, the recommended method of mounting this transducer is within a galvanized steel tube such as scaffolding standard.

The transducer should normally be suspended in the tube to the LAT level (lowest astronomic tide value) or slightly below. A cable clip will suffice to mark the transducer cable position and retain the transducer at the correct depth. The steel mounting tube should either be regularly perforated or ‘butt jointed’ to prevent excessive level ‘stilling’.

Antenna Parameters

The Antenna Pod needs to be installed with due regard for normal VHF radio applications (clear line of sight over transmission area). A typical antenna mast on which the Pod would be mounted could be a 6m galvenised scaffold tube securly fixed to a building side or mast mount. The building should have a good lightning conductor mounted well clear of the Antenna Pod (typical either end of a roof pitch). The Antenna Pod is supplied with a 10m cable conduit tube which should be fixed to the mast and configured with a loop to prevent water running down it.

AtoN Transponder unit

The AtoN transponder unit is mounted in an IP67 weatherproof case with the cable glands for connection to the Antenna Pod, Tide Gauge transducer and the external power supply.

Power Supply

The TideMet power supply requirement is 12vDC 6 Watts, this hardware will vary according to the site installation …

- simple power adaptor from mains power supply
- Remote battery with wind/solar charging

It is recommended the power is floated over a sufficient capacity lead acid battery to continue TideMet transmission during short power supply interuptions.

License Application (UK example quoted)

All Maritime Navigational Aids, Automatic Identification Systems (AIS) and Radar require a licence and to adhere to strict specifications. All radio equipment must meet certain essential criteria, this is a legal requirement under the Radio and Telecommunications Terminal Equipment (R&TTE) Regulations. The license is based on allocation of a fixed FATDMA slot in the timing regime for the device, modern AtoN devices using the RATDMA standard can listen for available slots and allocate their own transmission slots accordingly.

The IEC standards for AIS allow two operating modes for an AtoN AIS. These are RATDMA (Random Access Time Division Multiple Access) and FATDMA (Fixed Access Time Division Multiple Access). An AtoN AIS unit operating in RATDMA mode uses its receiver to listen to both AIS frequencies for about one minute, and makes and stores a map of all the AIS "slots" on the VHF data link. It then looks for two free adjacent slots in which to send its AtoN message 21 or meteorological and hydrological message 8. This mode is ideal for many applications because the AtoN or weather/tide AIS unit can be placed at any location, and requires no reservation of slots by a base station. An AtoN AIS unit operating in FATDMA mode will transmit in a pair of slots which are reserved by an AIS base station. The main consideration in remote AtoN stations is that RATDMA is on for more time than FATDMA so power consumption is higher and less predictable.

Licensing Authority

The UK regulations governing maritime radio are, in general, derived from the International Telecommunication Union (ITU) Radio Regulations, the relevant EU Directives (99/5/EC) and the Wireless Telegraphy Act 2006. Within the UK the government body OFCOM are tasked with issuing licences for the use of the AIS radio frequencies and the issue of a unique MMSI number for each transmitting AIS site.

Control Authority

Generally speaking the control authority is the body responsible for the Coastguard and marine shipping control, this may be different if the site is private or part of an inland waterways network.

Operational Authority

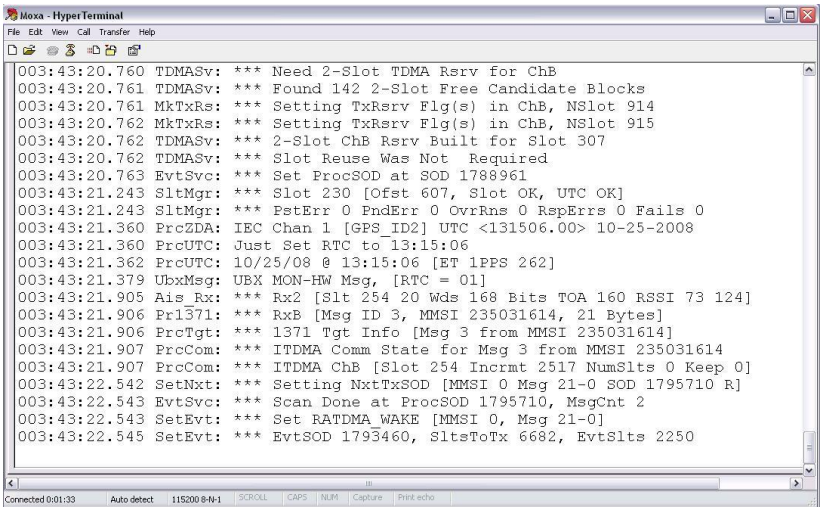
This is the body responsible for marine navigation within the immediate viscinity of the AtoN and is normally the VTS of the local port or harbour authority.

AtoN Configuration

Serial Interface

The user connects a serial interface program such as windows Hyperterminal to the port labeled P2 with Baud Rate settings of 115200-8-N-1 with no flow control.

Debug data will be seen streaming in as below …



Configuration Menus

To exit the debug monitoring output press 'C'

*** System Configuration Menu ***

1. Show Current Configuration Info
2. Set Unit MMSI
3. Set Configured Lat and Lon
4. Show Current Transmit Schedule
5. Create New Transmit Schedule
6. Set Attributes for Scheduled Binary Msg Types
7. Set System Startup Time (following Standby)
8. Enable or Disable 62320-2 FDIS Mode
9. Enable or Disable Standby Operation

a. Enable or Disable Acquisition Subsystem Control
b. Enable or Disable SART Relay Feature
c. Set SART Relay Mode Parameters
d. Enable or Disable DGNSS Serial Input
e. Set Tx Test Mode Parameters

View Current Configuration

Pressing option 1 will display the current configuration parameters …

Enter Selection (1 .. e) or ESC to Exit: 1

*** Software [Rev 1.15I of 22-May-08]
*** AtoN Configuration is [L3 Communications Type 3]
*** Serial Number is [000519420]
*** MMSI is [992351200]
*** Base Station MMSI is [0]
*** AtoN Name is [L3_ATON]
*** Configured Lat is [50 46.0800 N]

```
*** Configured Lon is [1 34.8360 W]
*** Base Startup Time is [10] Secs
*** Receiver Operation is [Enabled]
*** RATDMA Support is [Enabled]
*** Standby Operation is [Enabled]
*** Acquisition Subsystem Ctl is [Enabled]
*** SART Relay Feature is [Disabled]
*** DGNSS Input is [Disabled]
*** IEC 62320-2 Sentence Mode is [FDIS]
*** Flash Code/Data Checksum = C1D6
*** SDRAM Code/Data Checksum = C1D6
*** Code/Data Size [217381, 0x00035125] Bytes

*** Hit Any Key to Continue ...
```

MMSI number

Pressing option 2 will enable setting of the MMSI number …

```
Enter Selection (1 .. e) or ESC to Exit: 2

Enter MMSI [992351200] (or '0' for Default):

*** MMSI Unchanged, Hit Any Key to Continue ...
```

Set Position Lat/Lon

Pressing option 3 will enable sored AtoN position entry …

```
Enter Selection (1 .. e) or ESC to Exit: 3

Enter Configured Lat (Deg, Min, N/S) [50 46.0800 N]:

Enter Configured Lon (Deg, Min, E/W) [1 34.8360 W]:

Configured Lat and Lon Unchanged, Hit Any Key to Continue ...
```

Message schedule

Pressing option 4 will display the current schedule configuration …

```
Enter Selection (1 .. e) or ESC to Exit: 4

*** AtoN Transmit Schedule>

   ChA RATDMA MMSI 992351200 [Msg 08-01   0015 Secs] 00:00 Slt 0000 Ivl 004500
   ChB RATDMA MMSI 992351200 [Msg 08-01   0015 Secs] 00:01 Slt 0000 Ivl 004500
   ChA RATDMA MMSI 992351200 [Msg 21-00   0000 Secs] 00:00 Slt 0210 Ivl 013500
   ChB RATDMA MMSI 992351200 [Msg 21-00   0000 Secs] 00:03 Slt 0210 Ivl 013500

*** Hit Any Key to Continue ...
```

Pressing option 5 will enable schedule configuration menu …

```
Enter Selection (1 .. e) or ESC to Exit: 5

*** Transmit Schedule Setup Utility

*** Hit 'V'   to View Current Schedule
*** Hit 'C'   to Clear All Reservations

*** Hit 'F'   to Toggle FATDMA-RATDMA
*** Hit 'A'   to Toggle Add/Replace Mode
*** Hit 'T'   to Change Tx Mode
*** Hit '+'   to Adj Base Slot Upwards
*** Hit '-'   to Adj Base Slot Downwards
*** Hit '*'   to Toggle Slot Adj Value
*** Hit 'M'   to Change Msg ID and Index
*** Hit 'I'   to Increase Tx Interval
```

```
*** Hit 'D'   to Decrease Tx Interval
*** Hit Space to Change Chan Selection

*** Hit ESC to Quit with No Further Schedule Changes
*** Hit Enter to Make Specified Update

*** Adds or Replaces Schedule for Specified MsgID
*** Caution: Not All Setups Make Sense!

*** FATDMA [Rplc]    Normal Tx [Slt 0000] Msg 21-0 [ 2 Sec Ivl]  Ch A Only
```

Acquisition Subsystem Board

Pressing option a will enable/disable TideMet subsystem …

```
Enter Selection (1 .. e) or ESC to Exit: a

*** Enable or Disable Acquisition Subsystem Control

*** Hit Space Bar to Toggle On/Off
*** Hit ESC to Quit with No Changes


*** Hit ENTER to Retain Enabled  Setting:
```

Local TideMet Configuration

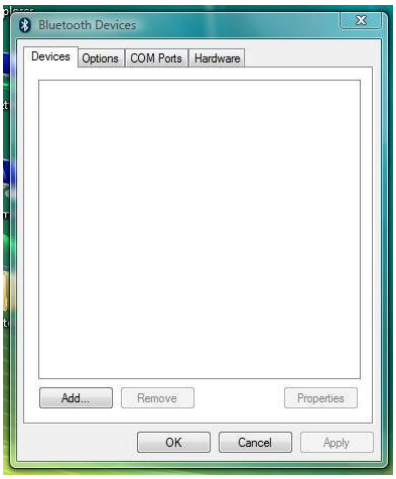
Software Executables

- **TiMePc.exe** – Configuration software for Windows XP/Vista
- **TiMePDA.exe** - Configuration software for Windows Mobile/Pocket PC

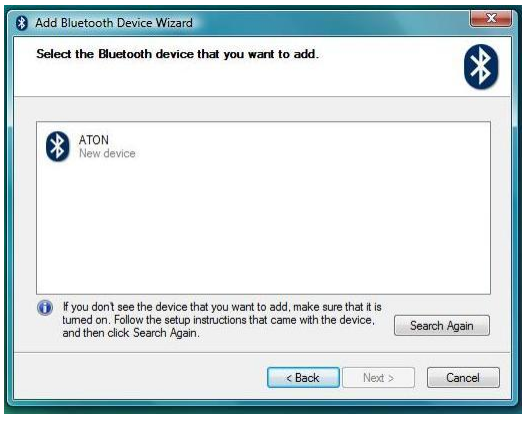
The TideMet application software is designed to run on PC and PDA platforms to enable the user to set basic parameters on the AIS TideMet station. Connection to the TideMet is via Bluetooth to enable configuation settings with a direct cable connection to the TideMet hardware.

Configuring the PC/PDA Bluetooth port …

1) Select Bluetooth 'Add' devices …

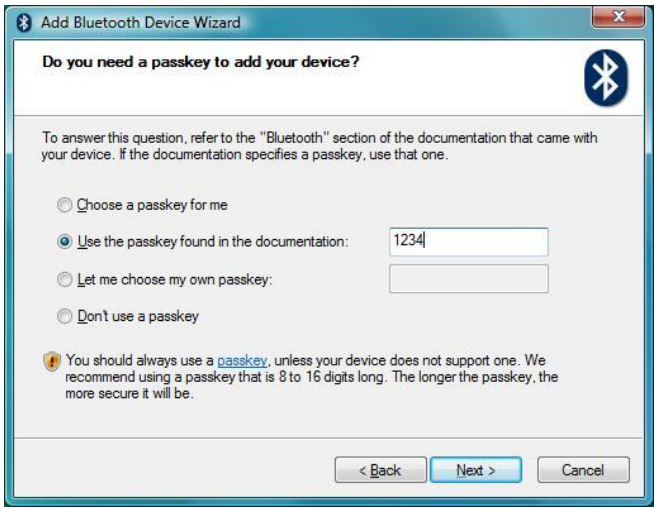


2) Select 'Search' Bluetooth devices



3) Select the 'AtoN' device then 'Next'

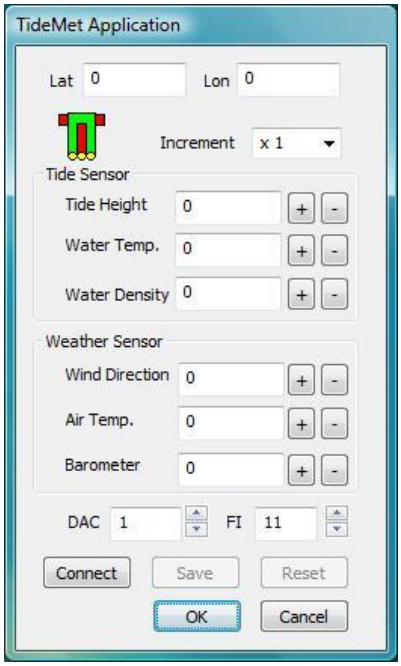
4) Enter the passkey of '1234'



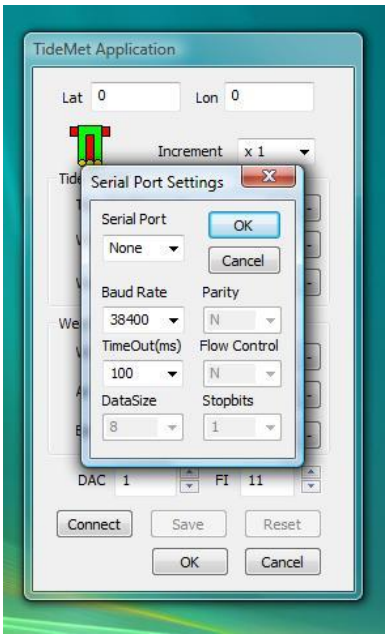
5) The software will set a serial port for the connection (Outgoing)

Connecting the TideMet software

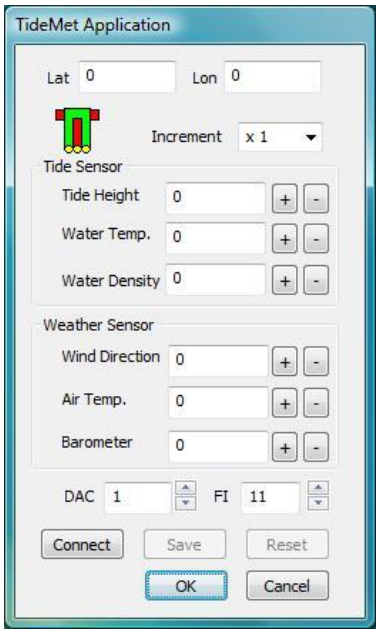
1) Run the application software …



2) Press the ‘Connect’ button and select Bluetooth serial port (as specified as Bluetooth Outbound port).



3) Pressing the '+' and '-' buttons alongside the parameters will increase/decrease the value by the amount shown in the Increment value. When selection is complete the user presses the 'Save' button to store the settings on the AtoN, pressing the 'Cancel' button will leave the program without changing the AtoN settings.



Notes

i. When connected the values display will be updated every second.

ii. Pressing the 'Reset' button will restore the offsets to their default zero values, **if Reset is pressed the user should ensure the Tide Gauge sensor is not in the water**.

iii. Values for DAC (Digital Area Code) and FI (Function Identifier) should be set as directed by the controlling authority where the AtoN is deployed.

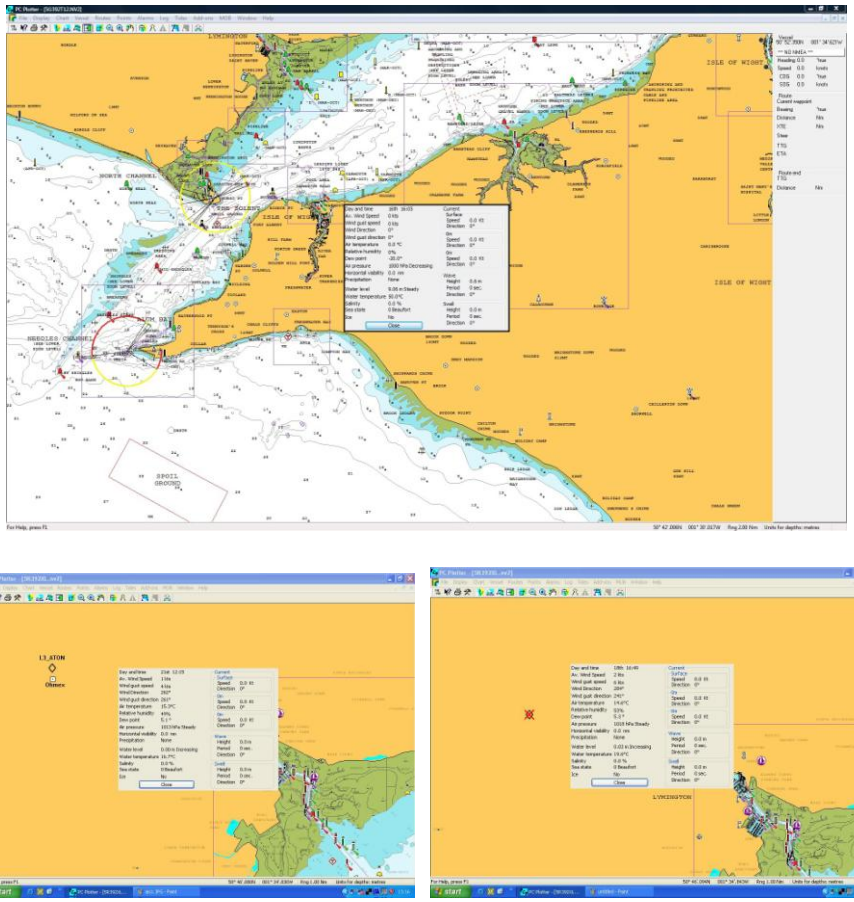
Technical Appendix

Receiving Software

A major current obstacle with TideMet data transmitted over AIS using binary messages is that, as yet, very few of the software packages used commercially can decode and display the relevant data contained within the message. In fact the emphasis on predicted tide values shown on most of the chart displays used is in itself a potential hazard to navigation, the data is not live or corrected for local atmospheric conditions so could easily be up to 1m or more in error. However, this situation is already beginning to change, as navigators and Pilots begin to demand more accurate information, and are becoming more familiar with modern technology, in particular electronic chart systems. A number of software providers have added the potential to decode AIS Message 8, and many more will do so as the use of the message becomes more widespread.

PC Plotter

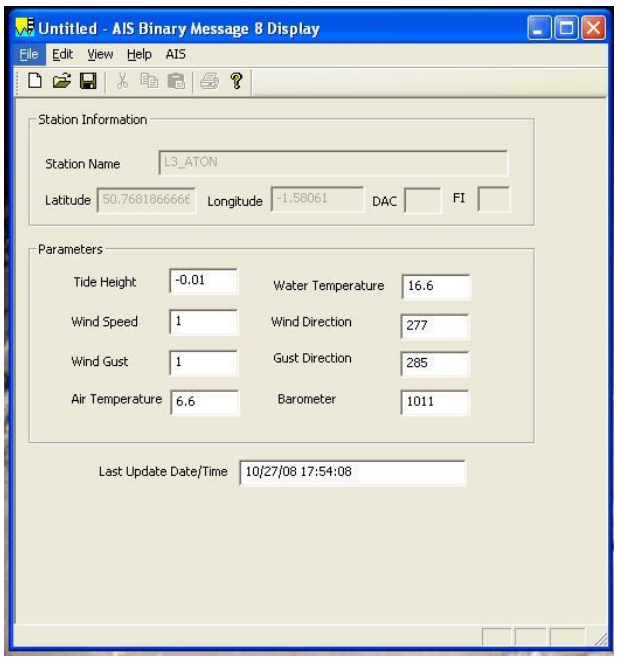
This application software correctly decodes the type 21 and type 8 messages, it also displays the timeout condition when the AtoN data becomes more than 10 minutes old or mores out of range.



PC Plotter application showing data & timeout

AIN application

The AIN application software is connected by serial port to an incoming VDL stream of VDM messages, normally by using a 'Listen Only' AIS receiver. The software looks for and displays all type 21 and type 8 messages seen.



The AIN application software

Network Software

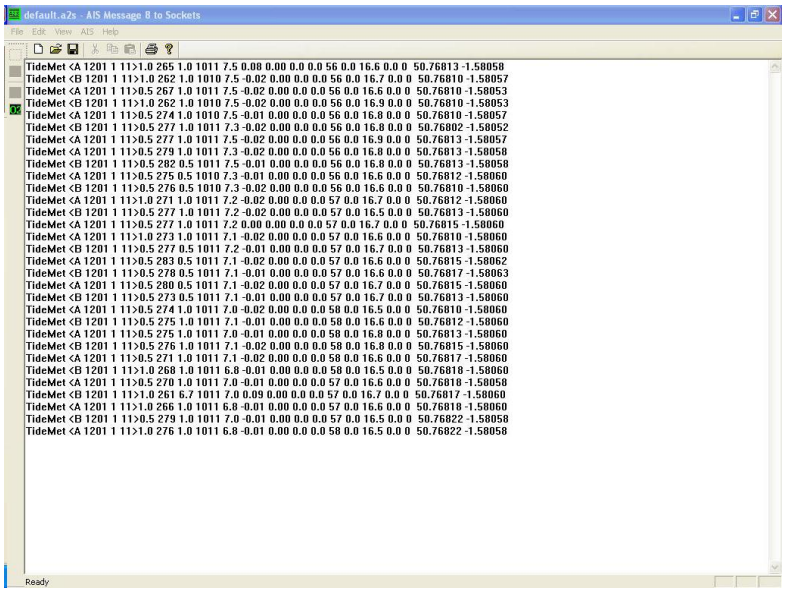
The Ohmex network software is based around the existing EDAS client/server model. The major difference between the design of 'single PC' and the 'Network' Environmental Data collection model is that the network model has been broken into logical 'components'. Each component executes as a single task which under modern operating systems can be run concurrently on the same or different computers across a network. The main components identified in a Networked EDAS system are as follows ....

- **EDAS Server -** These are programs run on machines directly connected to the input devices (instruments) such as **Tide Gauges and Weather Stations**. These programs capture , filter and pre-process (e.g. average) the data generated by the connected device. There are several of these programs, each supporting different formats and peculiarities of a particular manufacturer's instrument. They all collect the data save it in a standard database format/table using the database drivers. Local display is used to present data received, detected errors in equipment and system errors such as Server not responding.
- **Output Client -** This is a client program which collects its data from the database via the Data Server and provides a screen presentation of the data at the users location. Typically this would be a series of graphs and numeric windows showing both collected data and derived data such as average Wind Direction over the last 10 minutes. These clients can easily be authored by a software writer as the data provided is in a standard format and conforms to the WOSA standard as outlined in the ODBC documentation.
- **Passive Client -** These are programs that can be run anywhere on a network and listen for a particular message to be transmitted. The message is captured and displayed, the only user settings being the choice of message and local display settings. The programs are entirely passive and are not able to change or access the 'live' data in any way.

Each of the above software components can be tailored to run across a network of computers and provide a 'scaleable' system. By having a distributed system there are several features which add robustness to the data collection system.

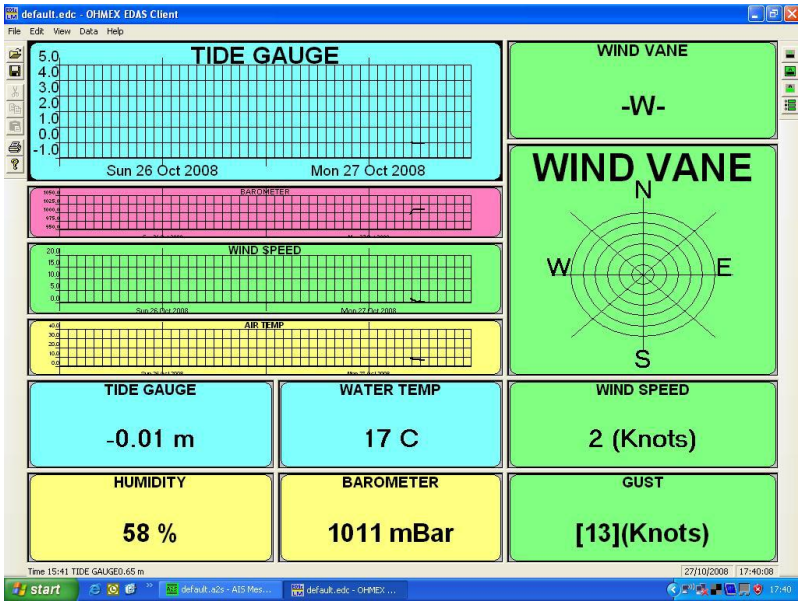
A2S program

The A2S.EXE software is an EDAS server program which listens to an incoming stream of AIS data looking for a particular type 8 messages identified by their station DAC/FI identity. When a specified message is seen the message is broadcast across the network as a Socket message using the user specified socket number.



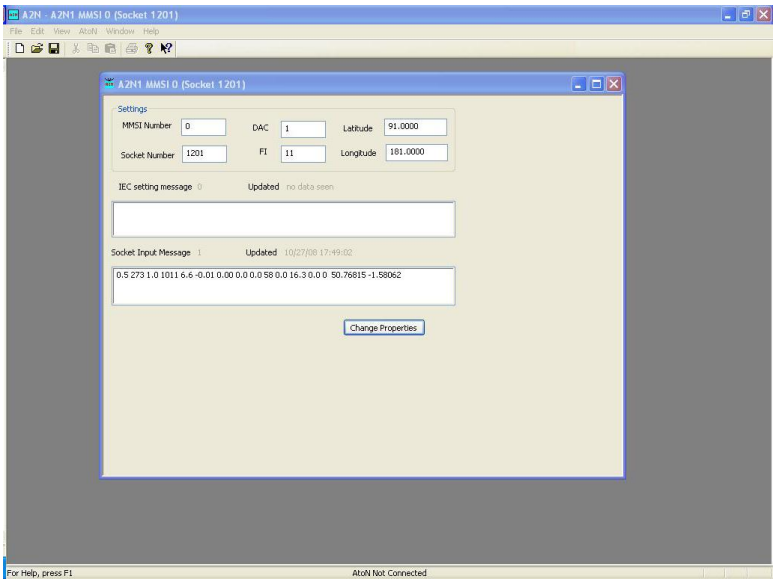
EDAS client

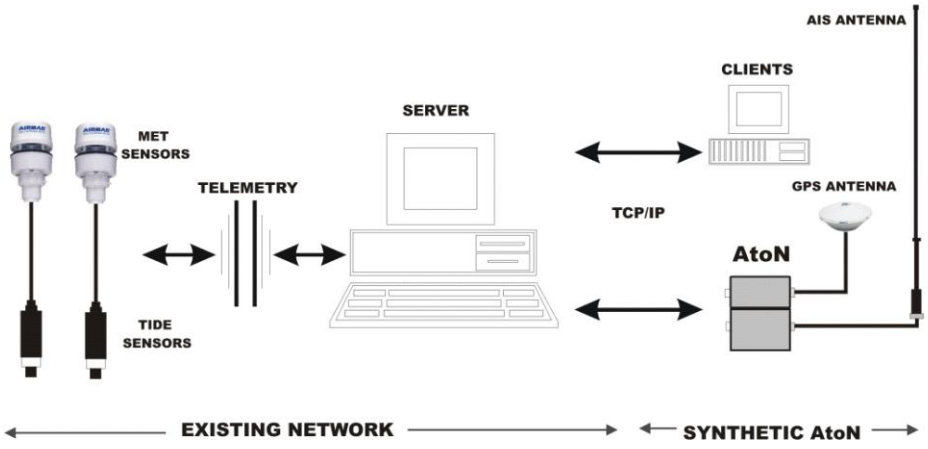
The EDSclient.EXE program will see and display in incoming socket message using the user specified display options.



A2N program

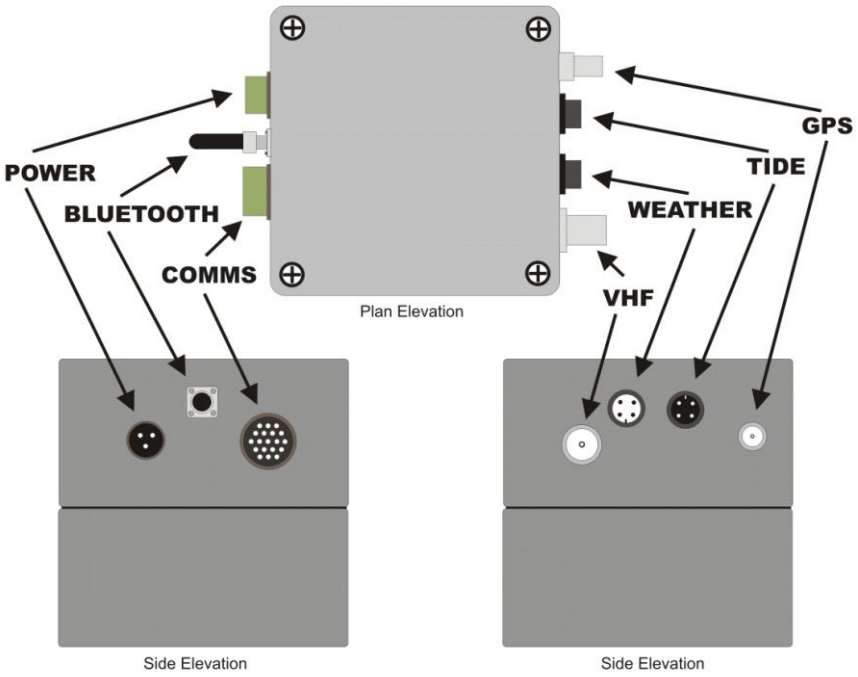
The A2N.exe program will look for incoming socket messages and build an AIS transmission message to be broadcast as an outgoing type 8 message. Multiple sockets can be monitored and broadcast as user defined 'Synthetic' TideMet stations.



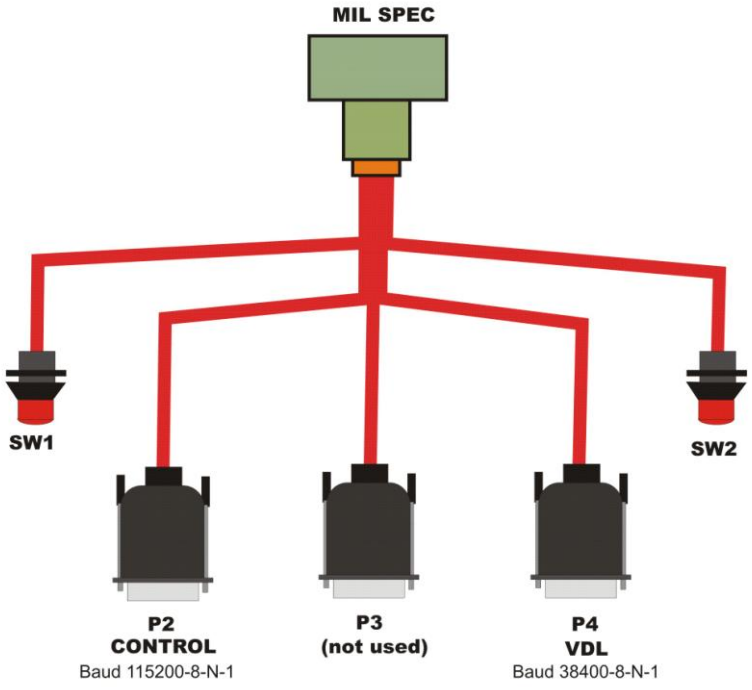


Hardware Wiring

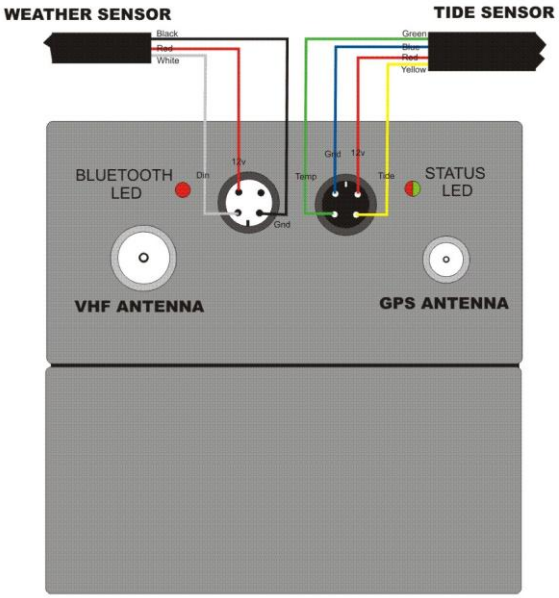
AtoN Connection Ports



AtoN Configuration Cable

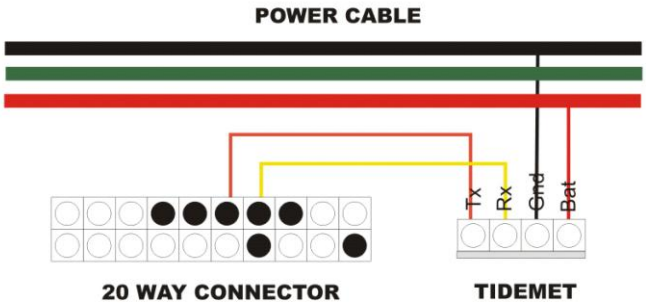


TideMet External Connections



TideMet Application board cable

The following diagram is the modifications that connect the TideMet application board to the internal L3 AtoN connectors



Firmware sequence

The following is the firmware sequence …

- Set status LED off
- Read the Weather parameters
- Read the GPS position from Weather pod
- If both the above set status LED Green
- Wait for notification from AtoN to prepare
- Read Tide Gauge
- If all the above set status LED to Red
- When AtoN signal ready sent data
- Go to beginning of sequence

Message 8 details

PARAMETER	BITS	DESCRIPTION
Message ID	6	Identifier for Message 8; always 8
Repeat Indicator	2	Used by the repeater to indicate how many times a message has been repeated.
Source ID	30	MMSI number of source station
Spare	2	Not used. Should be set to zero.
IAI	16	DAC = 001; FI = 11
Latitude	24	Measuring position, 0 to + /- 90 degrees, 1/1000th minute
Longitude	25	Measuring position, 0 to + /- 180 degrees, 1/1000th minute
Date and time	16	Time of transmission, Day, hour, minute, (ddhhmm in UTC)
Average wind speed	7	Average of wind speed values for the last 10 minutes. 0-120 kts, 1 kt
Wind gust	7	Wind gust is the maximum wind speed value reading during the last 10 minutes, 0 - 120 kts, 1 kt
Wind direction	9	0 - 359 degrees ,1 degree
Wind gust direction	9	0 . 359 degrees, 1 degree
Air temperature	11	Dry bulb temperature - 60.0 to + 60.0 degrees Celsius 0.1 of a degree
Relative humidity	7	0 . 100%, 1%
Dew point	10	- 20.0 - + 50.0 degrees, 0.1 degree
Air pressure	9	800 . 1200 hPa, 1 hPa
Air pressure tendency	2	0 = steady, 1 = decreasing, 2 = increasing
Horizontal visibility	8	0.0 . 25.0 NM, 0.1 NM
Water level (incl. tide)	9	Deviation from local chart datum, . .10.0 to + 30.0 m 0.1 m
Water level trend	2	0 = steady, 1 = decreasing, 2 = increasing
Surface current speed	8	0.0 . 25.0 kts 0.1 kt
Surface current direction	9	0 . 359 degrees, 1 degree
Current speed, #2	8	Current measured at a chosen level below the sea surface, 0.0 . 25.0 kts, 0.1 kt
Current direction, #2	9	0 . 359 degrees, 1 degree
Current measuring level, #2	5	Measuring level in m below sea surface , . 0 .30 m 1 m
Current speed, #3	8	0.0 . 25.0 knots, 0.1 knot
Current direction, #3	9	0 . 359 degrees, 1 degree
Current measuring level, #3	5	Measuring level in m below sea surface, 0 . 30 m 1 m
Significant wave height	8	0.0 . 25.0 m, 0.1 m
Wave period	6	Period in seconds, 0 . 60 s, 1 s
Wave direction	9	0 . 359 degrees, 1 degree
Swell height	8	0.0 . 25.0 m, 0.1 m
Swell period	6	Period in seconds, 0 . 60 s, 1 s
Swell direction	9	0 . 359 degrees, 1 degree
Sea state	4	According to Beaufort scale (manual input?), 0 to 12, 1
Water temperature	10	-10.0 - + 50.0 degrees, 0.1 degree
Precipitation (type)	3	According to WMO
Salinity	9	0.0 . 50.0 ., 0.1.
Ice	2	Yes/No
Spare	6	Total Number of bits 352 Occupies 2 slots

IMO Type 8 Tide and Met. message definition

Message 21 details

Message ID	Identifier for this message (21)
Repeat Indicator	Used by the repeater to indicate how many times a message has been repeated. 0 - 3; default = 0; 3 = do not repeat any more.
ID	MMSI number
Type of Aid-to- Navigation	0 = not available = default; refer to appropriate definition set up by IALA
Name of Aid-to-Navigation	Maximum 20 characters 6 bit ASCII, "@@@@@@@@@@@@@@@@@@@@" = not available = default. The name of the Aid-to-Navigation may be extended by the parameter "Name of Aid-to-Navigation Extension" below.
Position accuracy	1 = high (< 10 m; Differential Mode of e.g. DGNSS receiver) 0 = low (> 10 m; Autonomous Mode of e.g. GNSS receiver or of other Electronic Position Fixing Device); Default = 0
Longitude	Longitude in 1/10 000 min of position of Aid-to-Navigation (±180 degrees, East = positive, West = negative. 181 degrees (6791AC0 hex) = not available = default)
Latitude	Latitude in 1/10 000 min of Aids-to-Navigation (±90 degrees, North =positive, South = negative, 91 degrees (3412140 hex) = not available = default)
Dimension/Reference for Position	Reference point for reported position; also indicates the dimension of Aid-to-Navigation in metres, if relevant (1).
Type of Electronic Position Fixing Device	0 = Undefined (default); 1 = GPS, 2 = GLONASS, 3 = Combined GPS/GLONASS, 4 = Loran-C, 5 = Chayka, 6 = Integrated Navigation System, 7 = Surveyed. For fixed AtoNs and vitual/synthetic AtoNs, the surveyed position should be used. The accurate position enhances its function as a radar reference target. 8 – 15 = not used.
Time Stamp	UTC second when the report was generated by the EPFS (0 –59, or 60 if time stamp is not available, which should also be the default value, or 61 if positioning system is in manual input mode, or 62 if Electronic Position Fixing System operates in estimated (dead reckoning) mode, or 63 if the positioning system is inoperative)
Off-Position Indicator	For floating Aids-to-Navigation, only: 0 = on position; 1 = off position; NOTE – This flag should only be considered valid by receiving station, if the Aid-to-Navigation is a floating aid, and if Time Stamp is equal to or below 59. For floating AtoN the guard zone parameters should be set on installation.
Reserved for regional or local application	Reserved for definition by a competent regional or local authority. Should be set to zero, if not used for any regional or local application. Regional applications should not use zero.
RAIM-Flag	RAIM (Receiver Autonomous Integrity Monitoring) flag of Electronic Position Fixing Device; 0 = RAIM not in use = default; 1 = RAIM in use)
Virtual AtoN Flag	0 = default = real A to N at indicated position; 1 = no AtoN = ATON does not physically exist, may only be

	transmitted from an AIS station nearby under the direction of a competent authority. (2)
Assigned Mode Flag	0 = Station operating in autonomous and continuous mode =default 1 = Station operating in assigned mode
Spare	Spare. Not used. Should be set to zero
Name of Aid-to-Navigation Extension	This parameter of up to 14 additional 6-bit-ASCII characters for a 2-slot message may be combined with the parameter “Name of Aid-to- Navigation” at the end of that parameter, when more than 20 characters are needed for the Name of the Aid-to-Navigation. This parameter should be omitted when no more than 20 characters for the name of the A-to-N are needed in total. Only the required number of characters should be transmitted, i. e. no @-character should be used.
Spare	Spare. Used only when parameter “Name of Aid-to-Navigation Extension” is used. Should be set to zero. The number of spare bits should be adjusted in order to observe byte boundaries.

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Message 21 : Aid-to-Navigation Report Message