

Multifunctional Display. Navi-Sailor 4000 ECDIS

Functional Description

Version 3.02.350

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Printing House Conventions

SAMPLE OF NOTATION	USAGE COMMENTS
Setup.exe	Messages, commands, files, folders and other Windows OS info
<ENTER>	Keyboard key names
Start > All Programs	Menu items
Interface	Window names, tabs, icons, checkboxes, buttons, radio buttons and text box captions, and other interface elements, important text
NOTE	Notes
WARNING	Warnings
Auxiliary text	Auxiliary text
http://www.amver.com	URL

List of Documents

Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). User Manual.

Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Functional Description.

Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Additional Functions.

Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Installation Guide.

Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Utilities.

Navi-Planner 4000 (v. 3.02.347). User Manual.

Preamble

The preamble provides general information on work with the document.

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Data Required for Handling This Description

The aim of this book is to give the user some idea of the MFD operating principles and algorithms.

Definitions and Abbreviations

Definitions

Activated AIS target

Target activated for the display of additional graphically presented information.

Appropriate portfolio of up to date paper charts (APC)

A suite of paper charts of a scale to show sufficient detail of topography, depths, navigational hazards, aids to navigation, charted routes, and routeing measures to provide the mariner with information on the overall navigational environment.

CIE Colour Calibration

Colour calibration on the monitor performed to transform the CIE-specified colours for ECDIS into the colour coordinate system of the screen

Common Reference System

Means provided to assure that when navigational information from sensors and other information sources is displayed together with charted information, it is referenced to a consistent common reference point (CCRP).

Compilation Scale

The scale at which the data was compiled.

Corrupted Data

ENC data produced according to the IHO S-57 ENC product specification, but altered or modified during production, transmission, or retrieval.

Dangerous Target

Tracked radar or reported AIS target with a predicted CPA and TCPA that violates values preset by the user. The respective target is marked by a "dangerous target" symbol.

Dead-Reckoned Position (DR)

Position extrapolated from the last accepted position update, based on present course and speed, and updated on a time interval selected by the operator.

Degrade

Reduce the quantity or quality of information content.

Display Base

The chart content as listed in Annex A and which cannot be removed from the display. It is not intended to be sufficient for safe navigation.

Display Redraw Time

Interval from when the display starts to change until the new display is complete.

Display Regeneration Time

Interval from operator action until the consequent redraw is complete.

Display Scale

Ratio between a distance on the display and a distance on the ground, normalized and expressed as, for example, 1:10 000.

Electronic Chart Display and Information System (ECDIS)

Navigation information system which with adequate backup arrangements can be accepted as complying with the up-to-date chart required by regulation V/19 and V/27 of the 1974 SOLAS Convention, as amended, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required display additional navigation related information.

Electronic Navigational Chart (ENC)

The database, standardized as to content, structure and format, issued for use with ECDIS by or on the authority of a Government authorized Hydrographic Office or other relevant government institution, and conform to IHO standards.

ENC Cell

The basic unit of ENC data covering a defined geographical area bounded by two meridians and two parallels

ENC Data

Data conforming to Electronic Navigational Chart (ENC)

ENC Test Data Set

Standardized data set and testing instructions available as IHO S-64.

Estimated position (EP)

Position extrapolated from the last accepted position update, based on present course and speed (STW), including effects of wind, tide, current, and updated on a time interval selected by the operator.

Fix

Position of own ship determined, without reference to any former position, by the common intersection of two or more LOPs.

Important Indication

Indication that is displayed visually and continuously, which needs special attention and cannot be removed from the display other than by eliminating the cause of the indication.

Indication

Display of regular information and conditions, not part of alert management.

Line of Position (LOP)

Plotted line on which own ship is located determined by observation or measurement of the range or bearing to an aid to navigation or other charted element.

Lost Target

Tracked radar or reported AIS target for which the system is no longer receiving valid position data.

Non-ENC Data

Data not conforming to ENC data.

Official

By, or on authority of a government, authorized Hydrographic Office or other relevant government institution.

Overscale

Display of the chart information at a display scale larger than the compilation scale.

Readily Available Indication

Indication that can be, at any moment, immediately displayed by a single operator action.

Presentation Library

Implementation of the display specifications in IHO S-52, Annex A, by de-coding and symbolizing the SENC.

Raster Chart Display System (RCDS)

A navigation information system displaying RNCs with positional information from navigation sensors to assist the mariner in route planning and route monitoring and, if required, display additional navigation-related information.

Raster Navigational Chart (RNC)

A facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized Hydrographic Office.

RTS

Reported Target Simulator as defined in Annex F of IEC.

Route

Series of waypoints connected by one or more legs including both straight and curved segments.

RNC Data

Data conforming to Raster Chart Display System (RCDS).

RNC Test Data Set

Standardized data set and testing instructions available as IHO S-64.

Single Operator Action

Procedure achieved by no more than one hard-key or soft-key action, excluding any necessary cursor movements, or voice actuation using programmed codes.

Safety Contour

Borderline between safe and unsafe water based on depth defined by the mariner.

Safety Depth

Depth defined by the mariner, e.g. the ship's draught plus under keel clearance, to be used by ECDIS to emphasise sounding on the display equal to or less than this value.

Selected Target

Target selected manually or automatically for the display of detailed alphanumeric data, information and text in a separate user dialogue area. The target is represented by a "selected target" symbol.

Sleeping AIS Target

AIS target indicating the presence of a vessel equipped with AIS in a certain location. The target is represented by a "sleeping target" symbol indicating the vessel's orientation. No additional information is presented until the AIS target is activated.

Standard Display

The display mode intended to be used as a minimum during route planning and route monitoring.

System Electronic Navigational Chart (SENC)

A database in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the entire ENC contents and updates.

System Raster Navigational Chart (SRNC)

A database resulting from the transformation of the RNC by the RCDS to include updates to the RNC by appropriate means.

Abbreviations

- AIS – Automatic Identification System;
- ARCS – Admiralty Raster Chart System;
- ARPA – Automatic Radar Plotting Aid;
- BAM – Bridge Alert Management;
- BNWAS – Bridge Navigational Watch Alarm System;
- BWOL – Bearing to Wheel Over Line;
- CCRP – Consistent Common Reference Point;
- CIE – International Commission on Illumination;
- CMG – Course Made Good;
- COG – Course Over Ground;
- CPA – Closest Point of Approach;
- DGPS – Differential Global Positioning System;
- DIS – Draught Information System;
- DR – Dead Reckoning;
- DWOL – Distance to Wheel Over Line;
- EBL – Electronic bearing line;
- ECDIS – Electronic Chart Display and Information System;
- EML – Expected Motion Line;
- ENC – Electronic Navigational Chart;
- EP – Estimated Position;
- EPFS – Electronic Position-Fixing System;
- ER – Echo Reference;
- ERBL – Electronic Range and Bearing Line;
- ETA – Estimated Time of Arrival;
- ETD – Estimated Time of Departure;
- GC – Great Circle;
- GMT – Greenwich Mean Time;
- GPS – Global Positioning System;
- GZ – Guard Zone;
- HCRF – Hydrographic Chart Raster Format
- HDG – Heading;
- HO – Hydrographic Office;
- IEC – International Electrotechnical Commission;
- IHO – International Hydrographic Organization;
- IMO – International Maritime Organisation;
- INFO – Information;
- LDL – Limiting Danger Line;
- m – metre;
- min – minute;
- MMSI – Maritime Mobile Service Identities;
- MSI – Maritime Safety Information;
- MOB – Man Overboard;
- NAVTEX – Navigational Telex;
- NM – Nautical Mile;

- NMEA – National Marine Electronics Association;
- NS – Navi-Sailor;
- PS – Positioning System;
- PTA – Planning Time of Arrival;
- RCDS – Raster Chart Display System;
- RIB – Radar Integrated Board;
- RL – Rhumb Line;
- RMS – Route Mean Square (error);
- RNC – Raster Navigational Chart;
- ROT – Rate Of Turn;
- RPM – Revolution Per Minute;
- SENC – System Electronic Navigational Chart;
- SOLAS – Safety of Life at Sea;
- SAR – Search And Rescue;
- s – second;
- SMG – Speed Made Good;
- SOG – Speed Over Ground;
- STG – Speed To Go;
- TCPA – Time to Closest Point of Approach;
- TTG – Time To Go;
- UTC – Universal Time Coordinated;
- VDR – Voyage Data Recorder;
- VRM – Variable Range Marker;
- WGS-84 – World Geodetic Datum;
- WOL – Wheel Over Line;
- WPT – Way Point;
- WS – Work Station;
- XTD – Cross Track Distance.

Cyber Security

Cyber security permits computer systems to be protected from hacking, damage to software and theft of electronic or personal data of customers Wärtsilä Voyage systems.

Cyber assumes ever growing significance due to Wärtsilä' extensive use of cloud technologies and Internet.

In this connection, Wärtsilä Voyage takes a number of measures described below.

All the information from the ship is transferred via an encoded channel to the Microsoft Azure cloud certified for compliance with the ISO/IEC 27017 security standard. The MS Azure uses the following services for storing data:

- Azure SQL;
- Azure CosmosDb;
- Azure Storage;
- Azure Key Vault.

All the information is stored in the data centre in Amsterdam, the Netherlands.

Access to data is strictly limited through the use of security certificates, and is used by the automatic services for providing services to the data owners.

Data exchange uses technologies like HTTPS and SSL.

All the processed data is protected with the aid of the Azure protection.

Electronic Navigational Charts

This chapter provides a description of principles underlying data display on the electronic navigational charts.

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Chart Formats

Raster and vector forms of data presentation have their benefits and disadvantages. The advantage of the raster form is the easiness of data production reduced to the organization of source paper chart scanning and presentation of raster data in compliance with specifications. The greatest drawback of raster data is the impossibility to activate signals and alarms in the shipboard display system as the ship is crossing a distinctive depth contour or the boundary of a dangerous area. Also noted is the impossibility to change the display scale, distortion of presentation if the scanner and screen resolution differ, which makes the chart considerably less easy to handle.

Unlike the raster charts, which are called “mute”, vector charts are “intelligent”. Indeed, they allow the safety of navigation to be considerably improved owing to the signal and alarm generation capability. They carry significantly more information, as for any element of navigational situation, the navigator can obtain exhaustive information, which is contained in the vector data in the form of object attribute values. It is only natural that the production of vector data should take much more time and cost.

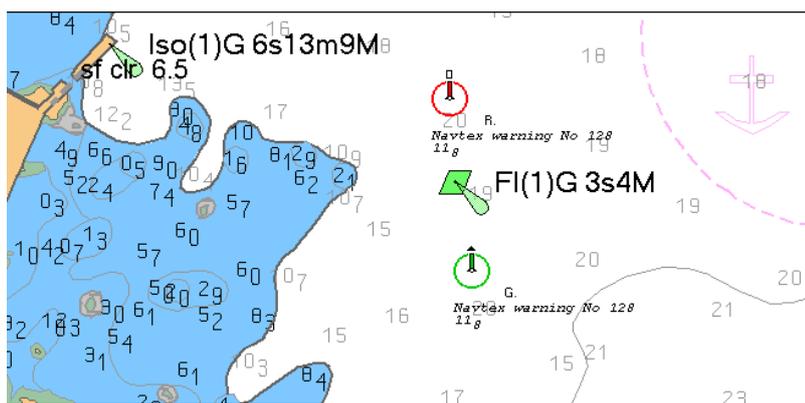
In the RADAR task, vector format charts only are used.

Manual Correction

Where the automatically performed electronic updating is unavailable or insufficient, there should be a facility for making it manually. This is what Manual Correction function has been designed for, it is controlled from the **Man Corr** panel of the ECDIS task.

Plotting and Editing of Updating Objects

The use of the manual updating function implies the creation of a separate chart information layer (updating layer). This layer is transparent and contains updating objects only, which when displayed is superimposed on the principal chart information. It is possible to plot updating objects contained in the provided library, enabling the check of attributes related to them in the process. Updating objects can be edited. Symbols of updating objects differ from information and official corrections of electronic navigational charts, and do not affect the presentation on the ECDIS task screen.

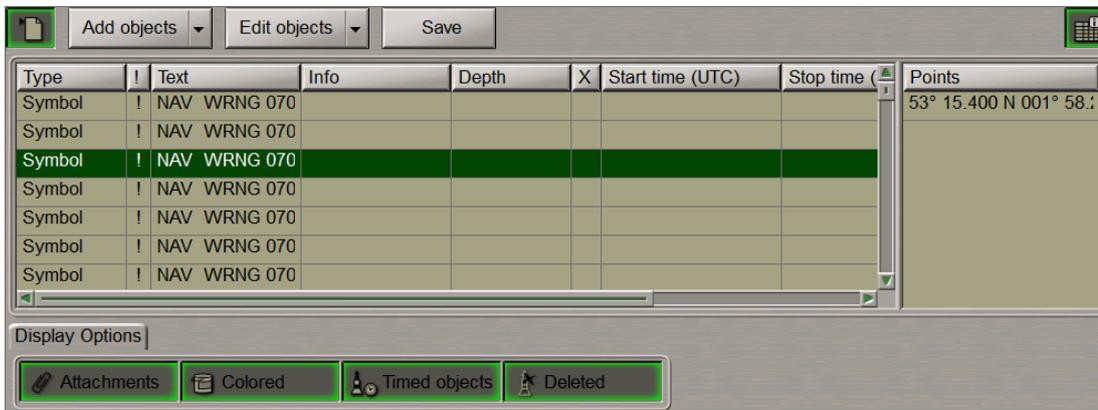


All the information on such layer objects is contained in a single file inaccessible for editing and referred to “manual updating” file, which is synchronised on all the workstations via the network.

For the plotting of temporary and preliminary updating, determining of the object (display) effective time is enabled. These terms are defined as “Temporary updating” object attribute.

Search for Updating Objects

The **Man Corr** panel is intended for a fast search for updating objects.



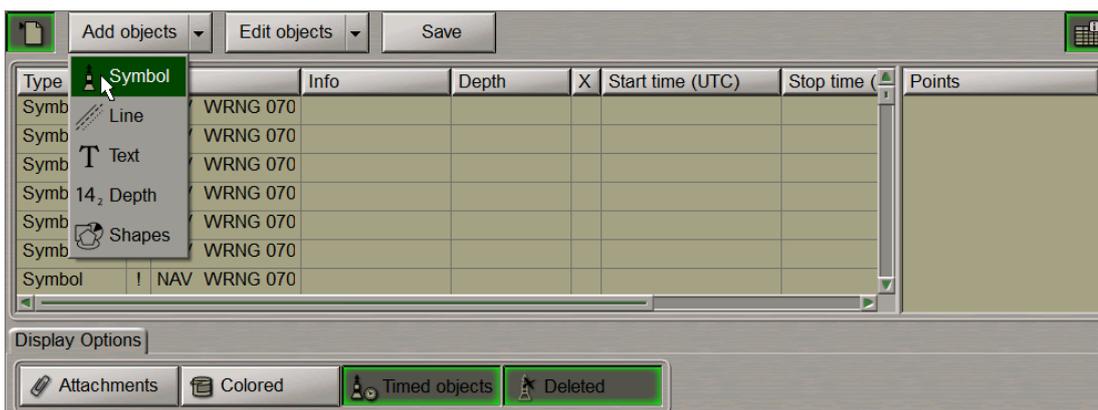
The table shows the created updating objects and their attributes. An object is selected from the left-hand part of the page; as this is done, the right-hand part displays its coordinates if this is a point type object, or coordinates of all the object points if this is a line type object. A double click on the line containing the object name displays it in the centre of the Chart panel. The found object is highlighted with a flashing circle.

Categories of Updating Objects

Updating files may contain the following object categories:

- Symbols: conventional signs of nautical charts from the symbol library;
- Lines: lines and areas from the provided types;
- Text: names and comments made by the operator in a special field;
- Depths: digits entered by the operator and specifying depth in metres;
- Shapes: lines and areas from the provided types (Ellipse, Rectangle, Sector, Polygon and Circle).

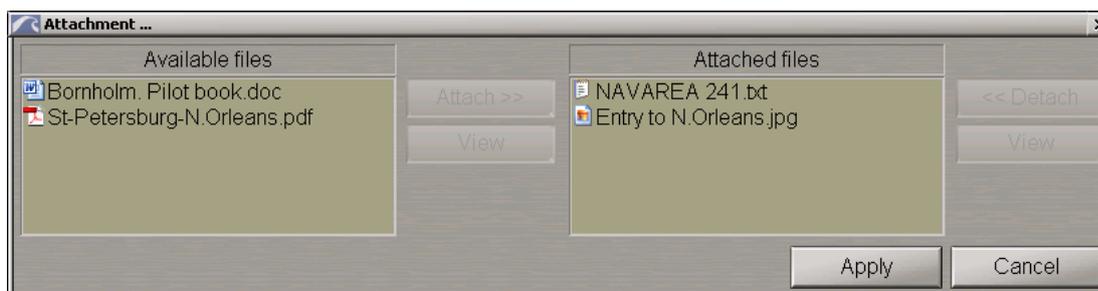
To create or edit an object, use the row of buttons on **Man Corr** panel where you can select the object category.



Updating Object Attributes

Each of objects can be assigned its own attribute. The following object attributes can be assigned, corrected or deleted:

- “Attached file”: file of a certain format supported by Windows OS (*.txt, *.rtf, *.bmp, *.doc, *.gif, *.jpg, *.tif, *.pdf). The list of files which can be attached to the object is provided in a special window with Attachments function in use. The database with such files is generated by using the Data Tool utility:



- “Object colour” is selected by the operator from the provided colour palette. This attribute is not available for the “symbols” object category as the library presents type coloured objects;
- “Object information”: the text of information is entered by the operator in the **Info** field of attributes window. The entered data is used for the display in the **Chart Information** window if the  button on the Control Panel is pressed. Information related to this object will be displayed in the top part of the message panel;
- “Text” is used for the display in combination with an object as its name, property, etc.;
- “Danger”: when this checkbox is selected, the updating object will be considered by the ECDIS task as a danger to navigation (isolated or area type) with relevant parameters;
- “Object depth” is assigned by the operator for specifying depth over the object which will be taken into account as a safety criterion in the ECDIS task;
- “Temporary updating” is used for the display of updating in the specified period of time. Time limits are set in the relevant fields activated by selecting checkboxes where **Start** is the object display start time, and **End** is deleting time. If the latter setting is not made, the object which has temporary updating attribute is not deleted;
- “Deleted object”: object status which is assigned when the object is deleted. Object data is saved in the updating file.

Not each of the updating object categories may have all the attributes. The table below clearly illustrates the possibility of assigning attributes to various categories of such objects. The possibility to assign a certain attribute is marked with an X.

	SYMBOL	LINE	TEXT	DEPTH	CIRCLES
Attached file	X	X	X	X	X
Colour	–	X	X	X	X
Info	X	X	X	X	X
Text	X	X	–	X	X
Danger	X	X	X	X	X
Depth	X	X	X	–	X
Start/Cancel	X	X	X	X	X
Deleted	X	X	X	X	X

Where an attribute cannot be assigned to any object category, this function is disabled, and the corresponding field is greyed.

Updating objects with the following attributes can be highlighted with colour by using the relevant buttons on the **Display option** page:

- Objects with “attached file” (**Attachments**);
- “Deleted objects” (**Deleted**);
- “Object colour” (**Colored**); in this case, the capability to display objects in the assigned colour is disabled, and all the objects (except those already selected: objects with attached files, temporary updating and deleted objects) are displayed in orange.

Maps

To create and display information not connected with the official chart and updating data, the ECDIS task has a capability to compile a separate object layer which is referred to as maps. The use of this functionality is recommended for the storage of cartography related notes and service information.

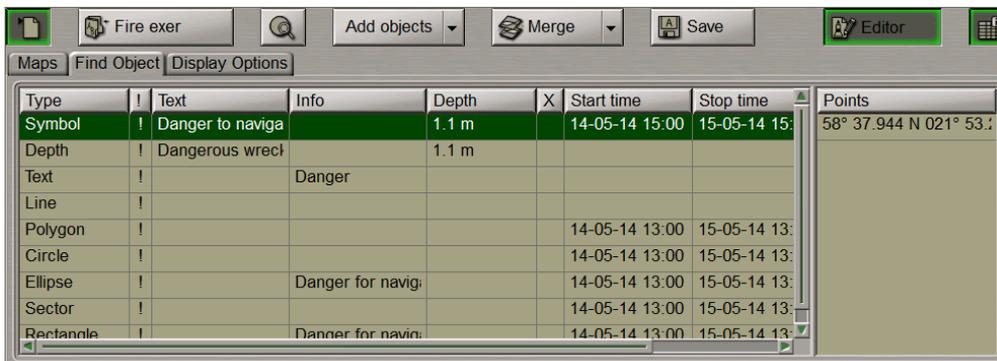
Maps Display

The map is displayed if loaded and if its display is enabled. On the ECDIS task screen it is shown as a transparent layer with map objects plotted onto it. This layer is superimposed on top of the principal chart information.

When several maps are loaded simultaneously, the map selected by the user from the list of loaded maps is active, i.e., information on this chart objects is available on the **Find Object** page.

Creating and Editing Maps

Maps are created by using the dedicated ECDIS task graphic editor which is controlled from the **Maps** panel.



For the map editing, they should first be loaded by using the **Load** button.

The chart name is shown on the button after the chart has been loaded.

Maps can be created by using the following methods:

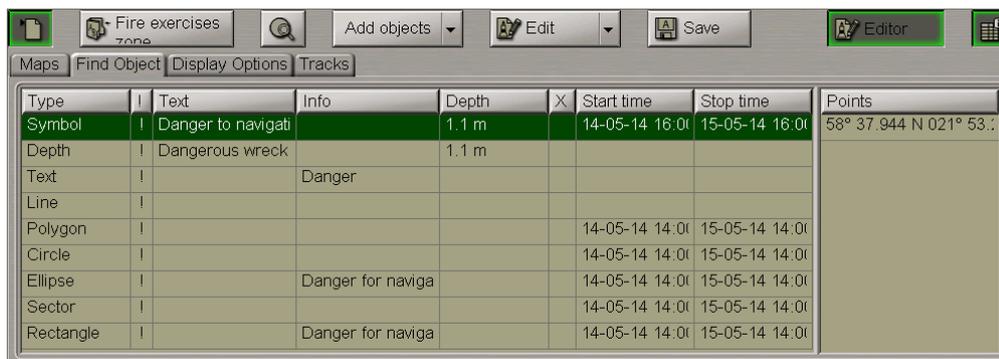
- Creating a map with new objects: first the objects are plotted, then the chart is saved by using the **Save** function;
- Creating a chart by merging several maps: this is done automatically by using the Merge function: the chart resulting from the maps merging can be saved under the name of one of the merged maps, or under a new name by using the Save function.

The saved user information is stored in separate files with *.ai extension. Such files contain a set of objects with the following characteristics determined by the user:

- Symbol number from the symbol library;
- Coordinates;
- Object attributes.

Search for Map Objects

The **Find object** page is intended for a fast search for objects plotted on the map.



Type	Text	Info	Depth	X	Start time	Stop time	Points
Symbol	Danger to navigati		1.1 m		14-05-14 16:00	15-05-14 16:00	58° 37.944 N 021° 53.0
Depth	Dangerous wreck		1.1 m				
Text		Danger					
Line							
Polygon					14-05-14 14:00	15-05-14 14:00	
Circle					14-05-14 14:00	15-05-14 14:00	
Ellipse		Danger for naviga			14-05-14 14:00	15-05-14 14:00	
Sector					14-05-14 14:00	15-05-14 14:00	
Rectangle		Danger for naviga			14-05-14 14:00	15-05-14 14:00	

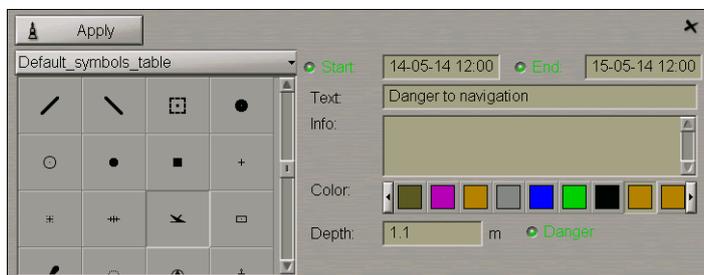
The table shows the created map objects and their attributes. An object is selected from the left-hand part of the page; as this is done, the right-hand part displays its coordinates if this is a point type object, or coordinates of all the object points if this is a line type object. A double click on the line containing the object name displays it in the centre of the Chart panel. The found object is highlighted with a flashing circle.

Categories of Map Objects

Maps can contain the following object categories:

- Symbols: conventional signs of nautical charts from the symbol library;
- Lines: lines and areas from the provided types;
- Text: names and comments made by the operator in a special field;
- Depths: digits entered by the operator and specifying depth in metres;
- Shapes: lines and areas from the provided types (Ellipse, Rectangle, Sector, Polygon and Circle).

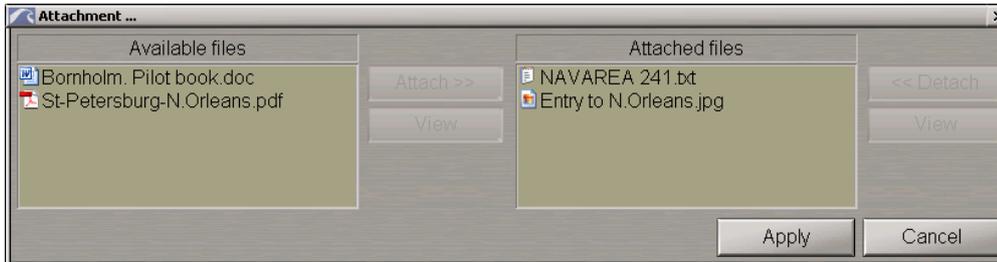
To create or edit an object, use an area on the **Maps** panel where you can select the object category and type, and the assigned attributes.



Attributes of Map Objects

Each of objects can be assigned its own attribute. The following map object attributes can be assigned, corrected or deleted:

- “Attached file”: file of a certain format supported by Windows XP OS (*.txt, *.rtf, *.bmp, *.doc, *.gif, *.jpg, *.tif, *.pdf). The list of files which can be attached to the object is provided in a special window with the **Attachments** function in use. The database with such files is generated by using the Data Tool utility:



- “Object colour” is selected by the operator from the provided colour palette;
- “Object information”: the text of information is entered by the operator in the **Info** field of the attributes window.

The entered data is used for display in the **Chart Information** window by pressing the  button on the Control Panel. Information related to this object will be displayed in the top part of the message panel;

- “Text” is used for the display in combination with the object as its name, property, etc.;
- “Danger”: when this checkbox is selected, the map object will be considered by the ECDIS task as a danger to navigation (isolated or area type) with relevant parameters;
- “Object depth” is assigned by the operator for specifying depth over the object which will be taken into account as a safety criterion in the ECDIS task;
- “Temporary” is used for the display in the specified period of time. Time limits are set in the relevant fields activated by selecting checkboxes where **Start** is the object display start time, and **End** is deleting time;
- “Deleted object”: object status which is assigned when the object is deleted. Object data is saved in a map file.

Not each of the object categories may have all the attributes. The table below clearly illustrates the possibility of assigning attributes to various object categories. The possibility of assigning a certain attribute is marked with an X.

	SYMBOL	LINES	TEXT	DEPTH	SHAPES
Attached file	X	X	X	X	X
Colour	X	X	X	X	X
Info	X	X	X	X	X
Text	X	X	–	X	X
Depth	X	X	X	–	X
Start/Cancel	X	X	X	X	X
Deleted	X	X	X	X	X

Objects with the following attributes can be highlighted with colour by using relevant buttons on the **Display options** page:

- Objects with “attached file” (**Attachments**);
- “Deleted objects” (**Deleted**);
- “Object colour” (**Colored**); in this case, the capability to display objects in the assigned colour is disabled, and all the map objects are displayed in the orange colour;
- “Temporary” (**Timed objects**).

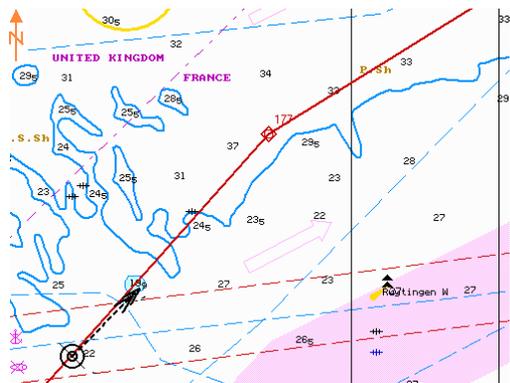
Object selection by their attributes is made for all the loaded maps.

Chart Orientation

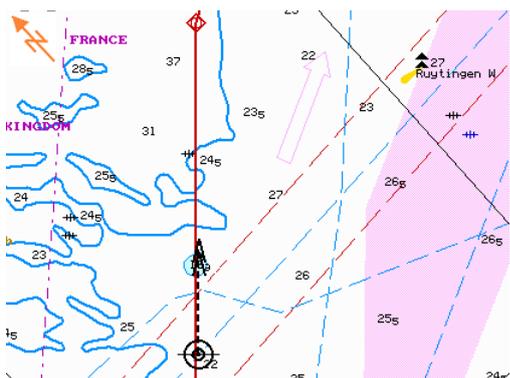
During the work with charts in the ECDIS task, the user can select any suitable chart orientation. Direction to the north is shown with the symbol: 

Charts on the Chart panel may have the following orientation:

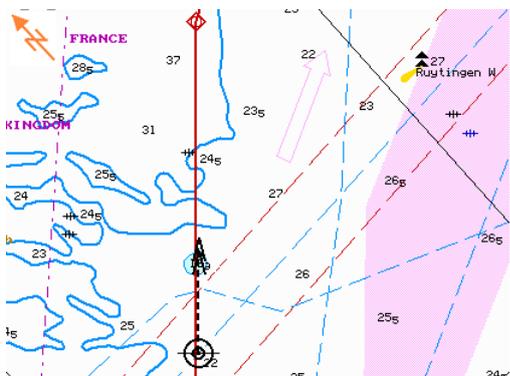
- North Up direction:



- Head Up direction (by the current heading direction):



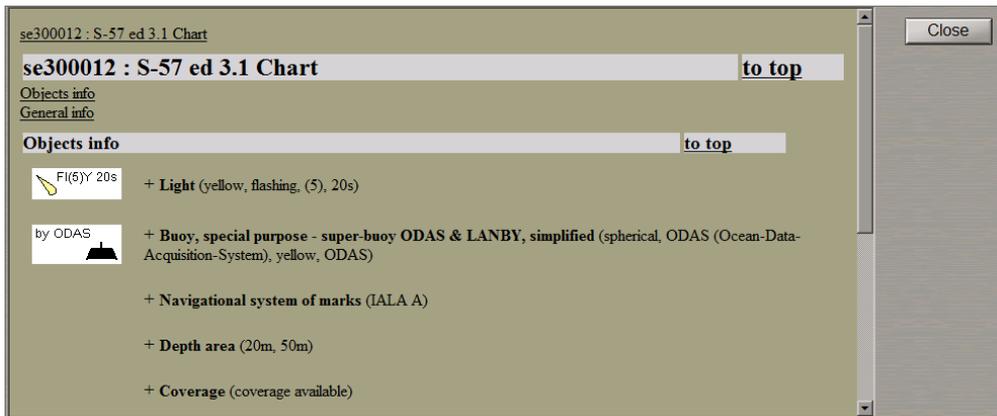
- Course Up direction (used with the loaded route only):



Info

General Chart Information

For the prompt obtaining of general information on the vector chart on whose boundaries the cursor is currently located, the ECDIS task implements the **Info** function. For S-57 format charts, information on the edition number and date, coordinate offset, the latest correction date and source of editions (country) is displayed.



For TX-97 format charts, information on the edition number and date, coordinate offset, the latest correction date is displayed along with data on the source of the paper which the vector electronic chart was made from.



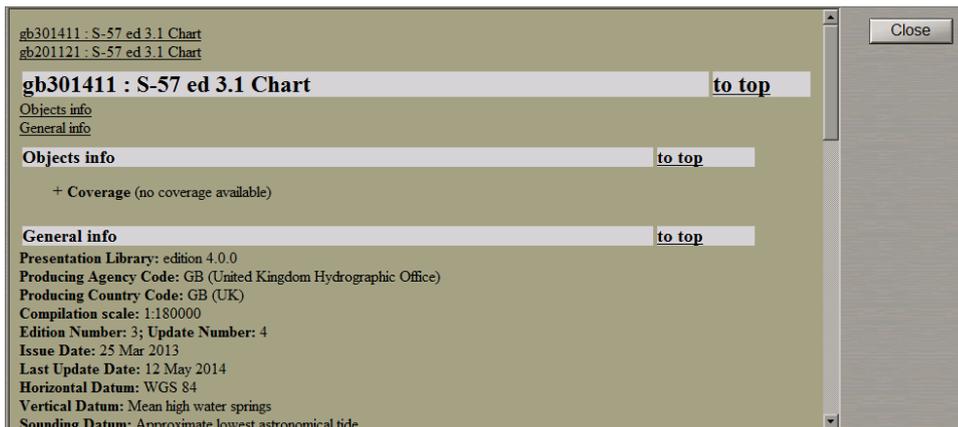
Information on Chart Objects

A large number of chart objects within a small screen area does not permit the display of all their associated information. With the use of the **Info** function, a free cursor for performing the “acquisition” function appears in the chart area. A press on the left trackball/mouse button in the bottom part of the screen opens up the **Info** panel which displays available information on the “acquired” objects in both text and graphic form.

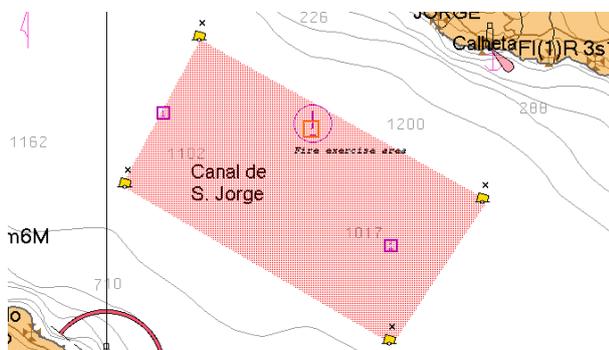
Objects are “acquired” by using the following procedures:

- Point type object (lighthouse, buoy, “i” information sign, etc.) – position the marker so that the object is within its box;
- Line or area (recommended route, cables, oil pipelines, traffic separation lines, areas, etc.) – position the marker on any line segment;
- Displayed chart – position the marker on any chart space free of chart objects;
- Any of the charts whose boundaries are shown within the chart area – position the marker so that one of the chart corners is under the marker;
- NAVTEX message symbol – position the marker so that the symbol is within the marker box.

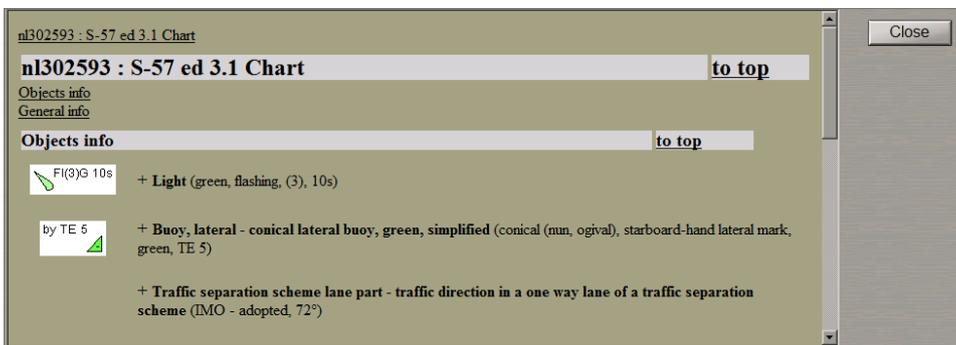
Information panel displays a list of acquired objects. To view the data, select the required object from the list.



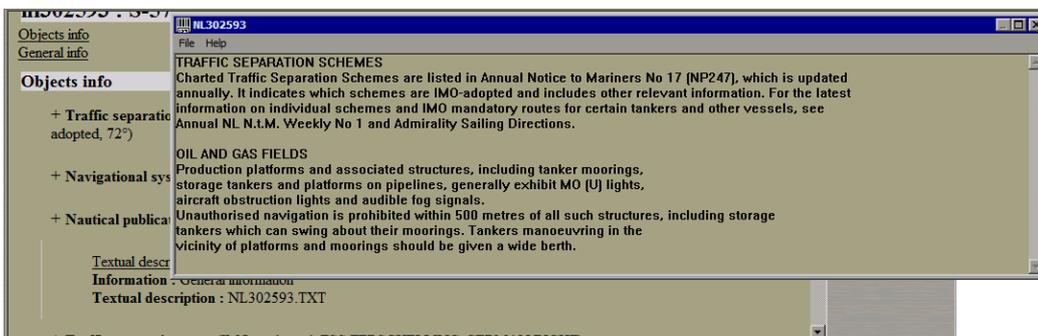
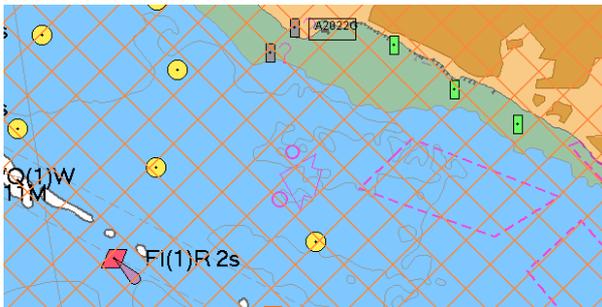
It is also possible to obtain information on updating and map objects. Text information on such objects is provided if they have “Object information” attribute. For the user to be aware that is available, objects can be supplemented with “Info”  and “Caution”  symbols from the symbols library.



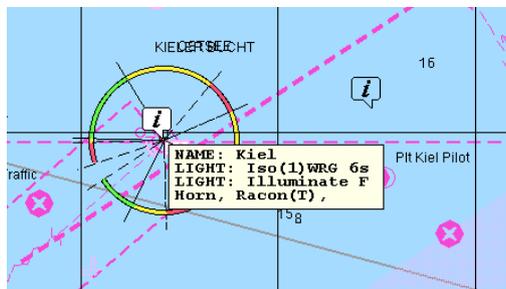
With the use of S-57 format charts, point type objects are marked with a circle if the **Highlight** function is selected on the **Info** panel. To cancel the marking, press the **Unmark** button.



With the use of S-57 format charts, information on objects can contain a textual description which is displayed in a special window after the selection of the **Textual Description** function in the **Info** panel. Part of the chart which the text refers to, is marked with hatching.



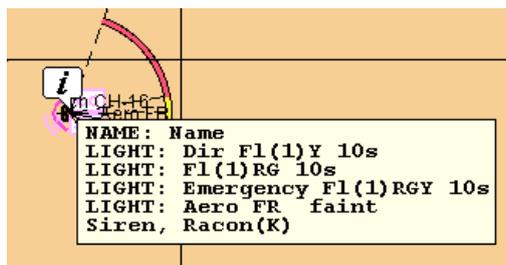
With the use of S-57 format charts, the navigator is sometimes in need of receiving promptly some important information about lights avoiding a long way to the full information. For this purpose the following feature is implemented: when the navigator positions the free **View** cursor on an object (light, buoy, beacon) a hint with info will appear (see also *Chapter 3, section ECDIS Task Cursors, paragraph Free Cursor*).



The following information is specified in the hint window for objects encoded together with lights:

- **NAME** – lighthouse name;
- **LIGHT** – characteristic;
- **Horn, Racon** – additional information which can include characteristics of the Radar Transponder beacon, Fog Signal, Signal Station;
- **BRG** – bearing to the light (not specified unless the light is within the visibility range from the own ship);
- **DIST** – distance to the light (not specified unless the light is within the visibility range from the own ship).

Should several lights turn up under the cursor, they will all be shown in the hint.



Information on a light in the sector can also be obtained by positioning the free **View** cursor on this sector.

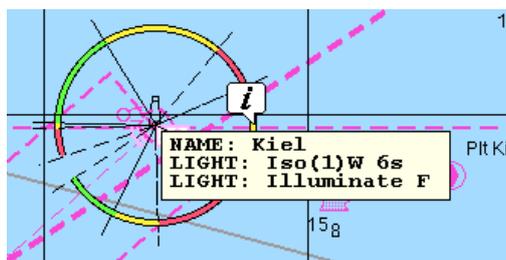


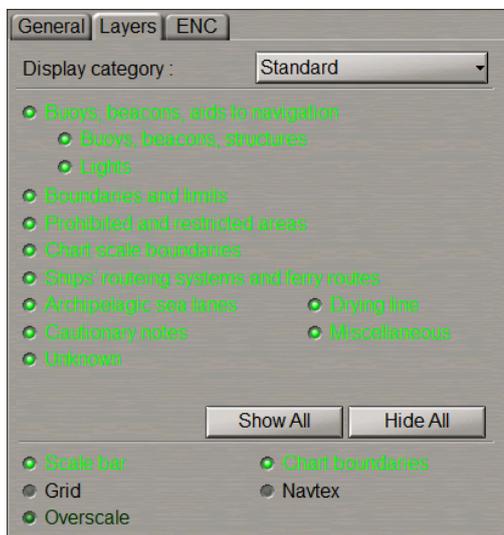
Chart Control

Layers Control

In compliance with requirements of IEC 61174 ECDIS and S-52 standards, the ECDIS task implements a capability to select the display of various chart information categories:

- **Base** display includes classes of information whose display must not be turned off in any circumstances whatsoever;
- **Standard** display includes classes of information essential for the navigation and route planning modes (it is possible to select the display of different chart information classes included in this display, in this case an important indication is displayed on the Control panel, see also *Chapter 4*, section **Indications**, paragraph **Display of Important Indications**);
- **Custom** display includes classes of other information which was not included in the previous two categories (it is also possible to select the display of different chart information classes included in this display).

The display of individual classes is controlled from the **Layers** page of the **Charts** panel.



According to the IEC 61174 standard the following information should be displayed during the route planning and monitoring:

- The Display Base to be permanently shown on the ECDIS display, consisting of:
 - Coastline (high water);
 - Own ship's safety contour;
 - Isolated underwater dangers of depths less than the safety contour which lie within safe water defined by the safety contour;
 - Isolated dangers above water which lie within the safe water defined by the safety contour such as fixed structures, overhead wires, etc.;
 - Scale, range and north arrow;
 - Units of depth and height;
 - Display mode.

- The Standard Display, consisting of:
 - Display base;
 - Drying line;
 - Buoys, beacons, other aids to navigation and fixed structures;
 - Boundaries of fairways, channels, etc.;
 - Visual and radar conspicuous features;
 - Prohibited and restricted areas;
 - Chart scale boundaries;
 - Indication of cautionary notes;
 - Ships routing systems and ferry routes;
 - Archipelagic sea lanes.
- All other information to be displayed individually on demand, for example:
 - Spot soundings;
 - Submarine cables and pipelines;
 - Details of all isolated dangers;
 - Details of aids to navigation;
 - Contents of cautionary notes;
 - ENC edition date;
 - Most recent chart update number;
 - Magnetic variation;
 - Graticule;
 - Place names.

Autoload

For a clear presentation of the sailing area and work with chart information, it is necessary to correctly select navigational charts and their scale. This kind of selection can be made automatically by the user set parameters, and manually. It is for this purpose, as well as for the clear display of chart information on electronic charts of different formats, that the **Charts** panel has been made.

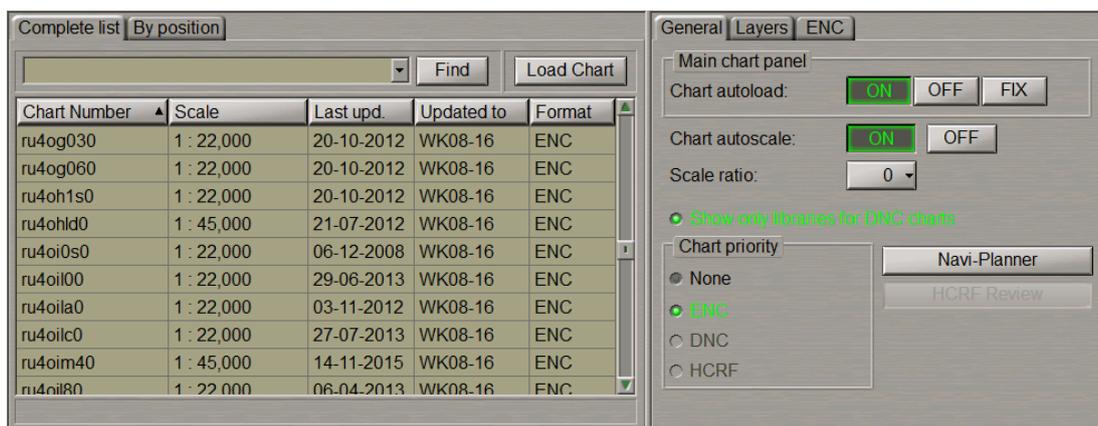


Chart loading is understood as the display of an electronic chart from the ship folio on the ECDIS task screen. Such loaded chart whose number is specified in the control on the Control Panel, is referred to as the current chart.

For an easy search and loading of the required charts, the ECDIS task offers two procedures: automatic and manual.

Chart Autoloading

Chart autoloading is a special ECDIS task function which allows automatic display of a chart, optimum in regard to its position and scale, and defines this chart as the current chart.

To turn this function on, press the **ON** button in the **Chart autoload** buttons row:



Charts are loaded automatically in the following cases:

- Under the ship position – when the ship sails beyond the current chart boundaries;
- Under the cursor – when the graphic cursor moves beyond the screen limits during the use of some functions (Review, ERBL, Zoom, WPT Editor, etc.).

Where it is necessary to use the chart which is not loaded automatically, a special function is provided which is activated by pressing the **FIX** button in the **Chart autoload** toolbar. As this is done, chart autoloading is disabled, and the required chart can be loaded manually. After the ship symbol has passed the boundaries of the fixed current chart, the autoloading mode will be turned on automatically.

Manual Chart Loading

The manual method of chart loading requires the operator to select the charts him/herself in one of the two windows adapted for the search of charts. Selection can be made from the list of the entire ship folio (the **Complete list** page) and from the list of charts covering the ship position (the **By position** page). Apart from differences in the lists, the functionality of these windows is identical.

Chart Number	Scale	Last upd.	Updated to	Format
gb301156	1 : 90,000	27-01-2012	WK08-12	TRS
gb301156	1 : 90,000	24-02-2012	WK36-12	ENC
gb301164	1 : 90,000	23-01-2012	WK08-12	TRS
gb301164	1 : 90,000	03-07-2012	WK36-12	ENC
gb301165	1 : 90,000	11-09-2012		ENC
gb301178	1 : 180,000	23-01-2012	WK08-12	TRS
gb301178	1 : 180,000	12-06-2012	WK36-12	ENC
gb301183	1 : 90,000	01-08-2012	WK36-12	ENC
gb301183	1 : 90,000	20-09-2011	WK08-12	TRS
gb301187	1 : 180,000	06-12-2011	WK08-12	TRS

For a fast search for charts by the number or part of this number, there is a window for the input of the number and the **Find** button for activating the search process. In this case, the required chart (or the one whose number is similar in the initial characters) is displayed and highlighted in the list. If the first character of the entered number matches no first characters in the numbers of charts in the provided folio, no chart is highlighted, whilst the bottom part of the window displays the “No chart found” message.

Another search method consists in the selection of a chart from the list; to make the search easier, this list can be sorted in the ascending/descending order of the following chart characteristics:

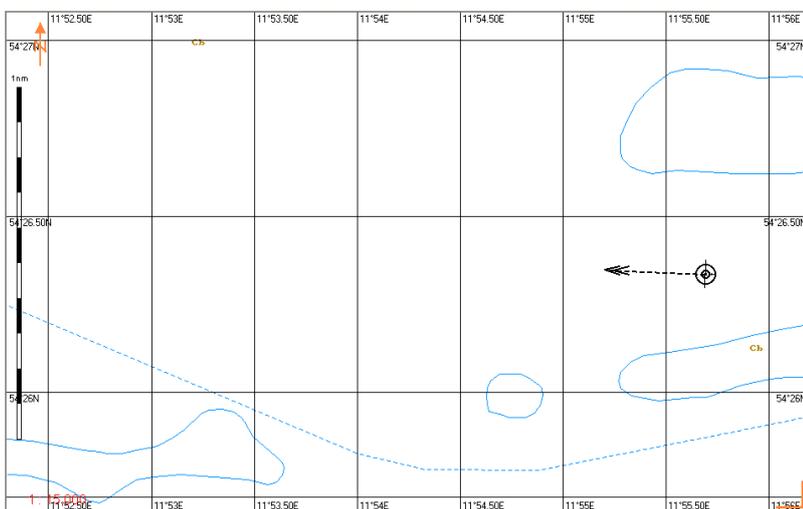
- **Chart Number** – chart number;
- **Scale** – chart scale;
- **Last upd.** – date of the most recent chart updating in the dd-mm-yyyy format;
- **Updated to** – media which was used for the latest of TX-97 or SENC chart collection updating;
- **Format** – chart format.

The “hot” chart loading method consists in working with the Control Panel's **Chart Area** window on the selection-from-the-list principle.

Chart ID	Type	Scale
n11805_0		
Autoload		OFF
n1101	TRS	1 : 75,000
n1101a	TRS	1 : 40,000
n1110b	TRS	1 : 50,000
n1116	TRS	1 : 40,000
n1116a	TRS	1 : 25,000
n1120	TRS	1 : 40,000
n1120a	TRS	1 : 20,000
n1120b	TRS	1 : 25,000

Autoscale

Each chart has its original scale. To set the required scale and support the scale uniformity in case of the chart multi-loading, the scaling function is provided. This function has manual and automatic setting modes. The scale set on the ECDIS task screen is displayed in the left-hand part of the screen in the digital and graphic form (scale bar).



Automatic Scaling

The automatic scaling enables the display of a chart loaded in the autoload mode on its original scale.

It should be noted that in the automatic scaling mode it is possible to change the scale manually. To do this, select the number from 1 to 5 in the **Scale Ratio** combo box (the **Charts** panel's **General** page), which will result in that with a switch to another chart, the scale will be increased/decreased as compared to the original current chart scale (“0” setting).

If negative values are selected, the scale of the chart in the Autoload mode will be increased, and the other way round. Autoloading of charts on the original scale is performed with the **Scale ratio** value set to 0:



With the automatic chart scaling OFF, charts are loaded on the current screen scale.

Manual Setting of Scale

The chart display scale can be set by using the <ZOOM IN> and <ZOOM OUT> keys on the ES6 keyboard or the  and  buttons on the Chart panel. As this is done, the current chart scale alters by one fixed scale value. To set the original chart scale on the ECDIS task screen, use the  button on the Chart panel.

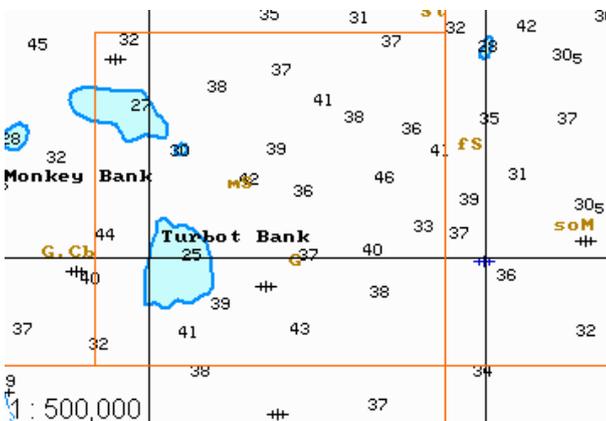
Autoscroll

The possibility of viewing charts in the area far away from the own ship position symbol is implemented in **Review** function. It turns on the graphic cursor moved around the ECDIS task screen with the mouse/trackball. As the cursor goes beyond the screen boundaries, and with the chart autoloading ON, the current and/or adjacent charts will be re-drawn around the central point determined by the cursor coordinates. Data on the coordinates and the cursor position relative to the ship is displayed in a special window.

Review	
Latitude	59°59.626' N
Longitude	028°12.108' E
Ship position	
	<input type="radio"/> true <input type="radio"/> relative
Bearing	161.0 ◀ 109.0 °
Opp. Bearing	341.0 ▶ 071.0 °
Range	5.91 NM
	10945 m
Press Tab to edit manually	

Zoom

The possibility of displaying the necessary chart fragment or sailing area is implemented by the **Zoom** function. With the **Zoom** function ON, the operator selects the required sailing area on the Chart panel keeping the left mouse button depressed.



After the left trackball/mouse button is pressed, the ECDIS task automatically sets the scale to such fixed scale value which will enable the selected sailing area to be fully displayed on the Chart panel. At the same time, the chart will be loaded on the scale closest to the fixed scale value set in the ECDIS task.

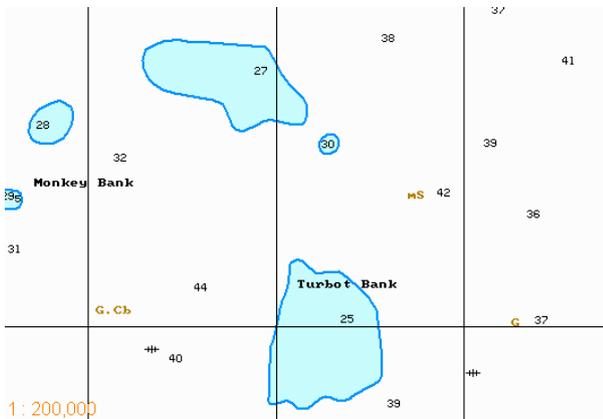


Chart Formats Priority

The ECDIS task implements a mode for the priority loading of different format charts. This mode is enabled in the **Charts** panel's **General** page.



With the selected **None** checkbox, the standard ECDIS task operating mode is set, whereby all the charts from the collection in any format are equally suitable for use. In this case, if there are several charts on the same scale, priority is given to the TX-97 (TRX) format charts.

With the selected **ENC** checkbox, and with optimum charts in different formats available under the ship position, it is the ENC format chart which will be loaded.

Colour Palettes

For an easier perception of information shown on the ECDIS task screen, the ECDIS task implements a capability to select colour palettes to suit the external illumination conditions:

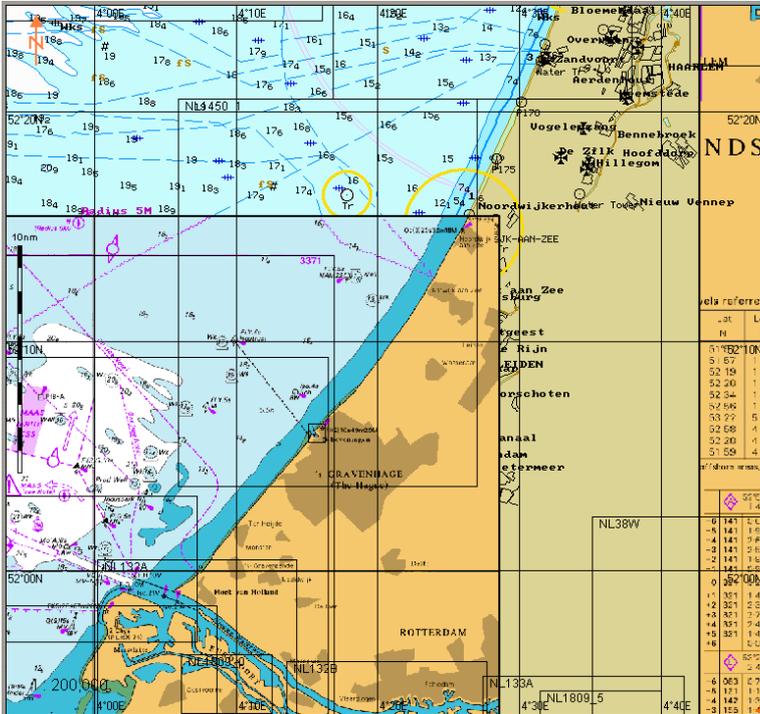


The **Palette** group is intended for the selection of the screen colour palette depending on the environmental illumination:

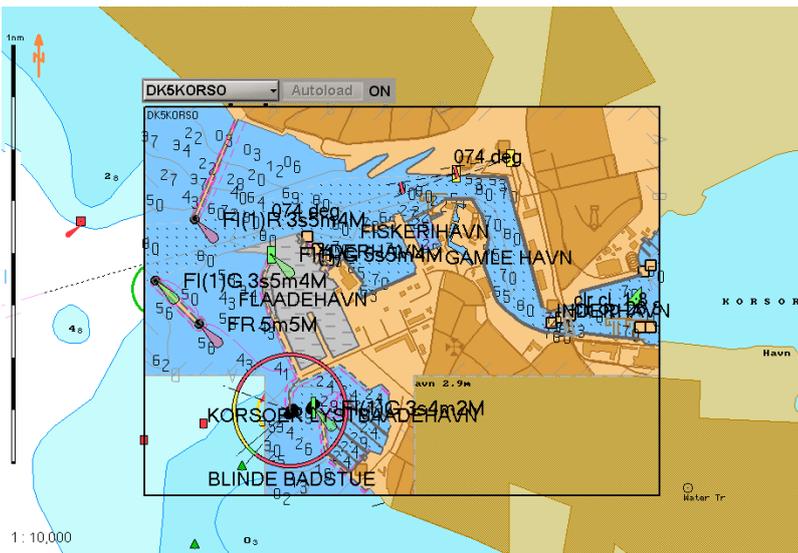
- **Daylight;**
- **Dusk** – night with moon shining;
- **Night** – moonless night;
- **Night inverted** – moonless night (the text is shown in a contrasting colour).

Multiloading

For covering areas adjacent to the current chart with chart information, chart multiloading is used. This function requires the chart autoload to be ON, and allows the remaining chart area to be filled with the most detailed charts on the scale set for the current chart. Up to 6 charts of different formats can be simultaneously displayed on the screen:



When the ECDIS task screen cannot be fully covered by the selected chart on the necessary scale, the remaining part is filled with information from other charts loaded on the same scale:



Information Sensors

This chapter provides a description of principles underlying the MFD process and display of information from external sensors.

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Navigational Sensors

Positioning

Processing of Data Received from EPFS

In this mode, the following systems can be used for the ship positioning:

- GPS (DGPS, PGPS);
- GLONASS;
- GNSS.

Where there are two positioning sources, they are connected in the System Configuration utility as **POS1** and **POS2** sensors, appropriate identifiers assigned to them. The MFD provides for two positioning systems: Primary and Secondary whose accuracy ensures navigational safety. In case of the Primary Positioning System failure, the Secondary Positioning System is automatically switched to for the reception of data.

The ship position coordinates can be received from the system sensors in the form of IEC 61162-1 standard messages (DTM, GGA, GLL and RMC). In this case, the **Latitude** and **Longitude** fields are processed (N/S and E/W hemisphere specified as appropriate).

Processing of Data Received from ER Positioning System

This method is based on the reception of ARPA information on the bearing and range to some stationary object (e.g. a lighthouse) with fixed coordinates. With this method in use, the ship position is determined by referencing the ship position to the radar image of such target. This method allows continuous positioning for both primary and secondary methods.

When the ship position is determined by the **ER** method, the selected radar target is set in the coordinates specified by the operator. Then, proceeding from the data on the selected target (bearing and distance), the ship position is calculated relative to the coordinates of the target. Therefore, as long as the data on the target is supplied continuously, the positioning will also be continuous.

As all the navigational calculations are made by the ECDIS relative to the ship position on the **Primary** track; with the ER mode selected for the primary ship positioning method, all the targets received from the ARPA are plotted on the chart relative to the ship position, i.e. are shifted by the value of the entered ship position correction.

Processing of Data Received from EP Positioning System

The Estimated Position (EP) mode is implemented on the basis of dead reckoning (DR) and takes into account additional data on currents or the last received drift value. You can select one of the following estimation modes:

- “EP: Drift” – to use the last calculated drift value or data from the drift sensor for correcting the position;
- “EP: Current” – to use total current (tidal and surface) from the navigational databases for correcting the position;
- “EP: Manual” – to use manually entered drift for correcting the position. The variation range in direction is 0–359.9 degrees, and 0.0–9.9 knots in speed;
- Drift sens – to use parameters from the drift sensor.

The name of the mode in use will be displayed in the **Primary** or **Secondary** windows on the Control Panel.

Prim	55° 56.421 N
EP:Drift	016° 11.026 E

EP positioning system is autonomous and is available if there is data from the compass and water-speed log. With the failure of one or more units, the positioning system is considered to be faulty.

The **COG\SOG\HDG\LOG** window on the Control Panel displaying the own ship motion parameters, shows heading and speed values supplied by the compass (“HDG”) and (“LOG”), whereas the “CMG” and “SMG” fields contain respective corrected values.

HDG GYRO 1	240.1°	STW DLOG 1	12.0 kn	CMG EP	235.8°	SMG EP	11.5 kn
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Processing of Data Received from DR Positioning System

In the Dead Reckoning mode, the ship position is determined from the information received from gyro and log.

NOTE: The NMEA VLW (Dual ground/water distance) sentence is not processed or used in the MFD. Covered distance calculations in the MFD (ECDIS) DR mode use the speed through the water received from the relevant sensor or entered manually.

ATTENTION! If the DR mode is used for a long time, this may result in a major ship positioning error, therefore, the ship position should be permanently checked and corrected as required.

For the display of Position data see below in *Display of Navigational (Essential) Information* paragraph.

RMS Calculations for Different Positioning Systems

RMS Calculations in Navigation Positioning Systems (PS)

1. If there is a GST message, by default, the processing of this sentence is disabled in the NMEA Input Filter (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration, paragraph MFD Settings*, and item 6). If this sentence is supplied to the system, the positioning accuracy is calculated from the following formula:

$M = 3 * \text{Standard deviation of semi-major axis of error ellipse (field 3 of GST message)}$

2. If there is no GST message, but there is a GBS message, values of fields 2 and 3 (expected error in latitude and Expected error in longitude) in metres are used in the following formula:

$$M = 1.73 \sqrt{m_{\text{latitude}}^2 + m_{\text{longitude}}^2}$$

3. If there is neither GST message, nor the GBS message:

$M = 1.73 * \text{UERE} * \text{HDOP}, m$

Where:

- HDOP – the RMS calculations are only made if the GGA or GNS message is available; if there is no HDOP data, the RMS is not calculated;
- UERE – default values are used:
 - GPS SPS – UERE=5.1 m;
 - DGPS SPS – UERE=1.5 m;
 - GPS PPS – UERE=3.3 m;
 - RTK fixed – UERE=1.5 m;
 - RTK float – UERE=1.5 m.

RMS Calculations in the Method of Ship Referencing to the Radar Picture (ER)

$$M = \text{MAX}(Mn)$$

Where Mn is calculated for each of the reference targets from the following formula:

$$M = \sqrt{(2 * m_p * D / 57.3)^2 + (2 * m_D)^2}, \text{ (nm)}$$

Where:

$$m_p = \sqrt{m_G^2 + m_B^2}$$

D – distance to the reference target;

m_G – gyro error – set in the System Configuration utility (1° by default);

m_B – ARPA target bearing determining error (1° by default);

– ARPA target distance determining error depending on the selected Range:

- Range of less than 1.5 nm – 20 metres;
- Range of 1.5 nm and more – 1% of the selected Range scale.

m_D The Range value from the RSD message can also be used (fields 10 and 11) for calculations for ARPA targets received via the NMEA protocol.

The m_D value changes dynamically with the scale changes.

Where the Range value is unknown, 1% or the 48 nm scale is used for calculations, i.e., 888 metres.

RMS Calculations in Dead Reckoning Sailing Mode (DR)

Calculations are not made unless the Heading and STW data is available.

$$M = S * 1.73 \sqrt{(m_G / 57.3)^2 + (m_L / 100\%)^2}$$

Where:

m_G – gyro error – set in the System Configuration utility (1° by default);

m_L – speed determining error – set in the System Configuration utility (2% by default);

S – distance covered after the most recent DR correction input is made, manually or automatically.

Heading

Data on the ship's true heading (HDG) is supplied to the MFD by the gyro in the HDT, THS and VHW sentences. Gyros connection is made on the **Sensors** page in the System Configuration utility.

Where there are two heading sources, they are connected in the System Configuration utility as **GYRO1** and **GYRO2** sensors, and appropriate identifiers assigned to them. It is possible to connect 2 Gyros.

The ship true heading can also be output to the MFD from the magnetic compass in the HDG sentence.

For the display of heading data see below in *Display of Navigational (Essential) Information* paragraph.

STW

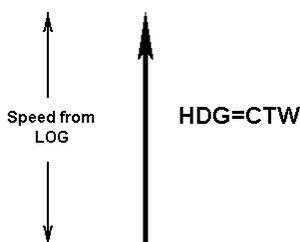
The following sources can be used in the MFD for calculating speed through the water (STW):

- LOG/DLOG – speed through the water from the connected sensor is used or Doppler log;
- Manual – speed value entered manually by the operator is used.

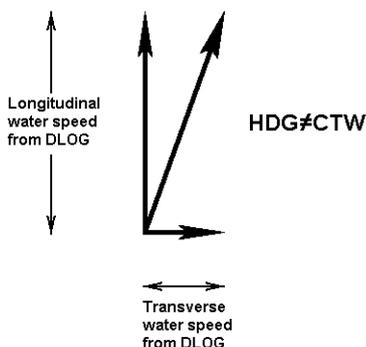
The STW speed data is received from the (D)LOG in VHW or VBW sentences. Connection of the (D)LOG is made on the **Sensors** page in the System Configuration utility.

Where there are two speed sources, they are connected in the System Configuration utility as **(D)LOG1, LOG2** sensors, appropriate identifiers assigned to them. It is possible to connect 2 LOG and 1 DLOG.

With the use of a log, or in the case of manual speed input, the numeric speed value and ship gyro course are used for forming a speed-through-water vector.



With the use of a DLOG, formation of a speed-through-water vector takes into account the longitudinal and transverse components (in ship coordinates) of speed through the water received from the DLOG. The direction of gyro heading (HDG) and speed-through-water vector (CTW) are generally not coincident. For the operator information, with the use of a DLOG as a speed-through-water sensor, the top left part of the Display Panel shows simultaneously the HDG and CTW.



The vector direction (CTW) is determined as a summary value of gyro heading (HDG) and speed vector in the ship coordinates, the longitudinal and transverse components of speed through the water received from DLOG taken into account. In the absence or incorrect value of the HDG, the direction of the speed-through-water vector (CTW) cannot be calculated. The absolute speed-through-water value (STW) is calculated and displayed. In this case, vector of the own ship speed through the water (CTW/STW) is not displayed on the ECDIS task screen.

If the single axis water log display can present the speed of the ship in other than the forward direction, the direction of movement should be indicated unambiguously. Therefore single axis water logs cannot detect the effect of leeway.

When the ship is in shallow waters, the dual-axis log accuracy is adequate.

If the ship is in the deep sea area, the dial-axis log accuracy may deteriorate, and this should be taken into account.

For the display of STW data see below in *Display of Navigational (Essential) Information* paragraph.

COG/SOG

The following sources can be used in the MFD for calculating speed over the ground (SOG):

- Positioning System;
- DLOG;
- STW + Drift;
- Echo Reference.

For the display of COG/SOG see below in *Display of Navigational (Essential) Information* paragraph.

Positioning System

Speed over the ground is supplied by the connected position sensor (GPS, DGPS, etc.). Speed vectors are calculated to take into account the course over the ground (COG) supplied by the appropriate sensor. COG/SOG can be received from the Positioning system in the VTG and RMC sentences.

DLOG

Calculations of the speed vector value take into account the longitudinal and transverse components of speed over the ground received from the DLOG. The vector direction (COG) is determined as a summary value of gyro heading (HDG) and speed vector in the ship coordinates, the longitudinal and transverse components of speed over the ground received from DLOG taken into account. COG/SOG can be received from the (D)LOG in the VBW sentences.

In the absence or incorrect value of the HDG, COG cannot be calculated and none of the modes which use it are operational.

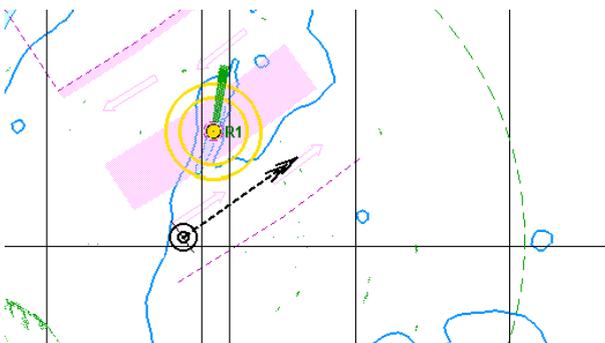
STW and Drift

Speed through the water takes into account manual drift input or data from the drift sensor. In this case, SMG and CMG values of speed-over-ground vector are calculated.

Echo Reference

This method is based on the reception of ARPA information on the bearing and range to some stationary object (e.g., a lighthouse) with fixed coordinates.

Such stationary objects are used as reference points. It becomes possible to use this mode if at least one such target is available. In MFD, up to 5 reference points can be used. On the ECDIS task screen, reference points are marked with the letter "R". As the reference points are selected, through numbering is used from 1 to 10, then numbering starts anew.



COG/SOG calculations use data on relative motion of targets selected for reference targets, and the own ship motion parameters (HDG and STW). If HDG and/or STW is not available, or their values are incorrect, reference points are dropped from tracking. When the supply of the correct own ship motion parameters is resumed, the user should select reference points anew.

ATTENTION! If the DLOG (LOG) has failed, to acquire reference points it is necessary to enter STW manually.

The reference points can only be set on the WS with the Navigation MASTER status. When the Navigation MASTER rights are passed to another WS, reference points are cancelled and should be set anew if you are planning to use the ER mode.

With the use of reference targets, there may be the following limitations the following limitations:

- The reference target function should be used if the own ship's speed cannot be displayed normally due to trouble such as a speed sensor malfunction. Do not use the reference target function except in emergencies;
- If the speed or course of the own ship is changed or a new reference target is set, the displayed speed may take 3 minutes or more to reach the specified speed after the speed/course change or the setting. Even after 3 minutes or more have passed, the speed may differ from the specified speed depending on the tracking condition;
- If a large radar echo such as a shore-based target is set as a reference target, the own ship and targets vectors will not be displayed correctly, which may cause an accident;
- If a sailing ship is set as a reference target, the own ship and targets vectors will not be displayed correctly, which may cause an accident;
- If a reference target is lost, or the target tracking function is stopped, the ER mode will be terminated;
- Reference targets are only used for true speed calculations.

Depth

Data on the depth-under-keel values is supplied to the MFD by the echosounder in the DBT and DPT message. Connection of the echo sounder (**ECHOSOUNDER**) is made on the **Sensors** page in the System Configuration utility. The depth value is shown on the **System Information** display in the ECDIS task.

Time

Time data is received in the ZDA sentences from the Positioning source (UTC sensor). Connection of the UTC sensor is made on the **Sensors** page in the System Configuration utility.

For the display of time data see below in *Display of Navigational (Essential) Information* paragraph.

Display of Navigational (Essential) Information

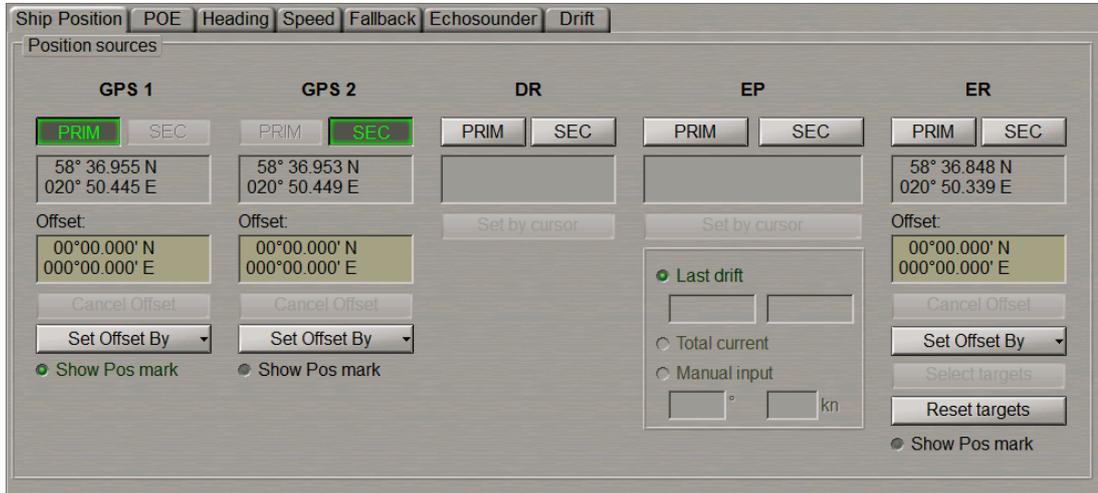
The main navigational information implies the following data:

- Time;
- Position;
- COG;
- SOG;
- Heading;
- Speed (STW).

This data is supplied to the MFD by the relevant sensors and is displayed on the **Display Panel** and **Sensors** panel. Provided below is a table which shows navigational information layout.

SENSORS PANEL

On the **Ship Position, Heading, Speed** and **Echosounder** pages of the **Sensors** panel



CONTROL PANEL



If the data was not supplied or has not passed appropriate checks, it is displayed in accordance with the algorithms described below. The following possible cases can be singled out:

- Data from sensor is not available, or the checksum is incorrect;
- Data has not passed validity, plausibility checks.

No Input, No Data or Corrupted Checksum Situation

Described below, as an example, is the system behaviour in the absence of data on the own ship position:

- No information is supplied by the sensor, or the sentences have an incorrect checksum (if the sentences have an incorrect checksum, they are not processed, i.e. they are considered to be absent):

TIME	ECDIS TASK	ECDIS CHART	ALERT				
T < 10 sec	<table border="1"> <tr> <td>Prim</td> <td>51° 06.441 N</td> </tr> <tr> <td>GPS 1</td> <td>004° 53.736 E</td> </tr> </table>	Prim	51° 06.441 N	GPS 1	004° 53.736 E	Ship symbol and vectors in ordinary colour	None
Prim	51° 06.441 N						
GPS 1	004° 53.736 E						
T ≥ 10 sec	<p>The sensor name is shown in orange, data is shown as orange coloured “**” symbols:</p> <table border="1"> <tr> <td>Prim</td> <td>** ** ** *</td> </tr> <tr> <td>GPS 1</td> <td>** ** ** *</td> </tr> </table>	Prim	** ** ** *	GPS 1	** ** ** *	<p>The ship symbol freezes in the last calculated data.</p> <p>No motion vector is displayed.</p> <p>The ship symbol turns red</p>	ECDIS - POSN: no input
Prim	** ** ** *						
GPS 1	** ** ** *						

- Some information is supplied from the sensor, but no data required for the indicator in question is received (e.g., the necessary fields in a sentence are empty):

TIME	ECDIS TASK	ECDIS CHART	ALERT
T < 10 sec		Ship symbol and vectors in ordinary colour	None
T ≥ 10 sec	The sensor name is shown in orange, data is shown as orange coloured “*” symbols: 	The ship symbol freezes in the last calculated data. No motion vector is displayed. The ship symbol turns red	ECDIS - POSN: no data

With other sensors, the system behaves in much the same way except for the display on the Chart panel. This also refers to the sensors which transmit non-essential data:

- Water temperature;
- Wind direction and speed.

Data Has Not Passed Validity or Plausibility Check

Described below, as an example, is the system behaviour for the own ship position data:

- If a validity check is not passed:

ECDIS TASK	ECDIS CHART	ALERT
	Ship symbol and vectors in ordinary colour	None
Data is shown as orange coloured symbols: 	The ship symbol turns red	None

- If a plausibility check is not passed:

ECDIS TASK	ECDIS CHART	ALERT
	Ship symbol and vectors in ordinary colour	None
Data is shown as orange coloured “*” symbols: 	The ship symbol turns red	None

In the plausibility checks, parameter values should not exceed the following limits:

- LAT: 84°59.99;
- LON: 180°00.00;
- HDG: 359.9°;
- LOG: 99.9 kt;
- Depth: 9998 m;
- Wind: 999 m/s;
- ROT: 999 deg/min.

With other sensors, the system behaves in much the same way except for the display on the Chart panel.

Consistent Common Reference System

General

To ensure the supply of non-ambiguous information to MFD components, the MFD uses the so-called “consistent common reference system”, which implies the following:

- Referencing to the same place and time;
- Compensation for latency.

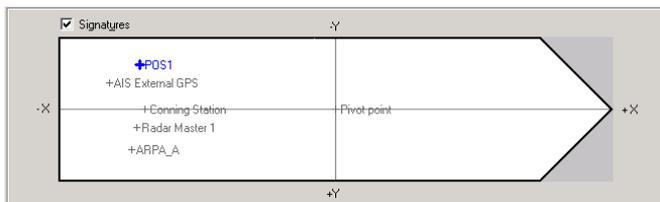
The validity and plausibility check is carried out at the previous data processing stage. Failure to pass these checks, triggers off relevant alarms.

The CCRS ensures that all parts of the MFD are provided with the same type of data from the same source.

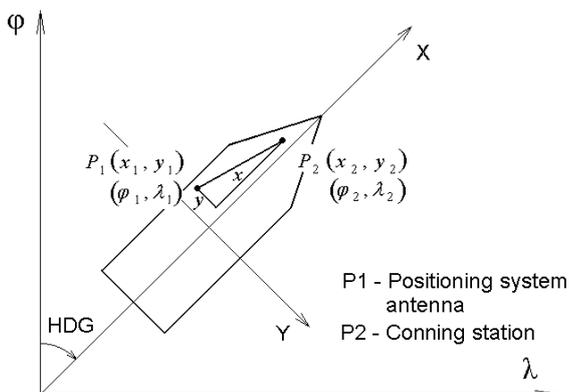
Referencing to Same Place

For a Consistent Common Reference Point (CCRP), the MFD uses the Conning Station which all the space-oriented information is referenced to (e.g., ship and targets position, ERBL, etc.).

Conning Station position in the ship system of coordinates is determined by the settings made in the System Configuration utility on the **Ship Settings** page of the **INS** panel:



An example of the ship position coordinates re-calculated after the positioning system antenna shift is provided below:



$$\varphi_2 = \varphi_1 + \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} * \cos(HDG) ;$$

$$\lambda_2 = \lambda_1 + \frac{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} * \sin(HDG)}{\cos\left(\frac{\varphi_1 + \varphi_2}{2}\right)}$$

If the heading is lost, the ship contour is no more displayed on the ECDIS task screen.

Information on the position of antenna units is permanently stored in the computer memory. When it is turned off, information is not deleted. Antenna configuration can be saved to an external storage by using the Backup function (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section Commissioning Table Creation and System Configuration Back Up*, paragraph *MFD Configuration Back Up*).

Information is output relative the Conning Station position.

Referencing to Same Time

Time in the MFD is supplied by the GPS. Time from the GPS, being more accurate, is considered to be the main one, and is used for the system time synchronising. Each time a message (ZDA) is received from the GPS (UTC sensor), the set 2 sec limit between the time from GPS and system time is checked. If the difference exceeds this limit, time is equalised with the GPS (UTC sensor).

Compensation for Latency

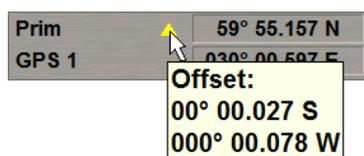
Data latency in the MFD is consistent with the data requirements of individual parts and their relevant international standards. The maximum data delay in the MFD does not exceed 1 sec, so no compensation for latency is performed.

Compensations for Navigational Data

Position Offset

If a constant-value error is identified in the ship positioning from any system, it can be taken into account. To this end, the MFD implements a function for the correction of the ship position coordinates.

The correction to ship position coordinates which is entered in the MFD and has a value other than zero, produces an appropriate change in the ship symbol position and coordinates shown on the ECDIS task screen. The fact that such correction is taken into account is indicated by a special symbol: a yellow triangle.



The correction entered for the ship position coordinates, regardless of the input method, has a constant value. With a change of the correction value, its input operation is required to be repeated.

Input of a position offset is made for every sensor on the of the Navigation MASTER task on the **Ship Position** page of the **Sensors** panel by using the following procedures:

- Manual input of correction. Corrections defined in the form of a numeric increment to the ship position coordinates are entered in the **Position offset** field with N/S and E/W characters as appropriate;
- Input of correction by the cursor position. In this method, corrections are calculated automatically as a difference between the coordinates specified by the cursor and produced by the positioning system.

The screenshot shows the 'Ship Position' panel with tabs for POE, Heading, Speed, Fallback, Echosounder, and Drift. The 'Position sources' section is active, displaying settings for five sensors: GPS 1, GPS 2, DR, EP, and ER. Each sensor has a 'PRIM' and 'SEC' button, a coordinate field (e.g., 58° 36.048 N, 020° 49.159 E), an 'Offset' field (e.g., 00°00.000' N, 000°00.000' E), and a 'Set Offset By' dropdown. The DR sensor has a 'Set by cursor' button. The EP sensor has radio buttons for 'Last drift', 'Total current', and 'Manual input', along with a speed field in kn. The ER sensor has a 'Set Offset By' dropdown, 'Select targets', and 'Reset targets' buttons. A 'Show Pos mark' checkbox is present for each sensor.

The calculated correction is used for correcting coordinates received from the positioning system.

To stop the effect of the correction, press **Cancel** button, whereupon the ship position will be determined exclusively by the coordinates received from the positioning sensor.

Magnetic Compass

With the use of a magnetic compass, heading data is supplied in the HDG sentence. In this case, deviation is taken into account if it is supplied by the magnetic heading sensor. The magnetic declination which is taken into account, is entered manually or taken from the ECDIS task database with the **Auto** button pressed on the **Heading** page of the ECDIS MASTER task's **Sensors** panel.

Gyro

In up-to-date gyros, deviation is offset automatically. To this end, connected to the gyro are position and speed sensors. If no such offset is available, it should be entered manually on the Navigation Master on the **Heading** page of the **Sensors** panel or as per the table below.

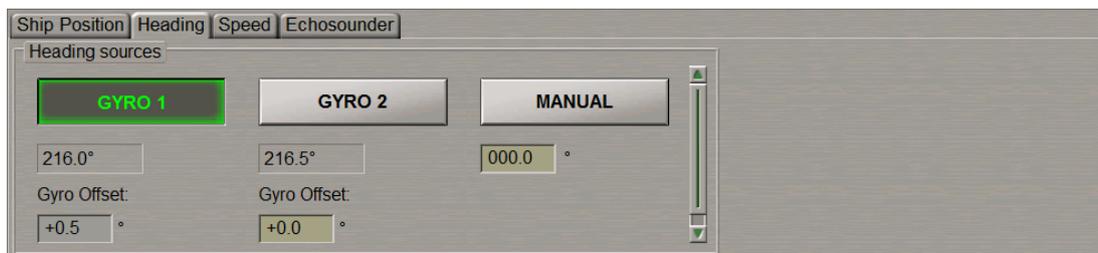
The screenshot shows the 'Heading sources' panel with tabs for Ship Position, Heading, Speed, and Echosounder. It displays settings for three heading sensors: Gyro 1, Gyro 2, and Magnetic. Each sensor has a heading field (e.g., 216.4°), a 'Gyro error' or 'Magnetic variation' field (e.g., +3.0 °, +0.0 °), and an 'Auto' button. The Gyro 1 sensor is highlighted with a green border.

The **Heading** page will display the uncorrected heading from the sensor. The corrected heading is taken into account by the MFD and is shown in the **COG/SOG/HDG/STW** window of the Display Panel.

If the HCR message is received and is valid (the HCR message “Correction state” field has the A,D or S values), the Display Panel **COG/SOG/HDG/STW** window displays the corrected heading and a special symbol: a yellow triangle.



As the free cursor is positioned on this triangle, the correction value is displayed in a pop-up prompt window.



Such correction is also shown in the **Gyro Offset** input box on the **Heading** page. In this case, the correction cannot be entered manually, and the input box is greyed.

If the gyro source stops sending a valid HCR message (the HCR message “Correction state” field has the N or V values), after a timeout of 20 sec, it becomes possible to enter the corrections manually. If such correction was already entered before the start of the HCR message reception, it will be displayed in the **Gyro Offset** box and taken into account in the subsequent calculations. For the description of the HCR message, see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 4, section Format of Data Exchange Used in Accordance with IEC61162-1 Standard, paragraph Input*.

In this table, speed deviation is provided in the ship’s compass heading function for the speed of 10 knots. To determine speed deviation for other speeds, it is necessary to multiply the value obtained from the table by the coefficient equal to the ratio of the ship’s actual speed to 10.

Table 1. Speed deviations in the compass course function (for the ship speed of 10 knots). Beginning:

COMPASS HEADING				SAILING LATITUDE								
				0°	30°	40°	50°	55°	60°	65°	70°	
-	+	+	-									
0°	180°	180°	360°	0.64	0.74	0.84	0.98	1.11	1.27	1.51	1.86	
10	170	190	350	0.63	0.72	0.82	0.97	1.09	1.25	1.45	1.83	
20	160	200	340	0.60	0.69	0.78	0.93	1.05	1.20	1.41	1.75	
30	150	210	330	0.54	0.63	0.72	0.86	0.97	1.10	1.31	1.61	
40	140	220	320	0.48	0.56	0.64	0.76	0.85	0.97	1.15	1.42	
50	130	230	310	0.41	0.47	0.53	0.63	0.71	0.82	0.97	1.17	
60	120	240	300	0.30	0.37	0.41	0.49	0.50	0.64	0.75	0.93	
70	110	250	290	0.21	0.25	0.28	0.33	0.38	0.43	0.51	0.63	
80	100	260	280	0.10	0.12	0.15	0.17	0.19	0.22	0.26	0.32	
90	90	270	270	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Table 2. Speed deviations in the compass course function (for the ship speed of 10 knots). Continued:

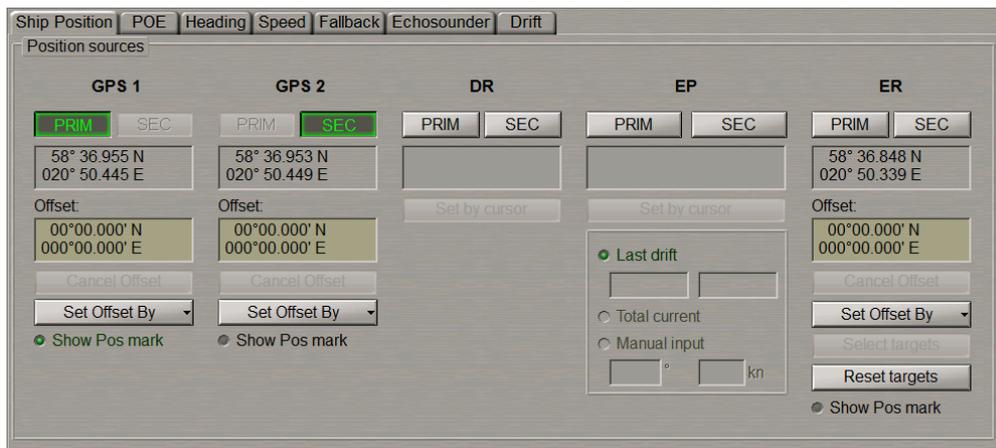
COMPASS HEADING				SAILING LATITUDE						
				73°	75°	76°	77°	78°	79°	80°
-	+	+	-							
0°	180°	180°	360°	2.18	2.46	2.63	2.83	3.06	3.34	3.66
10	170	190	350	2.14	2.42	2.59	2.78	3.01	3.28	3.62
20	160	200	340	2.04	2.31	2.47	2.66	2.88	3.14	3.45
30	150	210	330	1.89	2.13	2.28	2.45	2.65	2.89	3.18
40	140	220	320	1.67	1.88	2.01	2.16	2.34	2.55	2.85
50	130	230	310	1.28	1.58	1.69	1.82	1.97	2.15	2.36
60	120	240	300	1.69	1.23	1.32	1.42	1.53	1.67	1.84
70	110	250	290	0.74	0.85	0.89	0.96	1.04	1.19	1.24
80	100	260	280	0.37	0.42	0.45	0.48	0.52	0.57	0.64
90	90	270	270	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Navigational Sensors Selection

Manual Selection

Selection of Position Source

In the ECDIS task, use the **Ships Position** page of the **Sensors** panel to select the primary and secondary positioning systems. To select, activate the **PRIM** and **SEC** buttons.



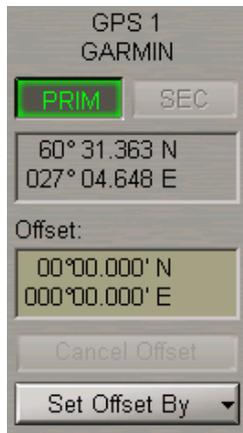
The **Ship position** page displays all the connected coordinates sensors, as well as the Dead Reckoning (DR) and Echo Reference (ER) modes.

The **PRIM** source data is used for making all the calculations in the navigational system. The **SEC** source is a hot backup for the Fallback functionality.

The primary and secondary positioning systems cannot be selected simultaneously for one and the same source.

The own ship position sensor name includes:

- Differential mode taken from the sentence;
- Source number assigned in the System Configuration utility;
- Source alias assigned in the System Configuration utility:

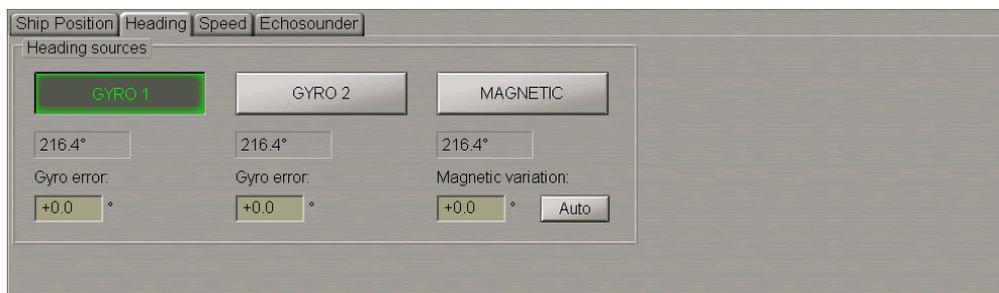


You may select a source with invalid data which is shown in orange. In this case, the screen displays a dialogue box requesting permission to select.

It is not possible to choose a source which no data arrives in.

Selection of Heading Source

In the ECDIS task, use the **Heading** page of the **Sensors** panel to select a heading source whose data will henceforth be used for making all the calculations in the system.



The **Heading** page shows all the connected heading sensors. The heading sensor name includes an alias assigned in the System Configuration utility.

To select the main source, activate the button with the source name. The selected source data is used for making all the calculations in the navigation system.

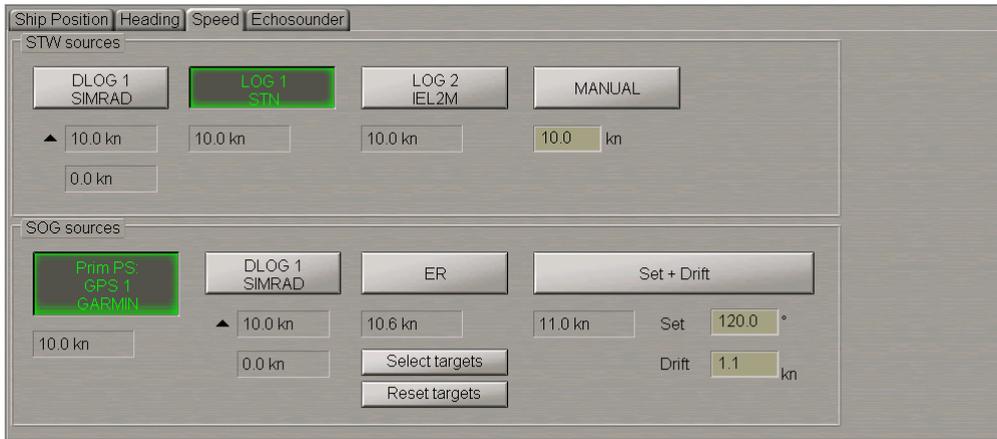
Magnetic compass may be selected as a heading source; magnetic variation is available either for manual selection or from the database (see above paragraph *Compensations for Navigational Data*, under *Magnetic Compass*).

You may select a source with invalid data which is shown in orange. In this case, the screen displays a dialogue box requesting permission to select.

It is not possible to choose a source which no data arrives in.

Selection of STW Source

In the ECDIS task, use the **Speed** page of the **Sensors** panel to select a source of speed through the water whose data will henceforth be used for making all the calculations in the system.



The **STW sources** group on the **Speed** page shows all the connected sensors of speed through the water. The speed sensors name includes an alias assigned in the System Configuration utility.

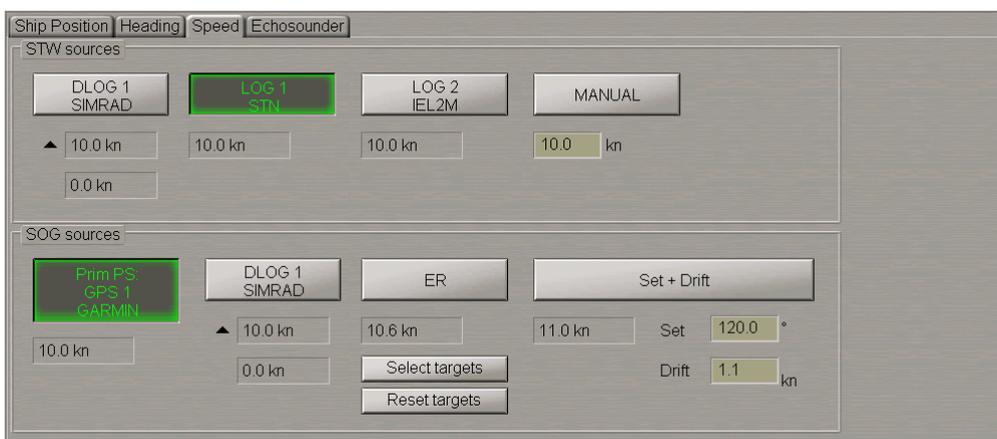
To select the main source, activate the button with the source name.

You may select a source with invalid data which is shown in orange. In this case, the screen displays a dialogue box requesting permission to select.

It is not possible to choose a source which no data arrives in.

Selection of SOG Source

In the ECDIS task, use the **Speed** page of the **Sensors** panel to select a source of speed over the ground whose data will henceforth be used for making all the calculations in the systems.



The **SOG sources** group on the **Speed** page shows all the connected sensors of speed over the ground. The speed sensor name includes an alias assigned in the System Configuration utility.

You may select a source with invalid data which is shown in orange. In this case, the screen displays a dialogue box requesting permission to select.

It is not possible to choose a source which no data arrives in.

Selection of Depth Source

In the ECDIS task, use the **Echosounder** page of the **Sensors** panel to select a source of depth whose data will henceforth be used for making all the calculations in the systems.



The **Echosounder** page shows all the connected depth sensors and data from the electronic chart and tidal height.

To select the main source, activate the button with the source name. The depth sensor name includes an alias assigned in the System Configuration utility.

You may select a source with invalid data which is shown in orange. In this case, the screen displays a dialogue box requesting permission to select.

It is not possible to choose a source which no data arrives in.

Automatic Source Selection with Actuation of Fallback Functionality

Fallback functionality implies the use of a backup data source in case of the main source failure. Fallback functionality is implemented for the following essential data:

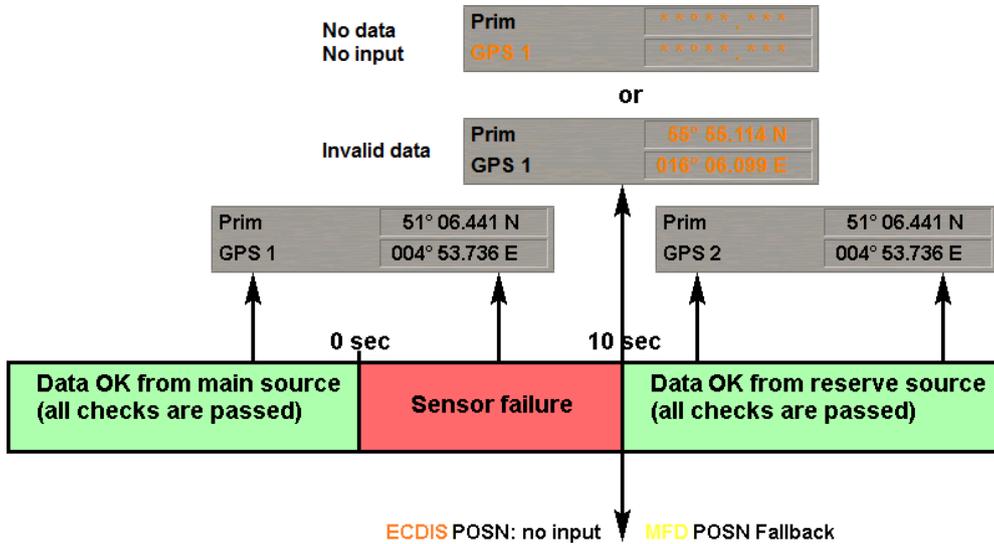
- Position. The secondary position source is used for the backup source which is set on the **Sensors** panel's **Ship position** page. If the secondary position source is not set, there is no switch to the backup;
- Heading. The second gyro is used for a backup. The magnetic compass is not used for a backup source;
- STW. The second log is used for a backup source.

By default, there is compulsory Fallback actuation in the case of the sensor failure.

Sensor Failure

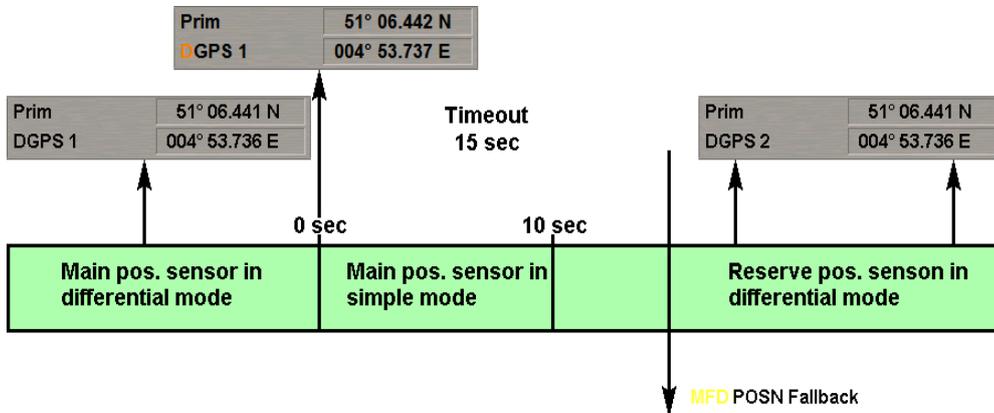
The data source switches to the backup when the main source does not receive any data or receives invalid data for 5-10 seconds (as set at the configuration stage).

After that the **Fallback** caution is activated, the system switches over to the backup source. There is no switchover to the backup source unless it has passed all the necessary checks.



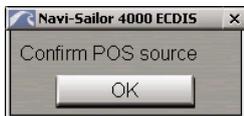
Differential Mode Lost

A switchover to the backup data source occurs with a differential mode loss by the ship's position sensor (the letter "D" in the source name stops to be displayed). If the differential mode is not recovered within the set time after its loss, the system switches over to the backup source. The timeout is set to 15 sec. There is no switchover to the backup source unless it operates in the differential mode.

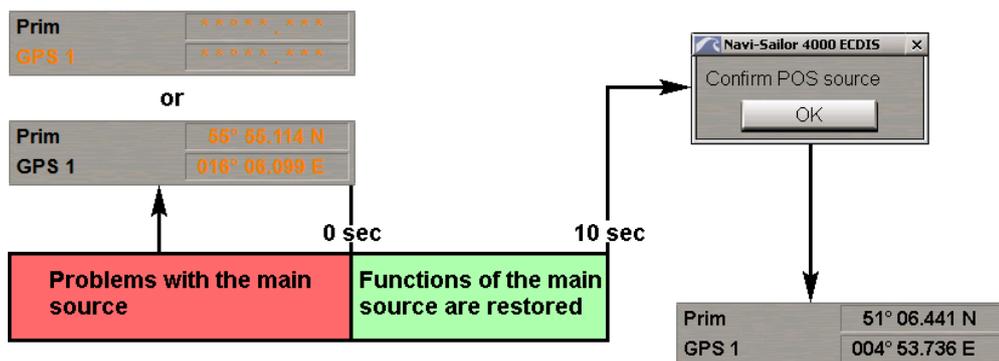


Automatic Restoration Function

After the main data source has restored its regular operation, there is no automatic switchover back to it. Upon of the set time expiry, the user is prompted to restore it as the main data source. The timeout is set to 10 sec.



If OK is pressed, the system switches over to this data source.



Other Sensors

Wind Interface

Data on the wind speed and force is supplied by the wind sensor according to IEC 61162-1 (the MWV sentence specifying the relative or true wind).

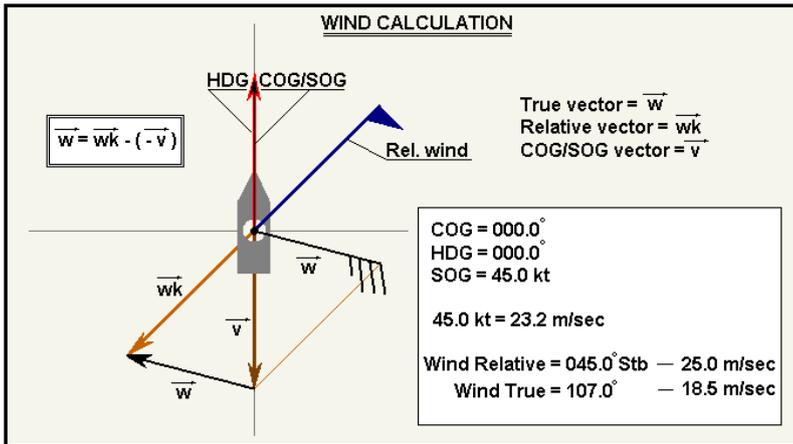
The table shows the content of information displayed in the **System Information** display in accordance with available NMEA sentences.

DATA AVAILABLE FOR MFD	MWD	VWR	MWV	
			RELATIVE	THEORETICAL
Only wind sensor	True wind	Relative wind	Relative wind	No information displayed
Wind + COG + SOG	True wind	Relative wind	Relative wind	No information displayed
Wind + HDG	True wind	Relative wind	Relative wind	True wind
Wind + HDG + COG + SOG	<ul style="list-style-type: none"> • True wind; • Relative wind re-calculated from true 	<ul style="list-style-type: none"> • Relative wind; • True wind re-calculated from relative 	<ul style="list-style-type: none"> • Relative wind; • True wind re-calculated from relative 	<ul style="list-style-type: none"> • True wind; • Relative wind re-calculated from true

Wind data can be displayed in three ways:

- True wind value is received – shown on the **System Information (True Wind)** display;
- Relative wind value is received – shown on the **System Information (Relative Wind)** display;
- If correct data from the gyro (HDG) and positioning system (COG and SOG) is available, wind is re-calculated from relative to true if the relative wind sensor is installed, and the other way round; if the positioning system is DR, correct data from the gyro (HDG) and log (STW – relative or ground speed) can be used for wind recalculations.

Wind recalculations from relative to true and the other way round are made according to the algorithm shown below:



The necessary condition for the wind re-calculations in the ECDIS task is the availability of:

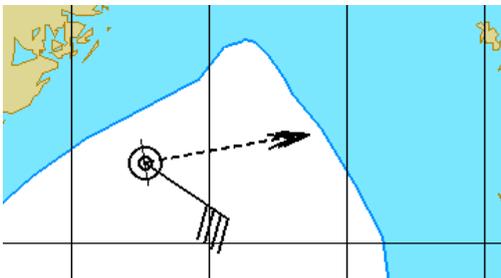
- Compass heading value (HDG);
- Vector of the ship motion over the ground (COG/SOG).

It is necessary to remember the two main rules for re-calculating wind from relative to true:

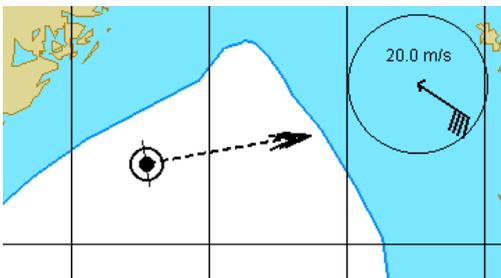
- Relative wind is blowing in the same direction as the true wind;
- The relative wind's track angle is always smaller than the true wind's track angle.

On the ECDIS task screen, the true wind vector can be displayed in two modes:

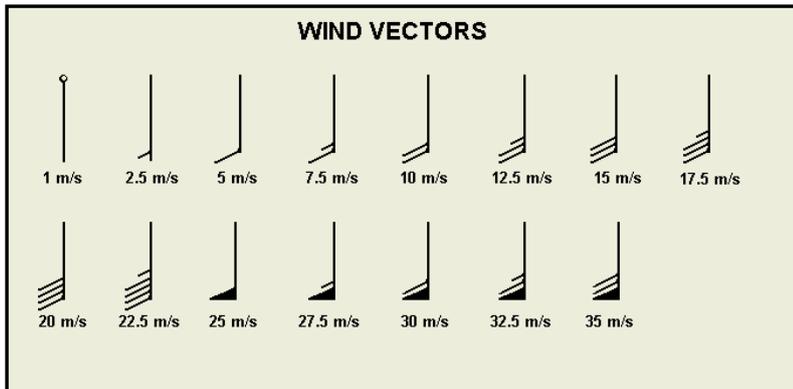
- Wind vector;



- Wind card.



Wind vectors are shown on the ECDIS task screen in accordance with its designation on the traditional sea weather charts.



The Wind card represents a circle in the top right corner of the Chart panel.

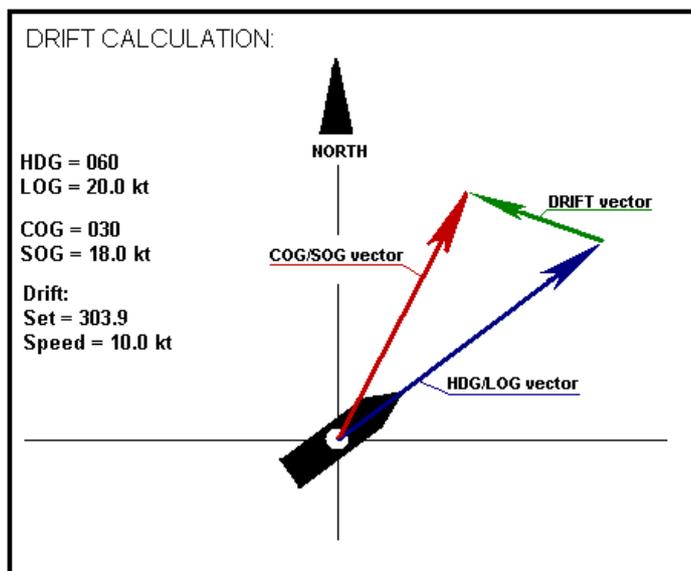
An arrow with a digital value shows the wind direction, and its speed is shown as a digital value in the centre.

Modes are switched on the **Route Monitoring** page of the **Monitoring** panel (see document *Multifunctional Display (v. 3.02.350). ECDIS User Manual, Chapter 11, section Obtaining Current System Information*).

Drift

If data is available from the **EPFS**, compass and log (COG, SOG, HDG, STW), an additional ship motion parameter is calculated: drift. The drift characteristics (direction and speed) are determined as the difference of COG-SOG and HDG-STW vectors.

The ECDIS task makes drift calculations if there is correct data supplied by the compass, log and positioning system (HDG, STW, COG, SOG). With the use of speed vector triangle, the drift direction and speed are calculated from the trigonometric formulas. The drawing below shows an example of drift calculations in the graphic form.



The drift characteristics are shown on the **System Information** display of the Control Panel.

CALCULATED		FROM DRIFT SENSOR	
System Information		System Information	
Drift	296.6° - 0.0 kn	Drift Sens	179.0° - 1.2 kn
Current	326.0° - 0.1 kn	Current	326.0° - 0.1 kn
Sf.contour	30 m - 50 m	Sf.contour	30 m - 50 m
True wind	119.9° - 10.0 m/s	True wind	119.9° - 10.0 m/s
Rel. wind	078.8°(P) - 10.1 m/s	Rel. wind	078.8°(P) - 10.1 m/s
Water t °	18.0 °C	Water t °	18.0 °C
Depth	28.0 m	Depth	28.0 m
ECHOSOUNDER 1		ECHOSOUNDER 1	
Tide height		Tide height	
No data	No data	No data	No data

It is also possible to display data supplied by the drift sensor according to IEC 61162-1 standard in the VDR sentence. To enable this, the drift sensor is required to be connected in the System Configuration utility (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration*, paragraph *Sensors Settings*).

To switch between different drift sources, use the **Drift** page of the **Sensors** panel which starts to be displayed when the drift sensor is connected.



When it is disconnected (the checkbox is cleared), calculated data is used.

Temperature

Data on the sea water temperature is supplied by the temperature sensor according to IEC 61162-1 standard in the MTW sentence. The MTW sentence always uses Celsius scale (°C) and degrees for the measurement unit. The temperature is shown on the **System Information** display.

VDR Output

To ensure the MFD compatibility with a new standard of the VDR which has a network interface, a module outputting data to the VDR can operate on each workstation.

With appropriate settings in the System Configuration utility (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration, paragraph MFD Settings, item VDR Output Configuring*), the following data is output to the network:

- For the radar and additional stations:
- Screenshots – once every 15 seconds.
- For the ECDIS:
- Screenshots – once every 15 seconds;
- Chart list (source info) – once every 10 minutes or within 2 seconds of the displayed charts set change.

NOTE: The System Configuration utility provides a capability to adjust the "Send image by user action" function (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration, paragraph MFD Settings, item VDR Output Configuring*). In this case screenshots are sent more often than required by the standard for intensive user activity (rescaling, chart review).

Information is not sent unless the relevant application is in the active mode.

The protocol for sending binary files with acknowledgements is used for sending screenshots. A simplified protocol without acknowledgements is used for the chart list (source info).

When data is output to the VDR, the workstation name is specified for the source position, and the station's main task set during the configuring – for the source identifier.

The sending of data to the VDR should be set for all the ECDIS stations on the bridge.

The VDR output functionality complies with the following standards:

- IEC 61162-450 ed. 1;
- IEC 61174;
- IEC 61996 ed. 2 CDV.

Navigational Tools

This chapter provides a description of functionality used in the Navigation Mode.

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ECDIS Task Cursors

Free Cursor

The ECDIS task provides a capability to use a free cursor which is moved over the entire screen by the trackball/mouse, acquiring various forms in different ECDIS task areas.

In the functional panel areas, the cursor acquires the form of an arrow and operates as a standard Windows cursor.

In the **Main** panel chart area, the cursor may have a form of different tools switched by pressing the right trackball/mouse button:

- Free **View** cursor.

The **View** cursor has some additional capabilities as it is positioned on certain objects acquiring a distinctive form in the process:

-  - Standard **View** cursor shape; as the left trackball/mouse button is pressed, the **Review** function is turned on, whilst the cursor acquires the form of a graphics cursor  ;
-  - **View** cursor appearance when positioned on a target; a press on the left trackball/mouse button calls the target data card;

CPA:	12.81 nm
TCPA:	28.4 min
COG:	346.8°
SOG:	19.5 kt
BRG:	054.5°
RNG:	13.12 nm

-  - **View** cursor appearance when positioned on a lighthouse; a press on the left trackball/mouse button calls the lighthouse data card (see also *Chapter 1*, section *Info*, paragraph *Information on Chart Objects*);

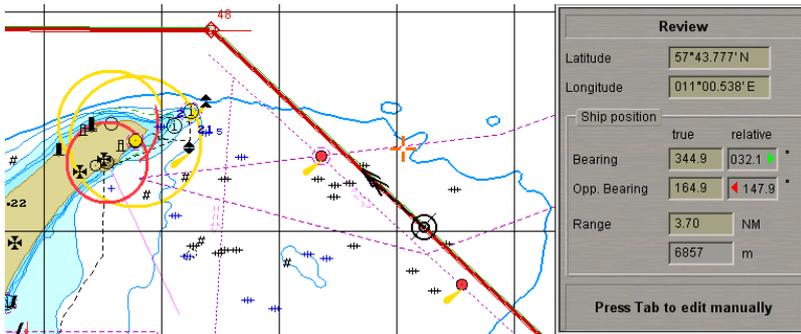
NAME:	Sommers
LIGHT:	F1(2)W 10s53m14M
BRG:	14.9°
DIST:	3827.4 NM

-  - **View** cursor appearance when positioned on a waypoint; a press on the left trackball/mouse button calls the WPT data card.

ROUTE:	St-Petersburg-Hamburg
WP#012:	
Arrival Circle:	n/a
Turn Radius:	0.30 NM

In the Navigation mode, it is possible to view charts in an area located far from the own ship symbol position, the capability implemented in the **Review** function.

It activates the graphics cursor moved by the mouse/trackball on the ECDIS task screen. Data on the cursor coordinates and position relative to the ship position is displayed in a special window:



While sailing areas not covering the ship position are viewed, the display of the current ship coordinates, or tracking of objects representing danger to navigation, is not interrupted. For the immediate return to the display of the area where the ship is located, use the **Ahead** function.

- Free **Zoom** cursor.

 **Zoom** - Standard **Zoom** cursor appearance. A press on the left trackball/mouse button turns on the **Zoom** function whilst the cursor assumes the form of a graphics cursor .

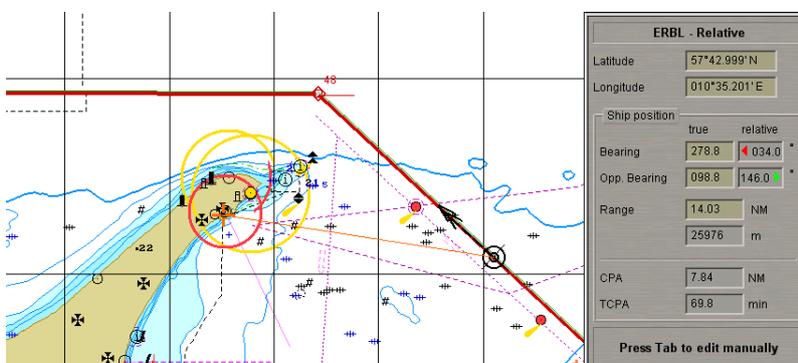
- Free **ERBL** cursor.

 **ERBL** - Standard **ERBL** cursor appearance. A press on the left trackball/mouse button turns on the **ERBL** function whilst the cursor assumes the form of a graphics cursor . After a second press on the left trackball/mouse button, the cursor obtains the second form of the graphic cursor . This is an electronic tool used in the ECDIS task for the range and bearing measurements.

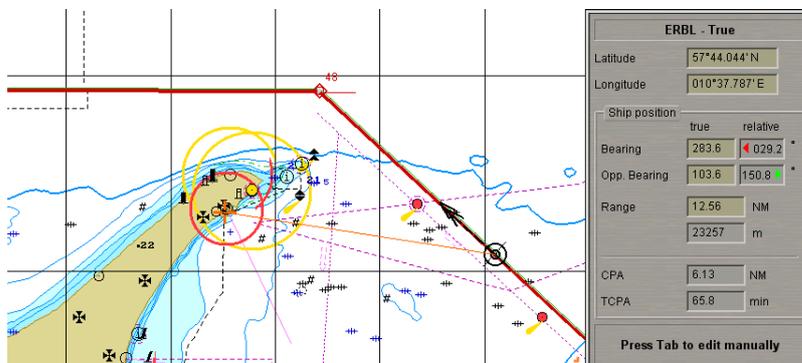
NOTE: WGS-84 datum is used for calculating all ranges and directions.

In the relative motion mode, the ERBL operates in three modes which are switched with the left trackball/mouse button:

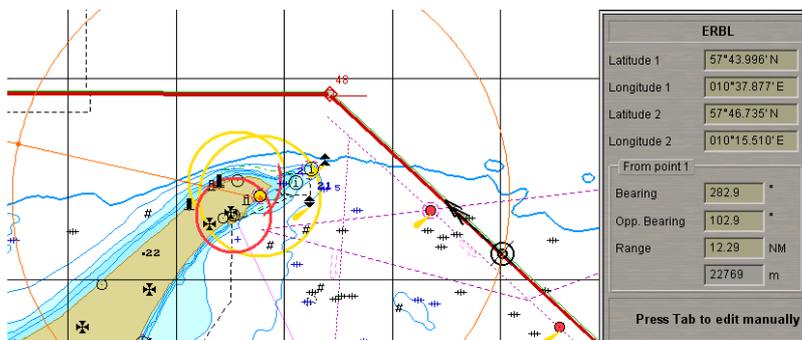
- ERBL-Relative mode. In this case, bearing and range to any point on the ECDIS task screen are measured relative to the ship position. The cursor is attached to the point of the ECDIS task screen where it is set. If the cursor is immobile, then as the ship is moving, geographic coordinates are changing in the cursor information window, whereas the bearing and range remain constant:



- ERBL-True mode. In this case, bearing and range to any electronic chart point are measured relative to the ship position. The cursor is attached to the chart point where it is set. If the cursor is immobile, then as the ship is moving, the range and bearing are changing in the cursor information window, whereas the geographic coordinates remain constant:



- ERBL mode. In this case, the bearing and range to any electronic chart point are measured relative to the point where the cursor was set in the **ERBL-True** mode:



In the true motion mode, the ERBL operates in a similar manner in two modes: ERBL-True and ERBL.

- Free **Info** cursor.

As the **Info** function is enabled (by pressing the  button on the Control Panel or on the Chart panel), the acquisition cursor  appears, which can be positioned on the necessary object. A press on the left trackball/mouse button opens the **Info** panel, and the cursor assumes the form of a standard **Info** cursor .

- ARPA acquisition cursor  with target acquisition function ON. (the **Acquire** button on the **Acquisition** page of the **Targets** display is pressed, also see *Chapter 9, ARPA* section);
- AIS activation cursor ;
- Cursor for cancelling ARPA tracking ;
- AIS deactivation cursor .

For the user convenience, the ECDIS task offers a capability to use the enlarged free cursor. The Large Free Cursor mode is enabled in the System Configuration utility (see document *Multifunctional Display. (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration*, paragraph *Workstation Settings*, item 2).

NORMAL FREE CURSOR		LARGE FREE CURSOR	

Graphics Cursor

The graphics cursor is used during the operation of some of ECDIS task functions and represents an intersection of lines corresponding to the latitude and longitude of the given point, but the form of the graphics cursor can be changed as required on the **Config** panel:

- Long – the cursor is shown in the form of an intersection of two lines across the entire Chart panel
- Short – the cursor is shown in the form of a small cross

Such cursor is moved by using the trackball/mouse. It is also possible to manually enter the coordinates of the point where the cursor should be positioned (after switching the activity from the cursor to the Information Window by pressing the <TAB> key).

Review

Latitude

Longitude

Ship position true relative

Bearing °

Opp. Bearing °

Range NM

m

Press Tab to edit manually

The Information window which appears in the menu area simultaneously with the graphics cursor, can contain the following data:

- Name of this window reflecting the ECDIS task functional capability using the graphics cursor;
- Cursor position coordinates;
- Values of its direct and reverse bearings and distance from the ownship position (in miles and meters);
- CPA/TCPA to the place indicated with the cursor.

A modification of the graphic cursor is an acquisition marker . This auxiliary tool represents a square orange coloured box with a dot in the centers, and is used in various functions for the acquisition of objects displayed on the ECDIS task screen. To control the acquisition marker and obtain information on its position, use the procedure similar to that detailed for the graphics cursor.

Multi-Unit Support

ATTENTION! There is no multi-unit support for the RADAR task.

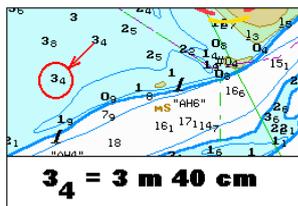
The MFD provides a capability to use different measurement units. It is possible to set measurement units for the following values:

- Own ship and target speed in knots (kt) or kilometres per hour (km/h);
- Distance in miles (NM), kilometres (km), statute miles (stm) or hectometres (hm);
- Precision distance in metres (m), feet (ft) or yards (yrd);
- Depths and heights in metres (m), feet (ft) or fathoms (fms);
- Draught in metres (m) or feet (ft);
- Wind speed in metres per second (m/s), kilometres per hour (km/h) or knots (kt);
- Temperature in degrees Celsius (C) or degrees Fahrenheit (F).
- Measurement units are set on the **Units** page on the **Config** panel.

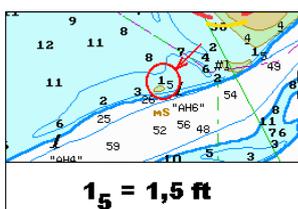
It should be noted that the selected units would be the same for all the depth and height values in the MFD. This refers to the chart data, depth information received from the sounder, and information on tides.

For TX-97 format on the electronic charts, the depth is displayed according to the following rules depending on the selected measurement units:

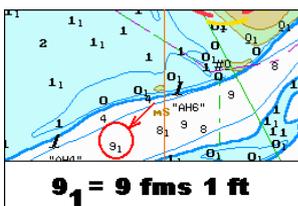
- Depth is measured in metres;



- Depth is measured in feet;



- Depth is measured in fathoms. In this case, depth of up to 11 fathoms which have a fractional part, are shown in fathoms and feet. Depths of more than 11 fathoms are shown in fathoms only.



Own Ship Motion Data

Own Ship Motion Parameters

Ship motion parameters are its course and speed.

The ECDIS task uses the following types of parameters:

- Ship's true motion direction – COG;
- True speed – SOG;
- Compass heading – HDG;
- Log speed – STW.

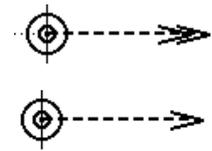
The heading (HDG) and speed (STW) data is provided from the gyro and log or is relayed from the information sensors.

Along with the ship positioning and ship time sensor, information on the own ship motion data is essential for all the navigational calculations connected with the own ship motion.

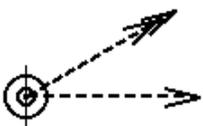
Own Ship Motion Vectors

Motion vectors are used for the graphic display of the ship course and speed. There may be two such vectors, and they correspond to the positioning system:

- COG – SOG (for PS and ER systems);
- HDG – STW.



No display of vectors is provided for the secondary method. In case of the primary method, it is possible to turn on the display of two vectors simultaneously (COG-SOG and HDG-STW). The point of origin of these vectors display is the centre of the ship symbol or contour:

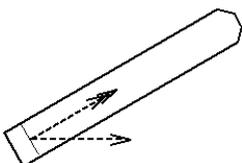


The display of vectors is enabled on the **Route Monitoring** page of the **Monitoring** panel.

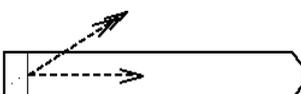


Switching of the own ship symbol display orientation along the ship's true motion (COG) vector, or along the vector of the ship's motion is performed by using the **Align by...** function on the **Route Monitoring** page of the **Monitoring** panel:

- Orientation of the own ship symbol display along the ship's true motion (COG) vector:



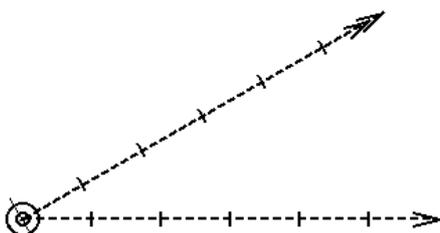
- Orientation of the own ship symbol display along the vector of the ship's motion as per the heading detector (gyro) reading:



Operation on the setting of the motion vector length for both own ship and the targets, is performed by using a drop-down list in the **Vectors** window of the Control Panel:



Vector length values may vary from 1 to 24 minutes:



In addition, it is possible to set the fixed vector length value (which does not change with the change of the chart scale) – **Fixed**. In this case, the speed vector length is represented by a segment whose value is equal to the fixed number of graphic pixels regardless of the current screen scale.

Ship Symbol on Electronic Charts

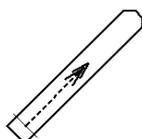
Standard Presentation

The ECDIS task provides for two positioning systems: **Primary** and **Secondary** whose accuracy ensures navigational safety. The ship symbol on the ECDIS task screen is shown in black (primary system) or blue (secondary system). The secondary positioning system performs the check functions.

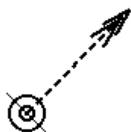
There are two ways to display the ship symbol on the electronics chart, set on the **Route Monitoring** page of the **Monitoring** panel:



- **Ship by contour** – as a ship contour on the chart scales commensurate with the ship dimensions, or a ship position symbol on small scale charts;



- **Ship by symbol** – as a ship position symbol regardless of the current screen scale.



User Ship Contour

The user ship contour function serves for displaying the own ship contour on the ECDIS task Chart panel, proportionate to its actual dimensions specified in the drawings and ship documents. This function is intended for improving navigational safety of non-standard shape ships (tugboats, naval ships, special purpose vessels), as well as of standard sea ships in the constricted areas, on the fairways, during the stay at anchor or mooring operations, etc.

The drawing of the own ship contour is loaded in the MFD system from an external carrier via the Data Tool utility (the **User Ship Contour** group). The necessary own ship contour is selected in the System Configuration utility.

ATTENTION! After setting the own ship contour, check if this contour dimensions correspond to the ship dimensions entered in the System Configuration utility (the **Ship settings** page of the **INS** panel).

For this function to be used in the MFD, it is necessary to order an appropriate option (delivered to the user as a special file).

Ahead Functionality

The Ahead functionality is intended for re-drawing the screen with the vessel symbol shifting in the direction opposite to the current course; the button can also be used for returning to the ship position, i.e., turning on the Navigation

Mode. The **Ahead**  button on the Chart panel toolbar is used for the purpose (see also document *Multifunctional Display (v. 3.02.350). ECDIS User Manual, Chapter 3, section Use of ECDIS Task Tools, paragraph Return of Own Ship Symbol Display to the ECDIS Task Screen*).

Upon a press on this button, the following occurs:

- The ship symbol is on the ECDIS task screen. The chart scale does not change regardless of whether the Autoscale functionality is ON or OFF.
- The ship symbol is not available on the ECDIS task screen (Position Dropped). With the Autoscale functionality ON, the ship is set in the required position on the ECDIS task screen, the largest scale chart under the ship is loaded on the original scale.
- The ship symbol is not available on the ECDIS task screen (Position Dropped). With the Autoscale functionality OFF, the ship is set in the required position on the ECDIS task screen, the projection scale does not change, it is the chart under the ship closest to the set scale which is loaded.

Split Screen

Display of Chart Information on ECDIS Task Screen

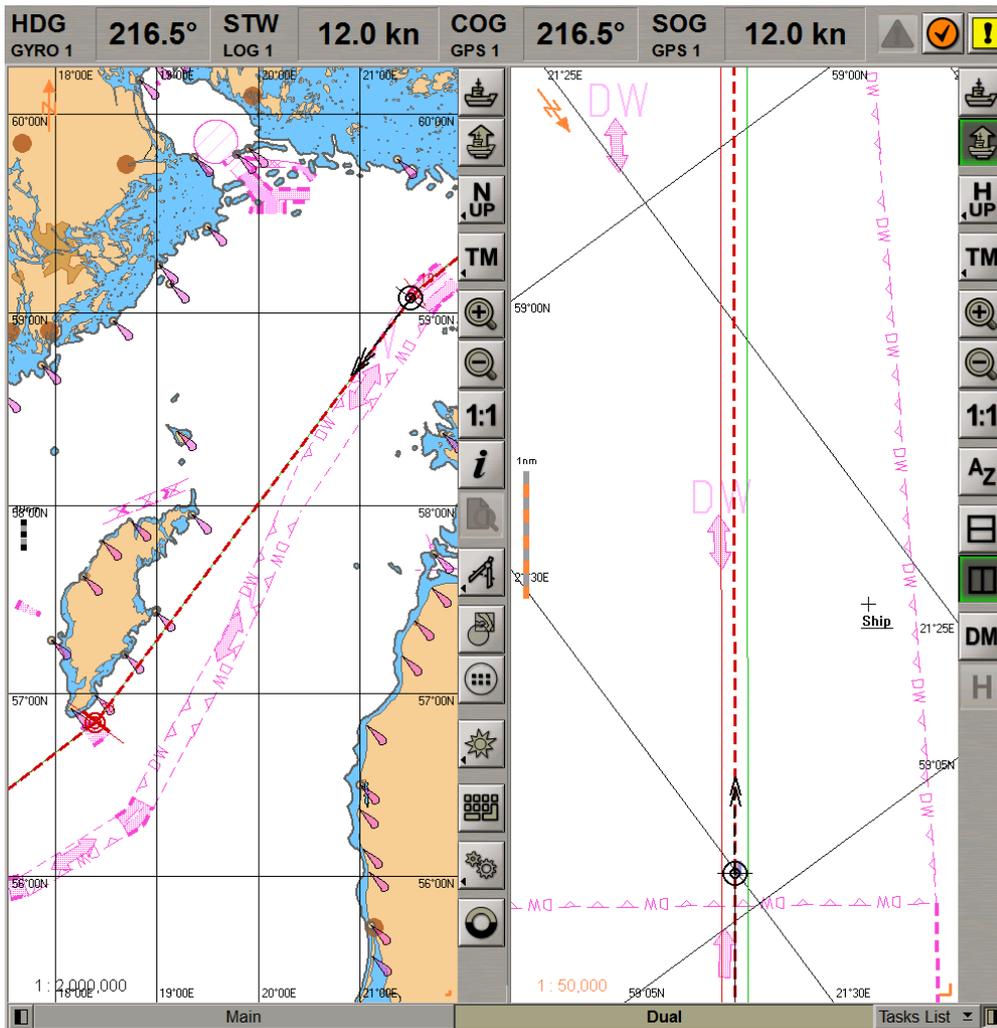
The **Main** panel is the main Chart panel which is intended for the following purposes:

- Display of electronic charts showing the chart information classes (determined on the **Charts** panel);
- Display of the own ship symbol with motion vectors;
- Display of the monitored route;
- Display of target symbols with motion vectors;
- Display of tides and currents information.



The **Main** panel is always displayed on the ECDIS task screen; the **Dual** panel is displayed by using the tab in the bottom part of the ECDIS task screen. The **Dual** panel is an additional Chart panel and serves for the navigation mode only.

It constantly shows the own ship symbol, but some of the functions are not available (Info, etc.).



For easier monitoring of the passing a waypoint during the sailing along the route, the **Dual** panel implements the AutoZoom mode.

AutoZoom Mode

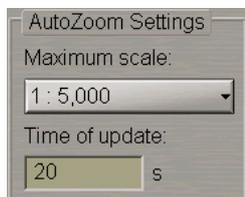
During the sailing along the monitored route, the ECDIS task provides the AutoZoom functionality which enables the automatic increase of scale as the next waypoint is approached. The AutoZoom mode is available on the **Dual** panel only.

The mode is turned on by pressing the **Az** button, as this is done, the chart display on the **Dual** panel is oriented along the current route leg (Course Up), and the relative motion mode sets (Relative motion).

The ECDIS task analysis the DTW at an interval set in the **Time of update** window. As the DTW is decreasing, the ECDIS task increases the scale by one fixed scale value so that the ship position remains within the **Dual** panel. With the ship approaching the boundary of the **Dual** panel in the process of manoeuvres, the scale may be reduced by one fixed scale value.

Adjustment of the AutoZoom mode is made on the **General** page of the **Config** panel:

- **Maximum scale** is the maximum electronic chart scale as the ship is passing the current WPT on the **Dual** panel;
- **Time of update** is the DTW analysis interval.



With a change of the WPT, the scale is set so that the **Dual** panel displays the ship symbol, current leg of the monitored route and the current WPT.

EBL/VRM

This function is intended for displaying the electronic bearing line (EBL) and variable range marker (VRM).

The system has a capability to simultaneously display two mutually independent EBL/VRM groups on the Chart panel, which also allows setting the bearing and distance of the base point shift relative to the current ship position.



Control of the function is from the **EBL/VRM/CHL** window on the Control Panel, or from the ES6 keyboard.

Relative and True Motion Modes

Two modes are used for the display of the ship motion on the Chart panel toolbar:

- True Motion mode (turned on by selecting the  button);
- Relative Motion mode (turned on by selecting the  button).

Man Overboard (MOB) Mode

General Information

The MOB mode enables the display of information on a geographic point saved at a certain time. It is made available by pressing the hotkey on the keyboard or the  button on the Chart panel toolbar. As this is done, the system makes a logbook entry which contains the name of the event: "MOB ENABLED" and a full set of recorded parameters.

Displayed Parameters

As the MOB mode is activated, the Control Panel displays a panel shown below:



The following parameters can be displayed:

- Coordinates of the MOB mode activation;
- Time elapsed since the MOB mode was activated;
- Bearing from the ship current position to the activation point;
- Distance from the ship current position to the activation point.

Additional Control

A press on the **Set time...** button opens a box for setting the MOB event time.



After the time has been specified, the MOB point is set in the own ship track point closest to the entered time.

A press on the **Set pos...** opens a box shown below used for setting the coordinates:



After the input of coordinates (manually or by cursor), the MOB display is re-drawn to suit the entered data (e.g., upon receipt of coordinates from another ship).

A second press on the **MOB** button in the Chart panel turns the MOB mode off, and the **Display Panel** window assumes the previous appearance. As this occurs, an electronic log entry containing the MOB DISABLED event name, is made.

Manually Fixed Position

General Information

The Manually Fix Position method enables construction of the ship's Lines of Position (LOP) by measuring bearing and/or distance to a visible object whose coordinates are known in advance (or the object can be uniquely identified on the chart). The LOP can further be used for entering ship position corrections and for other navigational tasks. Up to 6 LOP's can be constructed simultaneously. Work with source data for the LOP construction is done on the **Manually Fix Position** display of the **Display Panel** window on the Control Panel.



Input of Source Data

Input of source data for the LOP construction (bearing and/or distance) can only be made manually. Initially available is only 1 button. The rest of buttons which no measurements have been made for yet, are disabled.

By default, the observation time is specified in the **Time** field as the current UTC time minus 5 seconds. The user can set any time within minus 2 hours from the current UTC time.

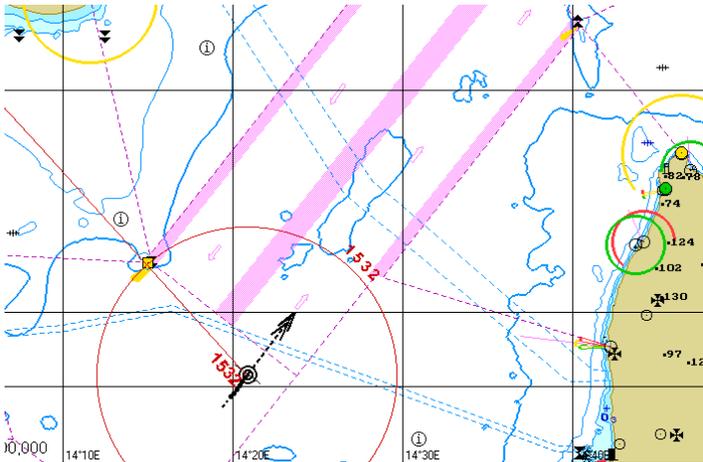
The bearing and/or range are entered in the relevant fields, which are enabled depending on the selected measurement type.



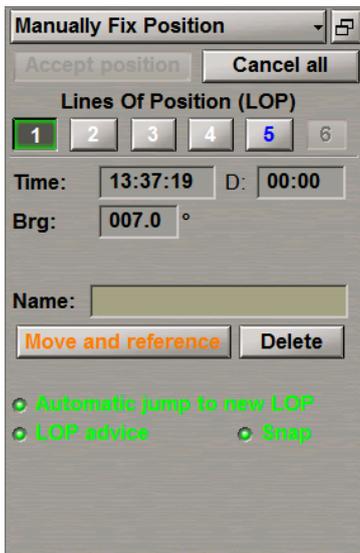
The entered data is not accepted for processing by the MFD until the **Apply** button is pressed. With the **Automatic jump to new LOP** checkbox selected, there is an automatic switch to the input of the next measurement results. In this case, the **D** box shows the time difference between the input of the first and current measurements, and it is the time which is taken into account in the ship position calculations from the position lines.

On the Chart panel, data accepted for processing by the MFD (the **Apply** button has been pressed), is displayed in the following way:

- Time – position fix time (UTC);
- Bearing – a blinking straight red coloured line to the point of the own ship track where the ship was at the time specified in the **Time** box;
- Distance – blinking red coloured circle centred in the point of the own ship track where the ship was at the time specified in the **Time** box.



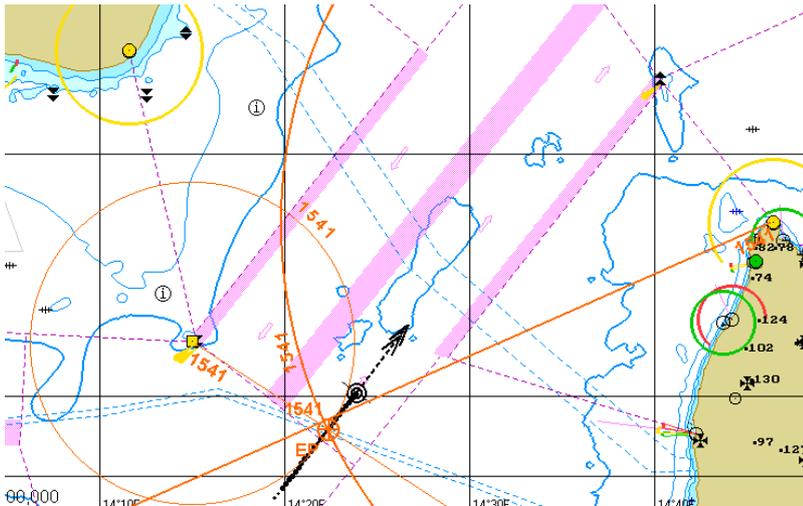
The name of the **Move and reference** button is shown in orange and is blinking.



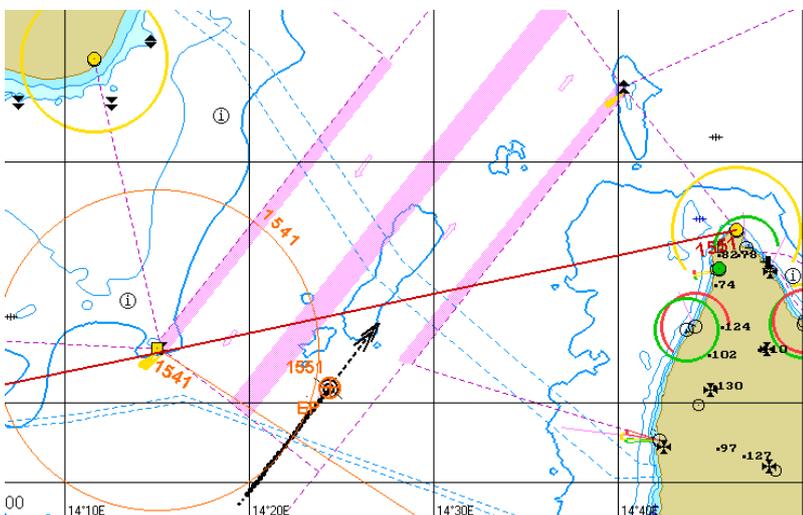
Line of Position Referencing

After the input of measurement results, it is necessary to reference them to the appropriate objects on the Chart panel. Using **Move and reference** button in the **Manually Fix Position** display also performs the position line referencing.

The graphics cursor is positioned on the chart, and the LOP is moved to the required object with the trackball/mouse. Click the left trackball/mouse button to fix referencing to the object. If referenced, LOP's cannot change their direction, only a parallel shift is possible. After referencing, LOP's are displayed in the orange colour and end in the reference object as shown in the drawing below.



If a position line is at a distance of 1 mile or more from the reckoned position, it is shown in the red colour.



If during the referencing, the **Snap to Object** function is turned on, with the LOP beginning/centre within a circle with a radius of 0.5 mile from the reference object, the LOP is automatically referenced to the object on the chart. As this occurs, the **Name** box of the **Manually Fix Position** display shows, depending on the chart format, the object name or type which is extracted from the object on the chart.

Object names are available for the S-57 charts only. For the TX-97 format charts, the object type only is taken.



The table below provides examples of object types (S57 and TX-97 charts), which extracts from the charts are available for.

Table 1. S-57 format charts

NO	OBJECT	DESCRIPTION/EXPECTED INPUT	INT
1	LNDMRK (Land marks)	A prominent object at a fixed location which can be used in determining a location or a direction	
		Tower	
		Light support	
		The individual name of an object	
2	BUISGL (Single building)	A relatively permanent structure, roofed and usually walled. It is designed for some particular use which it may be important to indicate (Digital Geographic Information Working Group)	
		Light support	
		The individual name of an object	
3	LITVES (Light vessels)	A distinctively marked vessel anchored or moored at a charted point, to serve as an aid to navigation. By night, it displays a characteristic light(s) and is usually equipped with other devices, such as fog signal, submarine sound signal, and radio-beacon, to assist navigation. Also called light ship	
		The individual name of an object	
4	LITFLT (Light float)	A boat-like structure used instead of a light buoy in waters where strong streams or currents are experienced, or when a greater elevation than that of a light buoy is necessary	
		The individual name of an object	
5	OFSPFL (Offshore platform)	Lighted offshore platform.	
		A permanent offshore structure, either fixed or floating, used in the production of oil or natural gas	

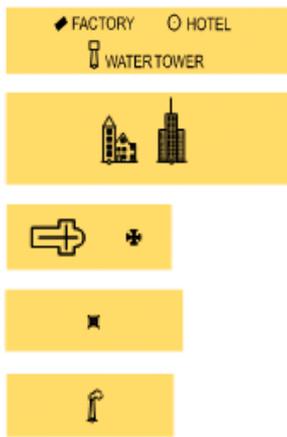
NO	OBJECT	DESCRIPTION/EXPECTED INPUT	INT
6	BCNSPP (Special purpose beacon)	A beacon is a prominent specially constructed object forming a conspicuous mark as a fixed aid to navigation or for use in hydrographic survey	
7	LNDMRK (Land marks)		All the rest except for item1 
8	BCNCAR (Cardinal beacon)		
9	BCNLAT (Lateral beacon)		
10	BCNSAV (Safe water beacon)		
11	DAYMAR (Squire or rectangular work)		

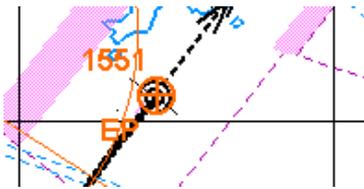
Table 2. TX-97 format charts

NO	OBJECT	DESCRIPTION\EXPECTED INPUT	COMMENTS
1	LH	Light house	General name – LH
2	BO	7 – Beacon 13 – Platform 23 – Fixed point	General name – Fixed point
3	HG	2 – building 3 – Chimney 4 – Church 6 – Tower 8 – Triangulation point 9 – Radio mast	General names are per the Description column

The **Delete** button serves for deleting measurement data. The rest of LOP's are automatically shifted to the vacant place to the left (re-numbered). A press on the **Move and reference** button again results in the repeated LOP referencing process. If, in the process of repeated referencing, the user presses the right mouse button, the current LOP referencing is cancelled. After referencing, the LOP's are shown in the constant orange colour. The name of the **Move and reference** button is shown in black.

Display of Calculated Ship Position

After the construction of two crossed position lines, the orange coloured  symbol with the letters **EP** (Estimated Position) appears on the Chart panel in the point with calculated ship position coordinates. Next to it, the time which this point is calculated for, is specified.



The **RMS Error** field on **Manually Fix Position** display shows accuracy of determining a fixed position. The user can accept this accuracy at the stage of making a decision on the input of an offset from the measurement results. Accuracy is determined from the referenced LOP's. Data is not available until at least 2 readings are taken.

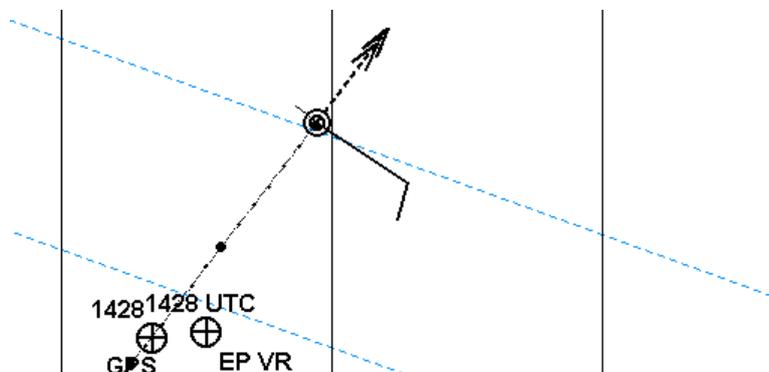


If it is necessary to accept the results of a manually fixed position, use the **Accept position** button. At the moment when the position is accepted, a "Position Fix" event is recorded, and an entry is made in the Electronic system logbook.

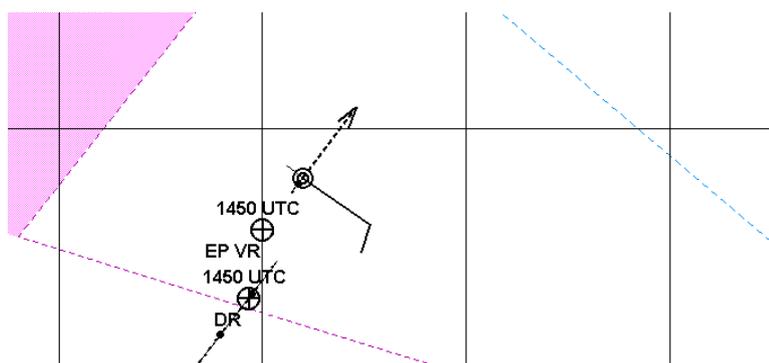
Ship LogBook		Archive	System Log	Logbook settings
Settings	Date	08-12-15	08-12-15	
08-12-2015	Time	14:50:17(UTC)	14:50:17(UTC)	
Fields	Event	LOP ACCEPTED LOP pos: GPS, TIME: 14:49:48 POS: 59°06.242 N / 021°32.271 E Offset: 00°00.381 N / 000°00.729 E	Position Fix Position fix accepted at 14:49:00 Fixed position: 59°06.242 N / 021°32.271 E	
Filter	Primary Sensor	GPS 1	GPS 1	
Reset Dist.	Secondary Sensor	None	None	
Print	L/L	59°06'239 N, 021°32'264 E	59°06'239 N, 021°32'264 E	
	Offset L/L	00°00'000 N, 000°00'000 E	00°00'000 N, 000°00'000 E	
	Prim/Sec Diverge			
	COG - SOG	227.6°-0.5 kn	227.6°-0.5 kn	
	HDG - LOG	227.5°-0.5 kn	227.5°-0.5 kn	
	Average speed			

In this case, if the PS positioning system is set, the black coloured  symbol on the Chart panel shows the ship position determined by using the Manually Fix Position. If three or more LOP's were used for the ship positioning, next to the  symbol, the **Fix** notation is shown with the time which this point is calculated for. The ship position determined with the aid of the PS source for the same time, is also displayed.

These points have accordingly the **EP (Fix)** name and the PS source name (**GPS** in this case).



With the use of the DR mode, calculated ship position coordinates are accepted. On the Chart panel, the black coloured  symbol is used for showing the ship's EP and DR position. In this case, the ship position calculations are continued from the EP point determined by using the Manually Fix Position.



Next to the **EP (Fix)** name, measurements which the position was determined for are specified:

- R – Range LOP's;
- V – Visual Bearing LOP's;
- VR – Visual/Range LOP's.

Colour Indication of Measurement Numbers

Colour indication of measurement numbers on the **Manually Fix Position** display is in accordance with the table below:

COLOUR	COMMENTS
Blue	Vacant cell for setting measurement
White	Data is entered but the line of position is not referenced by the user
Black	Bearing/range has already been referenced to a conspicuous chart feature
Dark red	With the LOP advice checkbox selected, the reading has been taken and referenced, but the system considers it to be incorrect, the LOP being at a distance of more than one mile from the reckoned position

User Configuration Functional Description

There may be a Local and Bridge User Configuration. The Local User Configuration is an aggregate of SW and GUI settings applicable to the Navi-Sailor and Navi-Radar applications on each station. The Bridge User Configuration is a set of selected local configurations which can be applied simultaneously when the Bridge User Configuration is loaded. All the configurations are synchronized among the bridge stations.

E.g., if a ship is mooring, set on the wing is a configuration with a predictor and Docking mode, and the radar is set for small scales. As the ship is sailing to the open sea, the station is switched to other settings by merely pressing the button.

This functionality permits prompt loading of the previously created software (NS, NR and NC) setting configurations, both on the local station and on several stations included in the navigational bridge. This may prove to be necessary, among other situations, in different sailing conditions and for the accomplishment of various navigation tasks. The functionality is not available on the Control Panel, and is only available in the **Multipanel** window, which is opened

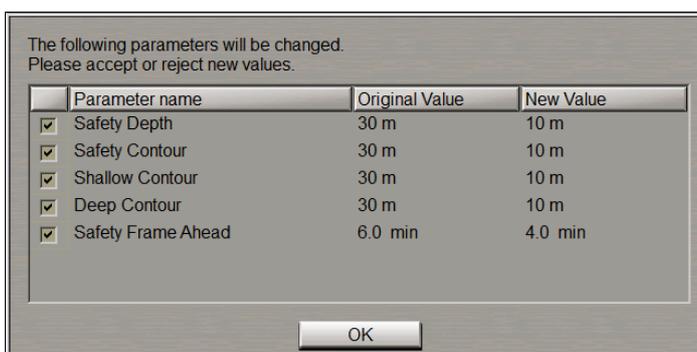
by pressing the  button in the Chart panel toolbar (see above).

When the Local User Configuration is saved, the following information is retained:

- Orientation (Head Up, North Up, Course Up for the **Main** and **Dual** panels);
- Motion mode (Relative, True for the **Main** and **Dual** panels);
- Additional settings for the **Dual** panel:
 - DM – enabled/disabled;
 - History – enabled/disabled;
 - All settings including Reference point for the Docking mode.
- Chart panel scale (with a restriction that a scale “jump” impossible unless the chart autoscale is set to ON);
- Settings on the Control panel:
 - Hide/normal;
 - Position of all displays;
 - Extracted displays when the Control panel is hidden;
 - Current display for the **Multipanel** window;
 - AIS – on/off;
 - ARPA – on/off;
 - Overlay - on/off;
 - Vector time;
 - **Navigator** display;
 - **Predictor** display.
- Opened functional panels;
- Settings on the **Targets Table** page of the **Targets** panel:
 - CPA/TCPA.

- Settings on the **Charts** panel:
 - Chart autoload – on/off;
 - Chart autoscale – on/off;
 - Chart priority;
 - Display category (base/standard/custom/all);
 - Scale bar;
 - Grid line;
 - Chart boundaries;
 - All ENC settings except the Shallow contour/Deep Contour.
- Settings on the **Route Monitoring** page of the **Monitoring** panel:
 - Headline;
 - COG vector;
 - HDG vector;
 - Ship by...;
 - Align by...;
 - Course/Leg/Spd;
 - Remark;
 - Sun Moon;
 - WPT name;
 - Radius;
 - XTD;
 - Wheel over line;
 - Ref points;
 - Heading mark;
 - Past track;
 - Past track length;
 - Plot interval;
 - Time labels;
 - Show time labels;
 - Alerts (End of route, Out of XTD, Out of schedule, WPT Approach, Off leg course).

If some safety parameters are changed when the Local User Configuration is loaded a special window will be displayed on the ECDIS Master WS.

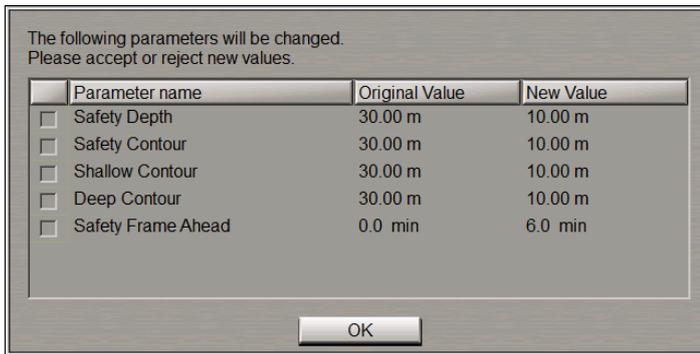


The window displays the currently set parameters (**Original Value**) and parameters which will be set as the result of loading the Local User Configuration (**New Value**). For the subsequent loading of the Local User Configuration it is necessary to accept (the **OK** button) new values for the selected parameters to be loaded.

Provided below is a list of parameters which the loading values should be specified for:

- Safety Depth;
- Safety Contour;
- Shallow Contour;
- Deep Contour;
- Safety Frame parameters;
- Show Safety Frame;
- Mooring mode.

On the ECDIS Slave WS, the **New Parameters** window looks like follows:



For the NC, the Local User Configuration cannot be created. For a Bridge User Configuration, the operator can select any of the available Screen Views (**Docking, NavData, Navigation** or Custom Screen Views).

In the MFD, there is a default Local User Configuration and Bridge User Configuration which can be loaded for subsequent use with the aid of the Data Tool utility.

The created Local User Configuration and Bridge User Configuration can be exported/imported with the aid of the Data Tool utility (the **User Configuration** file group). For the procedure of copying files in the external storage see document *Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Utilities, Chapter 2, section Processing of Data Files by Data Tool Utility, paragraph Copying Data from an External Carrier and Copying Data onto External Carrier*. As the Bridge User Configuration is imported, the Local User Configuration for each application will automatically be assigned to its own group.

Also built into the product are default Local User Configurations for the ECDIS task which can be copied by using the Data Tool utility (the **User Configuration** feature, **Default** file group) for subsequent use.

The saved user configurations can be copied and restored during the product upgrade. The configuration file can also be saved and copied to the USB.

Alert Management

This chapter describes alarm, warning and caution generation algorithms, as well as their display and acknowledgement methods.

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Display of Alerts

The number of alarms shall be kept as low as possible by providing indications for information of lower importance (MSC 86(70) Annex 3, 4.3.5), this is why only very important messages are classified as alerts in the MFD. The MFD processes alerts in a similar manner, the only difference being in their display.

Alarm – high-priority alert. Condition requiring immediate attention and action by the bridge team, to maintain the safe navigation of the ship.

Warning – condition requiring immediate attention, but no immediate action by the bridge team. Warnings are presented for precautionary reasons to make the bridge team aware of changed conditions which are not immediately hazardous, but may become so if no action is taken.

Caution - lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information.

Alarms, warnings and cautions are displayed in the **Alerts** window located in the top part of the ECDIS task screen, to the right of the **COG/SOG/HDG/STW** window:

HDG GYRO 1	240.1°	STW DLOG 1	12.0 kn	COG GPS 1	240.1°	SOG GPS 1	12.0 kn			
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The **Alerts** window is presented in the form of three buttons:

-  - to open a list of generated alarms;
-  - to open a list of generated warnings;
-  - to open a list of generated cautions.

Icons on the **Alerts** button are shown according to the display priority based on alarm's state. Within each display priority, the alarms are displayed in the order of "time of last state change" (sequence with, on top, the alarm that changed state most recently):

-  - flashing if there is at least one active unacknowledged alarm;
-  - flashing if there is at least one active silenced alarm;
-  - flashing if there is at least one rectified unacknowledged alarm;
-  - if there is at least one active acknowledged alarm;
-  - if there is at least one responsibility transferred alarm;
-  - if there are no alarms.

Icons on the **Warnings** button are shown according to the display priority based on warning's state. Within each display priority, the warnings are displayed in the order of "time of last state change" (sequence with, on top, the warning that changed state most recently):

-  - flashing if there is at least one active unacknowledged warning;
-  - flashing if there is at least one active silenced warning;
-  - flashing if there is at least one rectified unacknowledged warning;
-  - if there is at least one active acknowledged warning;
-  - if there is at least one responsibility transferred warning;
-  - if there are no warnings.

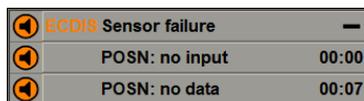
Icons on the **Cautions** button are shown according to the priority:

-  - if there is at least one active caution;
-  - if there are no cautions.

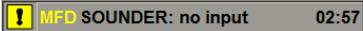
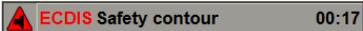
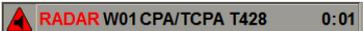
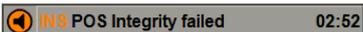
Alarms are associated with a sound signal, 3 beeps every 7 seconds.

Warnings are associated with a sound signal, 2 beeps every 5 minutes.

A press on the alert button opens a pull-down list which contains all the currently active alerts and rectified unacknowledged alerts (except cautions, they require no acknowledgement):



The alert name is preceded by the name of its source. The name of the alarm source is shown in red. The name of the warning source is shown in the yellowish orange colour. The name of the caution source is shown in yellow:

- **MFD** – alert refers to the entire MFD; 
- **ECDIS** – alert refers to the ECDIS task within the scope of the entire MFD; 
- **RADAR** – alert refers to the RADAR task within the scope of the entire MFD; 
- **TCS** – alert refers to the TCS mode; 
- **INS** – alert refers to the INS mode; 

Alarms and warnings may be active, i.e., what caused their generation has not been eliminated, and rectified when the cause is eliminated. Active and rectified alarms and warnings may have the following status:

- Acknowledged – acknowledged by the operator;
- Unacknowledged – unacknowledged by the operator.

The principles of displaying alerts in the **Alarms**, **Warnings** and **Cautions** drop-down lists are set forth in the table below:

ALERT STATUS	FONT	COLOR OF SOURCE	BLINKING	SOUND GENERATION
Active unacknowledged alarm (no operator actions taken)	Bold	Red	Yes	Yes
Active unacknowledged alarm silenced, but to be acknowledged in the relevant task	Bold	Red	Yes	No
Active acknowledged alarm	Bold	Red	No	No
Active responsibility transferred alarm	Bold	Red	No	No
Rectified unacknowledged alarm	Regular	Red	Yes	Yes
Rectified acknowledged alarm	No	No	No	No
Active unacknowledged warning	Bold	Yellowish orange	Yes	No
Active unacknowledged warning silenced, but to be acknowledged in the relevant task	Bold	Yellowish orange	Yes	No
Active acknowledged warning	Bold	Yellowish orange	No	No
Active responsibility transferred warning	Bold	Yellowish orange	No	No
Rectified unacknowledged warnings	Regular	Yellowish orange	Yes	No
Rectified acknowledged warnings	No	No	No	No
Active caution	Bold	Yellow	No	No
Rectified caution	No	No	No	No

At the beginning of the list, there are active unacknowledged alerts arranged in the growing age order. If the alert is unacknowledged, the name of its source is blinking. The age of the alert is specified to the right of the alert.

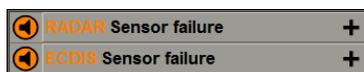
The second half of the list is occupied by active acknowledged alerts. Names of alerts and their sources are shown in regular fonts. Alerts in this part of the list are sorted by their acknowledgment time (the most recently acknowledged alarm/warning is placed at the very top, etc.).

Rectified acknowledged alerts are deleted from the list.

Positioning the free cursor on the alert name in the list displays a hint showing the detailed alert name.

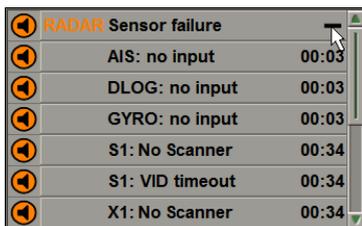


By default, alerts in the drop-down lists are aggregated in groups. There is no aggregation unless two or more alerts belonging to the group are generated. Aggregation principles are specified in the table of alerts (see *Annex D*).



In this case, the "+" sign is shown to the right of the group name.

A press on this sign displays a list of alerts included in the group. The source is specified for a group of alerts.



The principle of displaying an icon before the group name is the same as for the **Alarms**, **Warnings** and **Cautions** buttons on the Control panel (priorities are shown in the table above).

The history of all the alerts generation and their acknowledgement is shown on the **History** panel of the BAM Viewer application (see also document *Multifunctional Display (v. 3.02.350). Additional Functions, Chapter 6*).

Alert Acknowledgement

After familiarising him/herself with an alert, the operator acknowledges it. Distinction is drawn between the acknowledgement of the alert audible (silencing) and visual announcement (acknowledgement).

Acknowledgement is made on any operating panel which is directly assigned to the function generating the announcement, and where the cause of the announcement and related information for decision support is presented. According to this concept, alerts are classed into the following categories:

ALERTCATEGORY	VISUAL INDICATION
A	Alerts for which graphical information at the task station directly assigned to the function generating the alert is necessary as decision support for evaluating the alert related condition.
B	Alerts where no additional information for decision support is necessary besides the information which can be presented at the central alert management HMI.
C	Alerts that cannot be acknowledged on the bridge but for which information is required about the status and treatment of the alert. Such alerts can be temporary silenced.

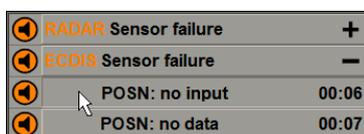
Alerts generated in the ECDIS, RADAR tasks, as well as in the INS and TCS modes have categories A and B.

Depending on the alert category, acknowledgement can be made as follows:

ALERT STATUS	WHERE ACKNOWLEDGEMENT CAN BE MADE
Alert generated for one task (e. g. Crossing safety contour)	Any station, only this task
Alert generated for all the tasks (e. g. Position failure)	Any station, any task

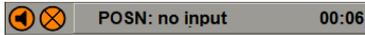
There are three ways to acknowledge an alert:

- By pressing the **Unacknowledged** button in the line with the alert name in the **Alerts** page of the BAM Viewer; if this alert cannot be acknowledged from this application, the alert is silenced;
- By pressing the <ALARM> button on the ES6 keyboard or the <ACK> button on the ES8 keyboard. The most recently generated alarm will be acknowledged. By pressing successively the <ALARM> or <ACK> button you will acknowledge all the alarms in the order reverse to their generation. Then all the warnings are acknowledged in the order reverse to their generation;
- By selecting the alert from a pull-down list of alarms or warnings which is opened by pressing the **Alarms** and **Warnings** buttons on the Control Panel.



If all the alarms (warnings) are acknowledged, **Alarms** and **Warnings** buttons on the Control panel assumes the following form:  and .

Category A alerts can only be acknowledged in the application which generated them. It should be noted that these alerts are shown in other applications with additional  and  icons ("Can't be acknowledged").



With the use of a keyboard for acknowledgement, if there are some unacknowledged alerts in the system, but no alerts available for acknowledgement for the active application, lists are shown in the collapsed form. The successive press on the <ALARMS> (ES6 keyboard) or <ACK> (ES8 keyboard) keyboard keys results in the consecutive navigation through the lists of Alarms-Warnings without alert acknowledgement.

Responsibility Transfer

The reduced number of high priority alerts in the system suggests that the CAM system may know about context of some alerts produced by other equipment (e.g., that a back-up option was automatically engaged for eliminating a problem that the alert was generated by). In this case, the CAM system may apply the "responsibility transfer" request to other equipment (alert source) to change the associated alert state, and to output a lower priority alert instead.

The result of the responsibility transfer has the following aspects:

- it calls a suitable (lower) operator diversion level (no urgent actions are required), reflecting the system's capability to help the operator automatically;
- it displays an alert message with better guidance to the operator (a back-up option is engaged instead of permanent presentation of the problem which has already been mitigated);
- it prevents the unnecessary announcement of the initial alert the responsibility for which has already been transferred.

If the system communication between the ECDIS and CAM system is lost, the ECDIS resumes the responsibility for alerts for which the responsibility was previously transferred.

Responsibility transfer request is accepted for the all Category B alerts.

NOTE: For this alerts, the ECDIS provides a 4 s delay for the presentation of the alert status change from "normal" to "active – unacknowledged".

If requested to transfer responsibility for other alerts, the ECDIS replies by sending the ARC "Responsibility transfer rejected" sentence (see document *Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Installation Guide*, chapter *Interface Capabilities*, section *Format of Data Exchange Used in Accordance with IEC61162-1 Standard*, paragraph *Output*, and paragraph *Format of Output Data*, item *ARC – Alert Command Refused*).

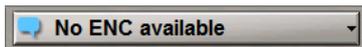
Indications

Indication - display of regular information and conditions, not part of alert management.

Important indication - marking of an operational status of displayed information which needs special attention, for example, information with low integrity or invalid information.

Display of Indications

Indications are displayed in **Indications** window on the Control panel. The window displays the most recently generated indication.



As a new indication appears, the drop-down list button displays the  sign. Press the button for familiarizing yourself with all the indications.



In the absence of indications **Indications** window displays “No Indications” notation.



The following indications are implemented in the ECDIS task:

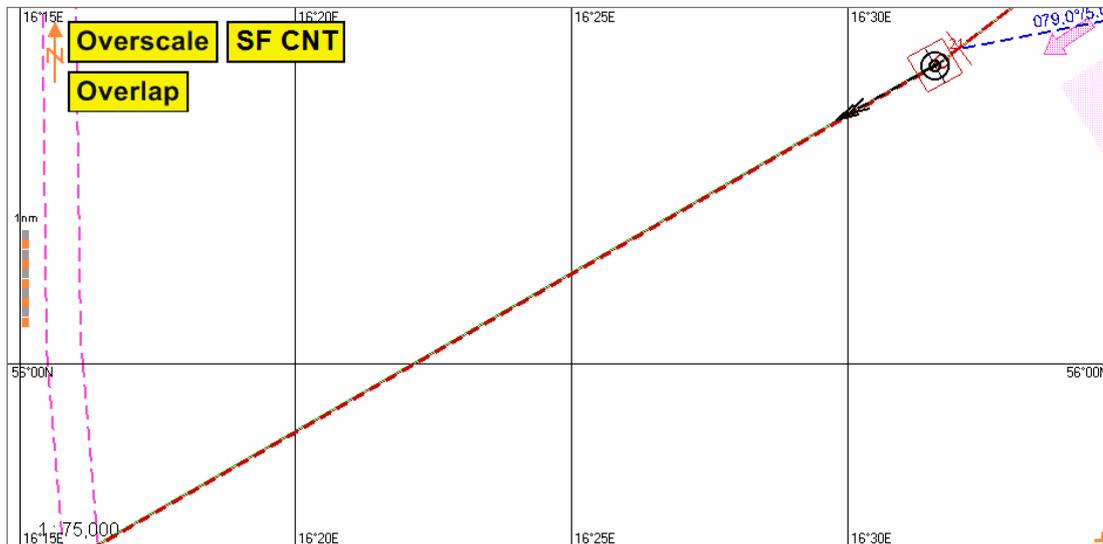
- Default Safety Contour - this indication is displayed in the following cases:
 - If the mariner does not specify a safety contour (30 m is set by default). If the safety contour specified by the mariner or the default 30 m contour is not in the displayed SENC, the safety contour shown is default to the next deeper contour;
 - If the safety contour in use becomes unavailable due to a change in the source data, the next deeper contour shown on the chart becomes the default safety contour;
- No ENC available - if the area covered by the ECDIS display includes waters for which no ENC at a scale appropriate for navigation is available.

For information on indications relating to the connected ECDIS, see the document *Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Additional Functions, Chapter1, section Connected ECDIS*.

Display of Important Indications

Important Indications may be displayed in different places on the ECDIS task screen.

Important indications related to the chart information are displayed in the top left corner of the Chart panel in black against the yellow background.



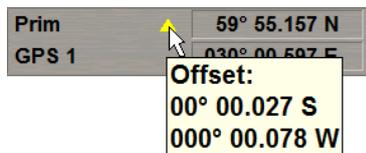
The following important indications are displayed here:

- **Overscale** - if the own ship position is covered by an ENC whose original scale is smaller than the current scale of the ECDIS screen;
- **SF CNT** - if the graphical indication of the detected dangers on Chart panel is turned off (cleared **Highlight Danger** checkbox in the **Antigrounding alerts** group on the **Safety Alerts** page of the **Monitoring** panel), and monitoring of a safety contour, navigational hazards or some IMO area is also off (cleared **Safety contour**, **Nav. hazards** checkboxes in the **Antigrounding alerts** group and **IMO areas** tab on the **Safety Alerts** page of the **Monitoring** panel);
- **Overlap** - if there is overlapping of two or more ENC cells of the same usage band;
- **ENC permit expired** - if the installed ENC permit has expired (the chart number is specified in the hint);
- **ENC expires in less than 30 days** - if the loaded chart(s) permit(s) expire within the next 30 days;
- **ENC cancelled** - if the installed ENC has been cancelled (the chart number is specified in the hint);
- **Chart information not up to date** - if the installed ENC is not up-to-date (the chart number is specified in the hint);
- **Non-ENC data** - if SENC data from a non-HO source is in use;
- **Larger ENC** - if a larger scale chart than that in use, is available for the vessel position;
- **Display Not Real Time** - if the viewing date or date range does not match the current date.

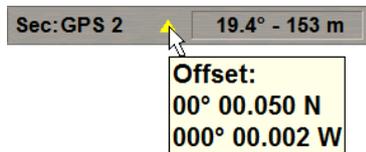
Important indications connected with selection of the Standard Display are shown on the **STD DISP** selection button in the **Operational** window of the Control panel:

-  - any display other than the Standard Display is selected on the **Charts** panel;
-  - the Standard Display is selected;
-  - the Standard Display is selected, but some viewing group included in the Standard Display is turned off on the **Charts** panel.

Important indications connected with the position and gyro offset are shown in a relevant window on the Control panel in the form of a special symbol: a yellow triangle:



- - primary position offset in the **Primary** window;



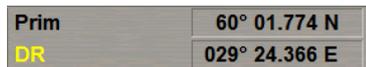
- - secondary position offset in the **Secondary** window;



- **Gyro offset: +0.3°** - gyro offset in the **COG/SOG/HDG/STW** window.

As a free cursor is positioned on this triangle, the correction value is displayed in the pop-up prompt window.

Important indications connected with selecting the DR and EP modes for the positioning system are shown in the **Primary** and **Secondary** windows by the positioning source name growing yellow:



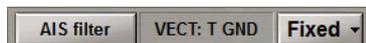
- - the DR mode is selected as the source for the primary positioning system;



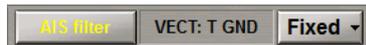
- - the EP mode is selected as the source for the primary secondary positioning system.

For the important indications connected with no input data, no data or invalid data, see *Chapter 2*, section *Navigational Sensors*, paragraph *Display of Navigational (Essential) Information*.

The important indication connected with the AIS filter On or Off status is displayed in the **Vectors** window (for the description of the AIS filter see *Chapter 9*, section *AIS*, paragraph *Display of AIS Targets*):



- - AIS filter is turned Off;



- - AIS filter is turned On.

If the **AIS filter** button is pressed, the **AIS** page of the **Targets** display on the Control panel will promptly open.

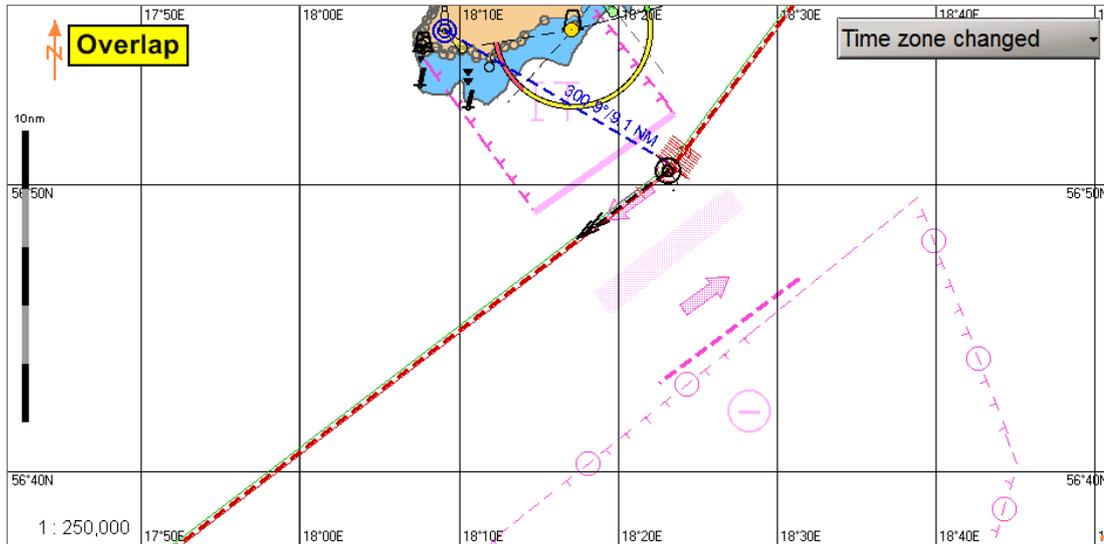
This window also displays important indication of the AIS targets vector mode (true or relative), stabilization mode (sea or ground) and vector time (1–24 min or **Fixed**).

Notifications

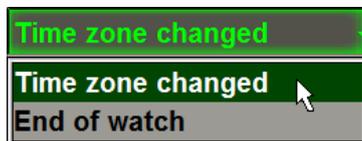
To inform the user of some event not directly related to navigation and not regulated by standards, notifications are used.

NOTE: Notifications are displayed in the ECDIS task only.

Notifications are displayed in the top right corner of the Chart panel.



A press on the button to the right of the notification name opens a pull-down list which contains all the notifications that the user has not yet read.



At the beginning of the list, there are notifications arranged in their growing age order.

To read a notification, use the free cursor to click on the notification name on the button or select it from the list.

Notifications that the user has read are deleted from the list.

In some cases, an additional event occurs at the time when a notification is being read, e.g., as you are reading an **AIS message** notification, the **AIS Messages** display of the Control panel opens up.

The MFD implements the following notifications:

- **AIS Long Range;**
- **AIS message;**
- **AIS route active time;**
- **End of Watch;**
- **IMO No changed;**
- **MMSI No changed;**
- **Time zone changed.**

For information on notifications associated with connected ECDIS see document connected ECDIS see document Multifunctional Display. Navi-Sailor 4000 ECDIS (v. 3.02.350). Additional Functions, Chapter1, section Connected ECDIS).

Guidance for Adjusting Alert Limits

ALERT	CONDITION	SET LIMIT	INDICATION	REMARKS
Main sensors	No data No input	10 sec	<ul style="list-style-type: none"> Warning; Values in yellowish orange asterisks; Ship's symbol in red color 	The set limits are not accessible for the operator
Auxiliary sensors	No data No input	10 sec	<ul style="list-style-type: none"> Caution; Values in yellowish orange asterisks 	The set limits are not accessible for the operator
Invalid position	No DTM message, or datum different from WGS 84	10 sec	Warning	The set limits are not accessible for the operator
CRS difference (for ECDIS mode)	Difference between the current route leg and heading is larger than the set value	5–30°	Caution	Set by the operator
CRS difference (for TCS mode)	Difference between the current route leg and heading is larger than the set value	5–30°	Warning	Set by the operator
HDG monitor	The difference in readings provided by gyros is larger than the set value	3-15°	Warning	The limit is set by the installation engineer and is not accessible for the operator
Nav.hazard	The ship is approaching danger to navigation	1–20 min	Warning or Caution (user defined)	Set by the operator. Monitoring/ Safety alerts
Off-Track	The set XTD value exceeded	0.00–9.99 NM	Alarm	XTD set by the operator. Route Planning/Route table
Critical point	The ship has approached a WPT	0.00–9.99 NM	Warning	Set by the operator
Anchorage area 1/2	The ship is leaving the set anchorage area	0.00–3000 m	<ul style="list-style-type: none"> Warning Alarm after 120 sec 	Set by the operator. Monitoring/Navigational Alerts
Area with special conditions	Approach to navigational area	1–20 min	Warning or Caution (user defined)	Set by the operator. Monitoring/Safety Alerts

CPA/TCPA	CPA and TCPA are smaller than the set ones	CPA 0.0–60 min TCPA 0.00– 24.00 NM	Alarm	Set by the operator
Safety contour	With a change of a chart set under the ship position, the previously selected safety contour becomes unavailable on these charts	0–20 min	Alarm	Set by the operator. Monitoring/Safety Alerts
Sounder depth	The current depth from the echo sounder is smaller than the set value	0–999 m	Warning	Set by the operator. Monitoring/Navigational Alerts

The rest of alerts are triggered off immediately upon the occurrence of an event.

Alert Management Principles

General

Alert management in the MFD is based on the following principles:

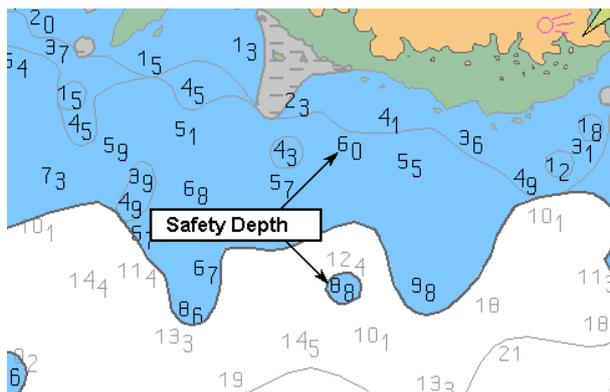
1. Category A alerts from the RADAR source can be acknowledged in the RADAR task (Navi-Radar 4000 application) only.
2. Category A alerts from the ECDIS source can be acknowledged in the ECDIS task (Navi-Sailor 4000 application) only.
3. Even if it is not permitted to acknowledge an alarm in the ECDIS or RADAR task, it will nonetheless be displayed in the task's alert list. An alert which cannot be acknowledged is shown with the  or  icons ("Can't be acknowledged").
4. For external ARPA targets (ARPA_A, ARPA_B) CPA/TCPA alerts cannot be generated. No danger status is displayed for such targets.
5. ECDIS with the radar overlay (no Navi-Radar 4000 installed): CPA/TCPA alarm cannot be generated.
6. AIS CPA-TCPA alarm can only be triggered by the Radar application. The AIS CPA/TCPA alarm generation does not depend on the radar scanner current mode (TX/Standby/Failure). If the RADAR task is not available (has not started), no CPA/TCPA alerts (ARPA or AIS) can be generated.
7. Immediately after the RADAR task shuts down, all the CPA/TCPA alarms (and all the category A alerts received from the radar source) get rectified due to the loss of the collision avoidance function provided by the Radar task.
8. Immediately after the ECDIS task shuts down, all category A alerts provided by the ECDIS source get rectified, since the ECDIS task's Route monitoring function is lost.

Safety Alerts

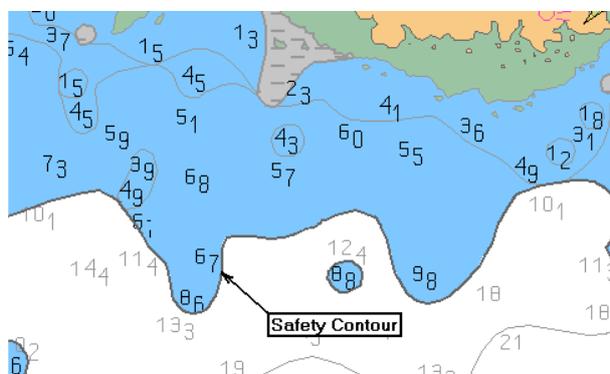
Navigation in the areas crowded with dangers to navigation requires permanent monitoring. With this aim in view, the ECDIS task implements functions for setting and monitoring safe navigation parameters on vector electronic charts.

Chart objects are identified by the ECDIS task as dangers to navigation by certain parameters. In the ECDIS task, such parameters are referred to as safety parameters and are set by the operator:

- **Safety depth** – mariner-defined depth to emphasize soundings on the display equal to or less than this value. By default, the **Safety depth** is set at 30 m. A depth equal to or less than the **Safety depth** is highlighted on the ECDIS task screen in bold type when the display of spot soundings is turned on:



- **Safety contour** - mariner-selected contour to distinguish on the display between safe and unsafe water. In the checking of an area delimited with the Safety frame, this contour serves as a criterion for classifying the detected depth as a danger to navigation. By default, the **Safety contour** is set at 30 m. The safety contour is highlighted on the ECDIS task screen with a bold line:



If, with a change of a chart set under the ship position, the previously selected safety contour becomes unavailable, the **Default Safety Contour** indication is generated. In this case, the safety contour is automatically set as equal to a deeper available depth contour.

ATTENTION! If the depth contour specified by the user is not digitised on the chart, the next deeper digitised contour available on the chart will be accepted as the safety contour.

Safety alerts are set on the **Safety Alerts** page of the **Monitoring** panel.

The main means of determining the safety alerts operation is the Safety Frame. Dangerous objects turning up within the Safety Frame cause generation of a relevant alert.

The Safety Frame is a rectangle, the user setting position of its sides relative to the ship.

Safety frame

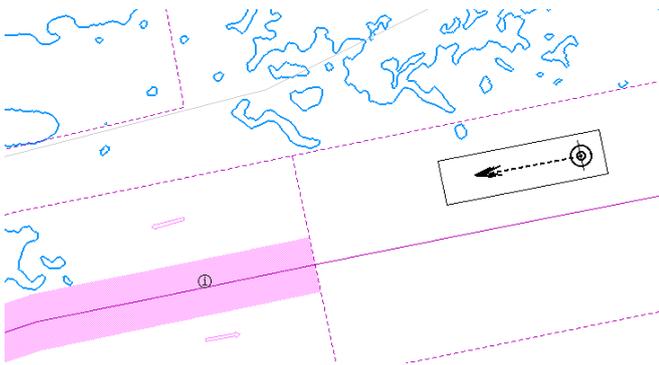
Ahead: min

Port: NM

Starboard: NM

Show safety frame

The Safety Frame is oriented along the COG. The Safety Frame size in front of the ship symbol is determined by the distance traveled by the ship in the COG direction at the current SOG in the time set by the user in the **Ahead** box. This time can be set within the range of 30 s to 60 minutes. The Safety Frame dimensions set in the **Port** and **Starboard** boxes (from 0.01 to 4.0 NM) are counted from the CCRP in the directions perpendicular to the COG-SOG vector.



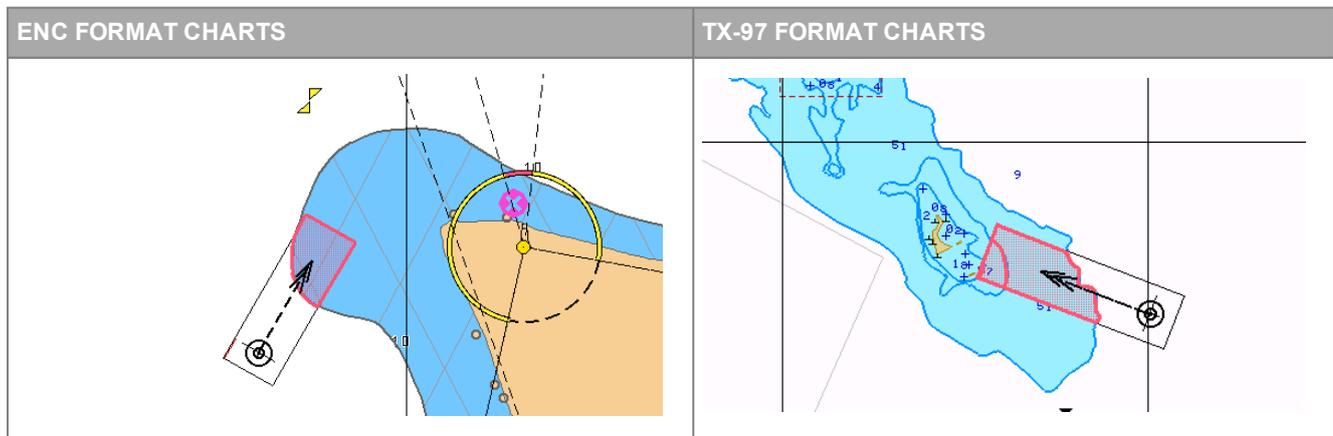
The check of charts consists in the search for objects identified as a danger to navigation. For the alert to be generated at the time when the danger to navigation turns up within the Safety frame, as well as when it crosses safety contour or area type objects, the largest scale charts available under the ship position are used.

Alerts are generated for the following chart objects:

- Safety contours if the **Safety contour** checkbox is selected (determined by the value of the operator-set safety contour). In this case, the **Safety contour** alarm is generated:

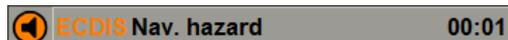
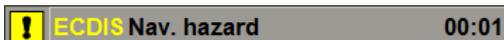


On the Chart panel, on the MASTER station only (if the **Danger highlight** checkbox is selected on the **Safety Alerts** page of the **Monitoring** panel) the safety contour will be indicated by highlighting in the following form:

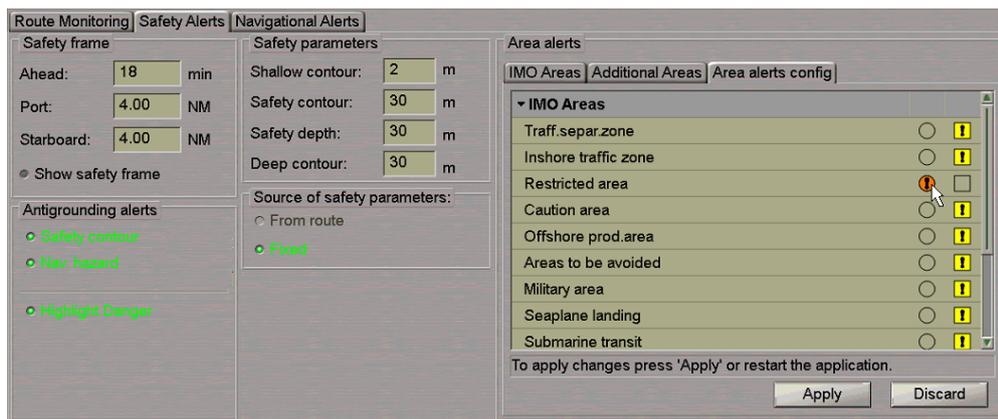


NOTE: For the TX-97 format charts, highlighting is applied to all the depth contours within the safety frame, whose values are smaller than the safety contour value.

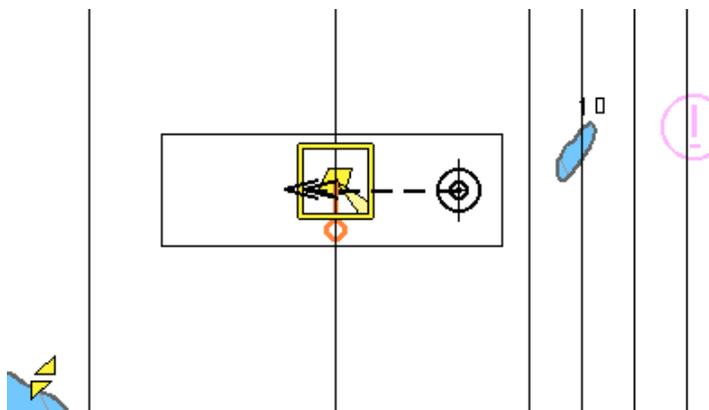
- Dangers to navigation if the **Nav.hazard** checkbox is selected. In this case, the **Nav. hazard** warning (caution) is generated:



For the “Dangers to navigation” and “Area” type object (see below) alerts, the user him/herself chooses the alert priority (warning or caution) on the **Area alerts config** tab of the **Safety Alerts** page of the **Monitoring** panel (see document *Multifunctional Display (v. 3.02.350). ECDIS User Manual, Chapter 5, section Monitoring of Safety Alarms, paragraph Setting Priority for Navigational and Area Alerts*).



On the Chart panel, on the MASTER station only (if the **Highlight Danger** checkbox is selected on the **Safety Alerts** page of the **Monitoring** panel) the navigation danger will be indicated by highlighting in the following form:



Navigational dangers include the following objects:

- Beacons;
- Buoys;
- Bridges;
- Overhead cables;
- Pipelines;
- Mechanical apparatus for moving bulk material or people;
- The equipment or structure used to secure a vessel;
- Marine farm/culture; obstruction;
- Areas of ice over land or water;
- Boat-like structure used instead of a light buoys;
- Distinctively marked vessels anchored or moored at a charted points, to serve as an aid to navigation;
- Maritime areas enclosed with connected floating timbers used as staging areas for sawn logs;
- Constructions to dam oil flow on water;

- Long heavy timbers or sections of steel, wood, concrete, etc.. forced into the earth which may serve as a support for a pier, or a free standing pole within a marine environment;
 - Vertical constructions consisting, for example, of a steel framework or pre-stressed concrete to carry cables, a bridge, etc;
 - Obstructions that hinder or prevent movement, particularly anything that endangers or prevents passage of a vessel
 - Concreted mass of stony material or coral which dries, is awash or is below the water surface;
 - Wrecks;
 - Updating objects which have the “Danger” and/or “Depth” attributes;
 - Symbols of NAVTEX messages with “Danger” attribute.
- Area type objects if the appropriate checkboxes are selected in the **Area alerts** group on the **Safety Alerts** page of the **Monitoring** panel.

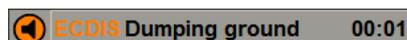
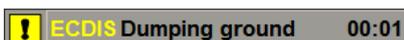
The list of objects is divided into two groups:

- **IMO areas** are a group of main areas tracked in accordance with IEC-61174 standard. In this case, the following warnings (cautions) are generated:

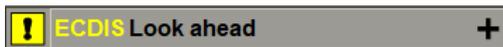
- | | |
|--------------------------------|-------------------------------|
| • Anchorage area; | • Offshore prod. area; |
| • Areas to be avoided; | • PSSA; |
| • Caution area; | • Restricted area; |
| • Inshore traffic zone; | • Seaplane landing ; |
| • Marine Farm Culture; | • Submarine transit ; |
| • Military area; | • Traff. separ. zone. |

- **Additional areas** are a group of additional areas which alerts are implemented for. In this case, the following warning (cautions) are generated:

- | | |
|--------------------------------|-------------------------------------|
| • Anchoring prohibited; | • Int. mar. boundary; |
| • Cable area; | • Harbour limit; |
| • Cargo transship area; | • Nature reserve; |
| • Danger area; | • Pipeline area ; |
| • Deepwater route; | • Prohibited area ; |
| • Dredged area; | • Precautionary area ; |
| • Dumping ground; | • Quarantine anchorage ; |
| • ESSA; | • Recommended traffic lane ; |
| • Excl. econ. zone; | • Spoil ground ; |
| • Explosives dumping; | • Swept area ; |
| • Fairway; | • Territorial sea base; |
| • Fishery zone; | • Territorial sea ; |
| • Fishing ground; | • Traffic SS crossing; |
| • Fishing prohibited; | • Traffic SS roundabout ; |
| • Ice area; | • Two way traffic route ; |
| • Incineration area; | • Unsurveyed area. |



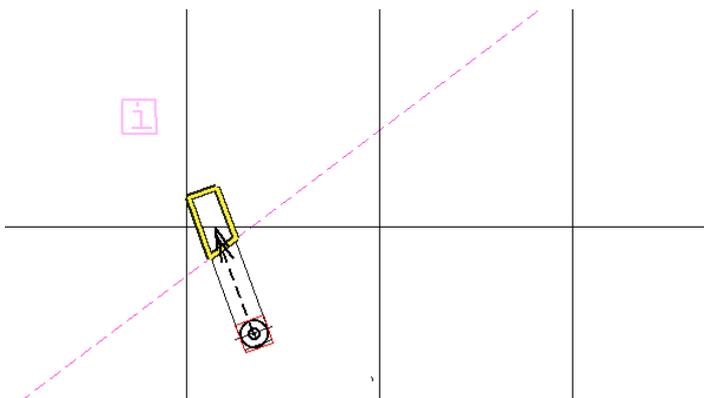
If the ship crosses several area type objects at a time, they are aggregated in the **Look ahead** group:



A press on the "+" sign opens a full list of generated cautions:

	ECDIS Look ahead	+
	Military area	00:00
	Restricted area	00:00
	Dumping ground	00:03

On the Chart panel, on the MASTER station only (if the **Highlight Danger** checkbox is selected on the **Safety Alerts** page of the **Monitoring** panel) the area type objects will be indicated by highlighting in the following form:

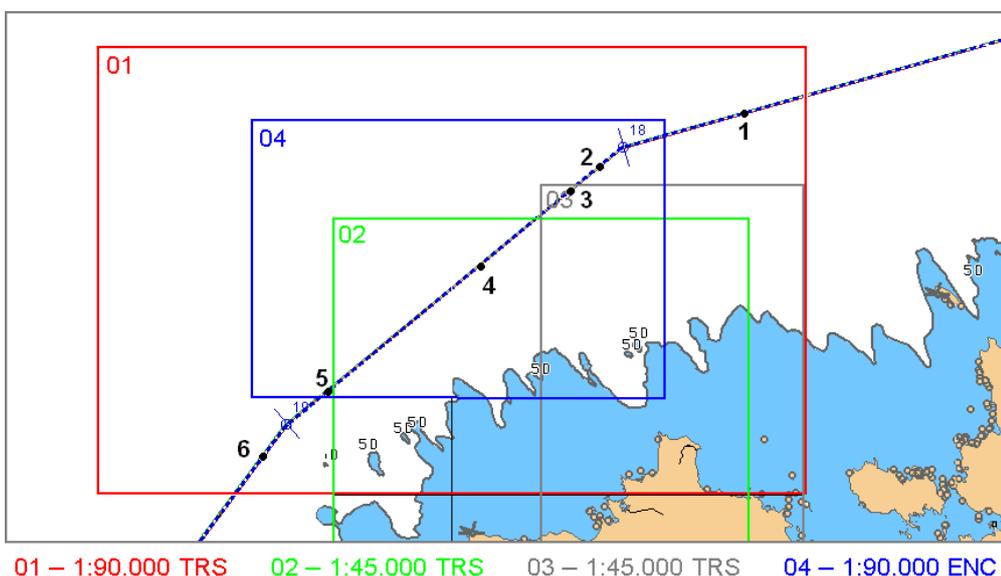


Charts are checked for the presence of dangers in two cases: during the route planning and sailing in the monitoring mode.

The "Best scale" criterion is used for chart analysis:

- In the monitoring mode, the NS4000 extracts objects from the best scale chart under the ship position. If the actually loaded chart is not the best scale one, objects from the loaded chart are extracted in addition to the object from the best scale chart;
- In the route check mode, the NS4000 selects only the best scale charts of every format whose data coverage falls under the route. Objects from the selected charts are extracted for warning the user.

For each route leg select the maximum scale charts which this leg passes through, and the check is made on these charts as, e.g., shown in the figure below.



E.g., for a check of the WP18-WP19 leg, charts 04, 03, 02, 04, 01 will successively be used:

POINT	AVAILABLE CHARTS	SCALE	FORMAT	RESULT
1	01	1:90.000	TRS	01
2	01	1:90.000	TRS	04
	04	1:90.000	ENC	
3	01	1:90.000	TRS	03
	03	1:45.000	TRS	
4	04	1:90.000	ENC	02
	01	1:90.000	TRS	
	02	1:45.000	TRS	
5	04	1:90.000	ENC	04
	01	1:90.000	TRS	
6	01	1:90.000	TRS	01

Navigational Alerts

The own ship position should be taken into account as accurately and reliably as possible. Navigational alerts are intended for alerting the navigator to the change of own ship position and chart information display conditions:

- If the user-set value of difference between the positioning systems' readings is exceeded, provided the **Prim/Sec diverged** checkbox is selected, the **POSN monitor** warning is generated;



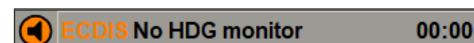
- If the set value of difference between the gyros' readings is exceeded, the **HDG Monitor** warning is generated;



NOTE: The Heading Monitor alert operation is activated, and the trigger-off limit is set by the service engineer at the installation stage (see document *Multifunctional Display. (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration*, paragraph *MFD Settings*, item 2). On the **Navigational Alerts** page of the **Monitoring** panel, information is provided for reference purposes.

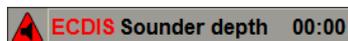


- If there is no data from even one of the gyros used for the heading monitoring, the **No HDG monitor** warning is generated;

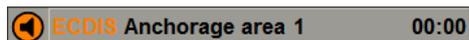


- If the ship sails beyond the chart boundary, with the chart autoload mode off, the **Off chart** warning is generated;

- **Sounder depth** is the set minimum depth which determines the depth as compared to the sounder readings. As a depth smaller than the set value is received from the sounder, the **Sounder depth** alarm is generated:



- If anchor point 1 or 2 gets beyond the user-set 1 or 2 rings, the **Anchorage area 1** or **Anchorage area 2** warning is generated (checkboxes in the **Alert** column should be selected).



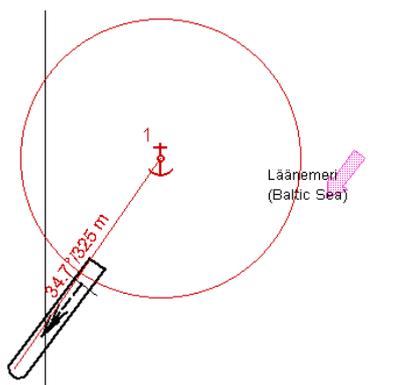
ATTENTION! If the **Anchorage area 1/2** warning is not acknowledged by the operator within 120 seconds of its appearance, it turns to the **Anchorage area 1/2** alarm. Further, if this alarm is not acknowledged within 30 seconds either, the **Backup Navigator** alarm is triggered off. Such alarm message is normally distributed via the ship's alert network for backup officers.

Anchor points 1 and 2 are set on the ship contour during the installation in the System Configuration utility (see document *Multifunctional Display. (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration*, paragraph *MFD Settings*):

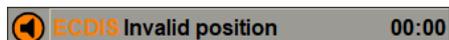


The centre of the anchor watch ring is set automatically at the moment of pressing the **Down** button, and corresponds to the anchor point position at this time. With the use of the **By Cursor** button, the user him/herself sets the anchor watch ring centre with the cursor on the Chart panel.

As this is done, the Chart panel shows bearing and distance from the ship's bow/stern to the relevant referencing point.



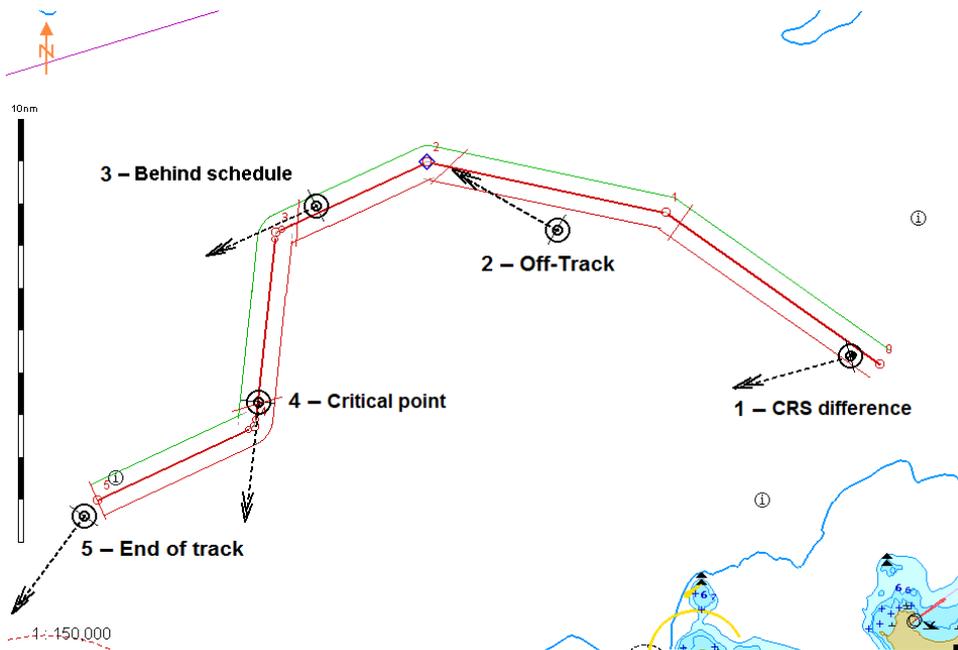
- Warnings connected with the system of coordinates used in the MFD, also belong to this group. The ECDIS task uses the system of coordinates based on WGS-84 datum. Information on the datum set in the PS receiver is contained in the DTM sentence. If the DTM sentence is not transmitted from the PS receiver, the ECDIS task assumes that the system of coordinates set in the PS receiver is WGS-84. In this case, and if some other system of coordinates is set in the PS receiver, the **Invalid position** warning is generated, warning the operator that the received coordinates do not comply with WGS-84 system of coordinates.



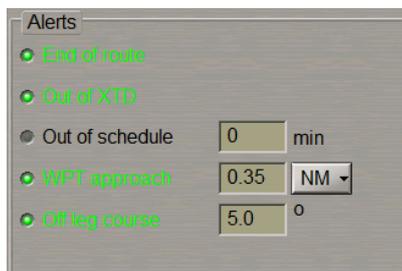
Route Alerts

The Route alerts notify about the ship's exit beyond the boundary of set limitations during the sailing along the route. The alert is generated according to the following principles:

- As the ship deviates from the plotted ship course to a value exceeding the setting in the **Off leg course** input box, the **CRS difference** caution is generated;
- As the ship deviation from the route leg exceeds the set value, the **Off-Track** alarm is generated;
- If the ship schedule is not observed (the ship is ahead of or behind the schedule), the **Ahead schedule** or **Behind schedule** warning is generated;
- As the ship approaches the next WPT, the **Critical point** warning is generated upon approach to the WOL at the advance time (or distance) set by the operator;
- As the ship passes the last WPT of the monitored route, the **End of track** warning is generated.



The aforementioned alerts are enabled and their parameters are set on the **Route Monitoring** page of the **Monitoring** panel.



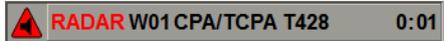
Target/Radar Alerts

Target/Radar alerts about events connected with targets and sensors which transmit target information to the MFD:

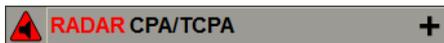
- When targets are handled, the principal safety parameters are CPA and TCPA:

ATTENTION! The CPA / TCPA alarm is generated only by the RADAR task. If the RADAR task is not available (not running) no CPA / TCPA alarm (ARPA or AIS) can be triggered (see paragraph *General* of this section).

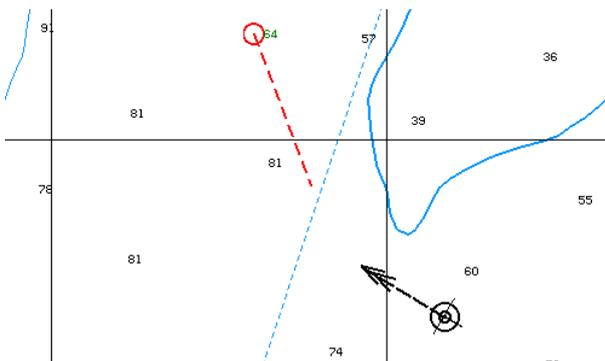
The set CPA value determines the distance of the closest point of approach to the targets whose information is supplied by the sensors, whereas the TCPA stands for time to the closest point of approach. A target is dangerous when both, its CPA and TCPA values are smaller than the **CPA** and **TCPA** values set in the **Alarm** group of the **Targets** panel. In this case the **Wxx CPA/TCPA Tgt ID** alarm is generated (**Wxx** - WS name and **Tgt ID** - AIS or ARPA target ID).



If this alarm is simultaneously generated for several targets, they are aggregated in the **CPA/TCPA** group:



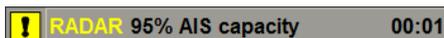
The symbol of a dangerous target is a red coloured circle:



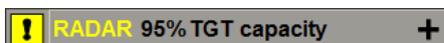
The symbol of the dangerous target is flashing until **CPA/TCPA** alarm is acknowledged in RADAR task. For the AIS targets, no CPA/TCPA calculations are made in the absence of the COG or SOG.

Vectors of dangerous targets are shown on the ECDIS task screen in red. Targets' tracks tracked and displayed on the ECDIS task screen are automatically saved (archived) to day files.

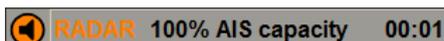
- If the number of targets exceeds 95% of the maximum number of targets, the following cautions are generated:
 - **95% AIS capacity** (973 AIS targets);
 - **Wxx 95% ARPA capacity** (76 ARPA targets).



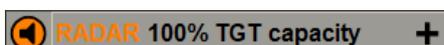
If this alert is simultaneously actuated for the AIS and ARPA targets, they are aggregated in the **95% TGT capacity** group:



- If the number of targets exceeds the maximum number of targets, the following warnings are generated:
 - **100% AIS capacity** (1024 AIS targets);
 - **Wxx 100% ARPA capacity** (80 ARPA targets).



If this alert is simultaneously actuated for the AIS and ARPA targets, they are aggregated in the **100% TGT capacity** group:



- With a loss of a target the **Lost target** warning is generated.

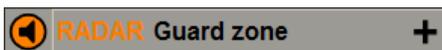


If this warning is simultaneously generated for several targets, its display does not change (this warning is not aggregated). When the **Lost target** warning is acknowledged, acknowledgement is applicable to all the lost targets.

- With the appearance of a target in the Guard Zone, the **Wxx GZ Tgt ID** warning is generated (**Wxx** - WS name and **Tgt ID** - AIS or ARPA target ID):



If this alarm is simultaneously generated for several targets, they are aggregated in the **Guard zone** group:

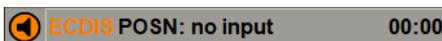


Sensor Alarms

Sensor alerts about absence of data from external sensors selected as data sources. These alerts are not generated unless the connected sensors have been selected by the user for the information sources. The alerts of this group are generated when there is not data from the sensor (sensor failure or connecting cable broken) or when sentences received from sensors have empty fields which should have contained necessary data, or contain unreliable data (see also *Annex D*):

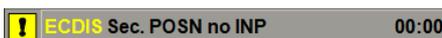
- Warnings for a position sensor selected for the primary positioning (if there are more than one of such warnings, they are aggregated in the **Sensor failure** group):

- **POSN: no data;**
- **POSN: no input.**



- Cautions for a position sensor selected for the secondary positioning (if there are more than one of such warnings, they are aggregated in the **Sec. POSN failure** group):

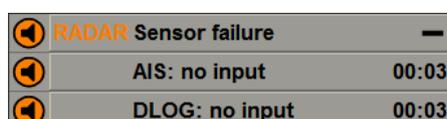
- **Sec. POSN no data;**
- **Sec. POSN no INP.**



- Warnings for sensors selected for the main ones (if there are more than one of such warnings, they are aggregated in the **Sensor failure** group):

- | | |
|-----------------------------|-----------------------------|
| • AIS: no input; | • Name: No Trigger; |
| • DLOG: no input; | • Name: No Heading; |
| • DLOG STW: no data; | • Name: No Bearing; |
| • GYRO: no data; | • Name: No Connect.; |
| • GYRO: no input; | • Name: No Video; |
| • LOG: no data; | • Name: No Scanner; |
| • LOG: no input; | • Name: VID timeout. |

(where **Name** scanner name)



- Cautions for sensors selected for supplementary ones (including the EPFS) (if there are more than one of such cautions, they are aggregated in the **AUX Sensor lost** group):

- **DLOG №: no SOG;**
- **DLOG №: no STW ;**
- **DLOG №: no input ;**
- **GYRO №: no data;**
- **GYRO №: no input;**
- **LOG №: no data;**
- **LOG №: no input;**
- **POSN № no input;**
- **POSN №: no data;**
- **SOUNDER%num%: no data;**
- **SOUNDER%num%: no INP;**
- **Wxx: VDR lost.**

 MFD AUX sensor lost	—
 LOG2: no input	00:13
 GYRO2: no input	00:14

- Cautions for the auxiliary sensors not directly related to the navigation (if there are more than one of such cautions, they are aggregated in the **Sensor failure** group):

- **ROT: no data;**
- **ROT: no input;**
- **SOUNDER: no data;**
- **SOUNDER: no input;**
- **TEMPER. no data;**
- **TEMPER. no input;**
- **WIND: no data;**
- **WIND: no input;**
- **MAG №: no data;**
- **MAG №: no input ;**
- **UTC: no input;**
- **UTC: no data.**

 MFD Sensor failure	—
 SOUNDER: no input	00:24
 WIND: no input	00:24

- Should the primary data source fail, the backup data source is used automatically, in this case the following cautions are generated:

- **POSN. Fallback;**
- **Heading Fallback;**
- **Speed Fallback.**

 ECDIS Position Fallback	00:00
--	-------

If this alert is simultaneously generated for several sources, they are aggregated in the **Fallback** group:

 ECDIS Fallback	+
---	---

Hardware Alerts

Hardware alerts are generated by faults in the operation of hardware that the system consists of. In this case the following alerts are generated:

- If power is not supplied to the autopilot, the **Autopilot power fail** alarm is generated;
- In the case of a network failure, the **Wxx Net 1 fail** warning is generated, where Wxx is the WS name;

If another network fails, too, alerts are aggregated in a **System degraded** group.

- In the case of a faulty or no connection with the display, or incorrect settings in the System Configuration utility, the **Wxx Display fail** warning is generated, where Wxx is the WS name.

NOTE: If there is no information on the MFD display, generation of this alert is indicated by the flashing of the <ALARM> key on the ES6 keyboard.

- In the case of a broken connection with the ES6 or ES8 keyboard, or incorrect settings in the System Configuration utility, the **Wxx KBD fail** warning is generated, where Wxx is the WS name;
- If an additional ES8 keyboard is connected to the station, its loss generates the "**Wxx: AUX KBD fail**" warning

If the aforementioned alerts are generated simultaneously, they are aggregated in the **System fault** group.

- In case of BNWAS WAGO failure, the "**BNWAS malfunction**" warning is generated. This warning should be adjusted in the BAM Config utility;
- If the UPS is fed from the internal emergency batteries, the **Wxx: Power fail** warning is generated;
- If the UPS batteries are discharged to down 20%, the **Wxx: Low Battery** warning is generated;

If the aforementioned alerts are generated simultaneously, they are aggregated in the **Power Failure** group.

- If the UPS for BAM/BNWAS is fed from the internal emergency batteries, the **Power failure** warning of the source BNWAS is generated (to be adjusted in the BAM Config utility).

Routes and Schedules

This chapter provides a description of the route planning and schedule generation principles.

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Route Planning

ATTENTION! WGS-84 datum is used for calculating all the ranges and directions.

Route Elements

Data associated with routes and schedules in the ECDIS task is presented in a graphic and tabular form:

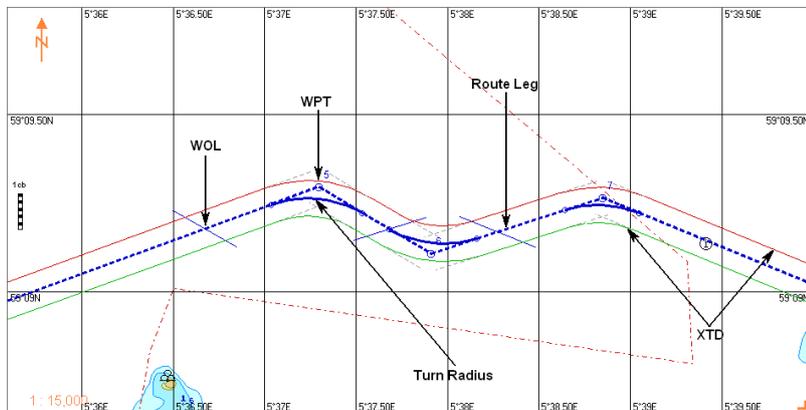


The route is displayed by superimposing a transparent layer containing route elements only, on the ECDIS task screen chart information. The following route elements are displayed on the ECDIS task Chart panel:

- Waypoints – display of points in the set coordinates (**Lat/Lon**) with numbers (**WPT**) or names (**Name**);
- Route legs – straight (**RL**) or arc shaped (**GC**) legs connecting waypoints successively and having certain length (**Distance**) and direction (**Course**). The aggregate length of the route legs represents the route distance (**Total Distance**);
- XTD – lines parallel to the route line and limiting the set deviation (**X PORT/X STBD**) to the left and to the right of the route leg. These lines are used for the timely alerting about the exit beyond these limits in the navigation mode. The portside and starboard limits of the **X PORT/X STBD** are shown in the red and green colours respectively;
- WOL – WOL is a line upon crossing which it is necessary to angle the rudder to turn in to the next leg of the route;
- Turn radius arc – an arc of the set radius (**Turn Radius**) circle inscribed in the angle between two adjacent route legs (used for the display of the approximate ship track on a turning circle).

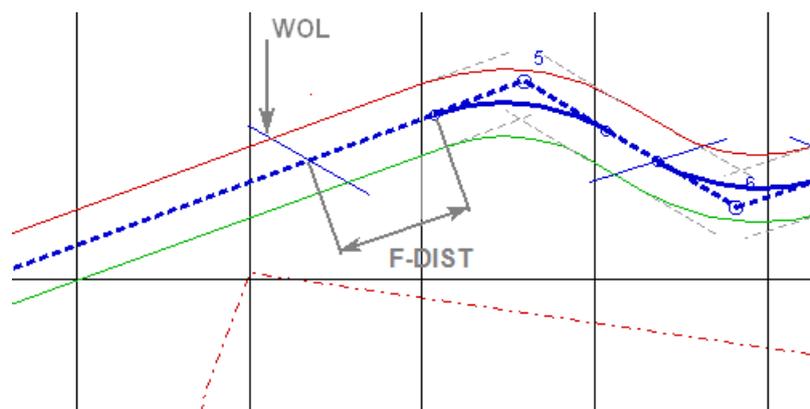
ATTENTION! The **Distance**, **Course** and **Total Distance** route elements are calculated automatically and cannot be changed by the operator in the table.

The plotted route is shown on the ECDIS task screen in the form of rectilinear (route legs) and curvilinear (turn radius arcs) segments.

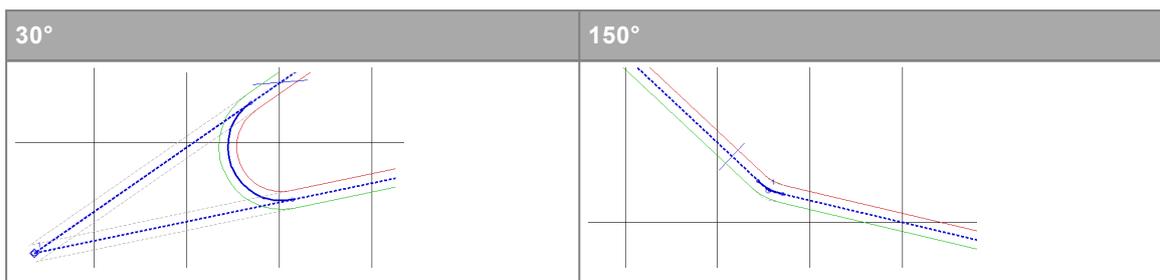


Calculations of the route elements are made in the following manner:

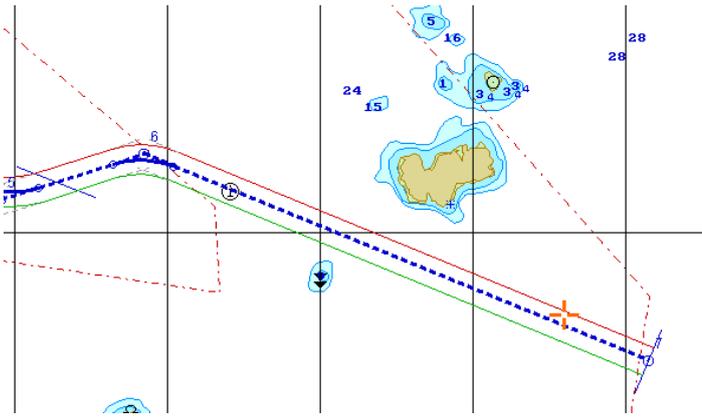
- the inscribed circle's tangent point on the current and next route legs is found. The radius of the circle is equal to the set turn radius. This point is the reference for further calculations;



- the lead distance (F-DIST) set on the **General** page of the **Config** panel is laid from the turn origin point in the direction of the current route leg start;
- the line which passes through the route leg in the F-DIST point is referred to as the WOL. The WOL is generally parallel to the next route leg. The exception is formed by an acute ($< 30^\circ$) or obtuse ($> 150^\circ$) angle between the adjacent route legs, as well as by the route's end point. In the former case, the WOL will have a 30° tilt regardless of the angle value, and in the latter case, it will be perpendicular to the leg.



In the case of the route's end point, the WOL is perpendicular to the last leg and passes through the WPT itself.



The WOL length is set so that it is 1 NM. If the scale is set at 1:100 000 or less, the WOL is equal to 20 mm.

Route File Format

Route data is stored in a file with *.rtz extension. A single file contains individual schedule and route which is described by WPT's with the following characteristics:

- WPT number (the first waypoint has 0 for number);
- WPT name;
- Coordinates;
- Leg form – GC or RL;
- XTD;
- Turn radius arc parameters.

The Navi-Sailor versions (NS 2400, NS3000 and NS4000) used *.rte and *.rt3 route formats, whilst the MFD operates with *.rtz format only. To convert route files from the old format to a new one, a special converter is built into the Data Tool utility. In addition, this converter allows performing operations on files containing route data (copying and deleting).

Route Generation

The route generation principle consists in setting WPT coordinates and the type of sailing between them: RL or GC. This data is used for the automatic calculations of:

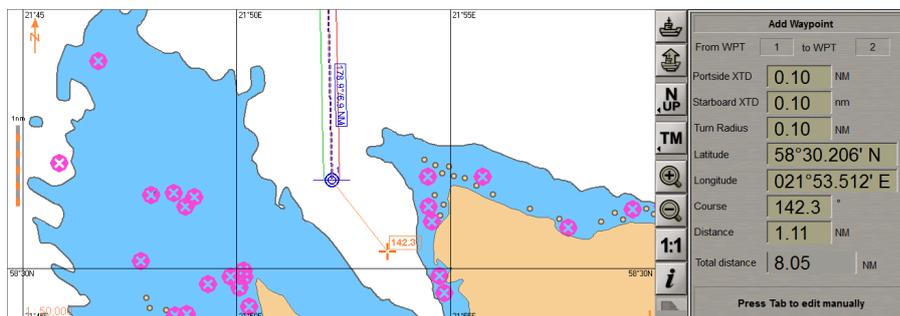
- Distance between WPTs, distance from the start of the route to each point and total distance of the entire route;
- Initial direction of the general course from each WPT to the next one.

This principle contains the minimum and necessary amount of data for the route generation. In addition, assigned to each WPT is its own name. It is worthwhile to use this kind of functionality for a brief characteristic of a certain WPT.

There are two ways to generate routes:

- Graphically. When this method is used, WPTs are plotted on the electronic chart with the graphic cursor. Such cursor is handy for a swift change of sailing area display. The disadvantage of this method consists in that it does not allow the type of sailing to be determined (RL/GC), or additional parameters (XTD and Turns radius) to be entered for the display of appropriate route elements.

The cursor method which is a variation of the graphic method, allows each successive WPT to be entered in the cursor information window by the coordinates, or bearing and distance from the previous point. This method allows XTD to be entered for the route leg which is being plotted.



- In a tabular form. This method is based on the manual input of all the route parameters in special tables on the **Route Planning** panel. The drawback is that it does not allow viewing the areas where the route is plotted beyond the ECDIS task screen, which may cause errors.

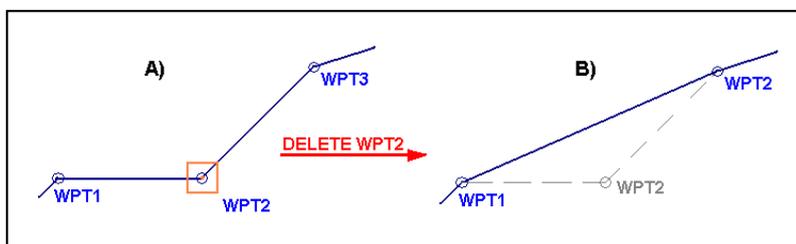
For the operator's convenience, there is a facility for the automatic change of methods in the ECDIS task. In this case, if the cursor is within the limits of the chart screen, it is assigned the former method function, whilst a double click on the cell allows data to be edited in a table.

- Route generation procedures (with the assigning of a new name):
- Generation of a new route: a route is first created and then saved via the **Save** function;
- Generation by editing an available route: an existing route is edited and then saved via the **Save** function;
- Generation by the automatic merging of several routes: the route which is being edited is linked automatically, by using the link-to function to an already existing route selected from the list, and is then saved by using the **Save** function under the existing or a new name;
- Generation of a reverse route through the automatic re-calculations: an existing route is selected and re-calculated automatically by using the **Reverse** function to obtain the reverse route; it is then saved via the **Save** function under the existing or a new name;
- Semi-automatic generation of a new route as recommended by IAMSAR manual.

Route Editing

An existing route can be edited by using a graphic or tabular method with the limitations inherent in the route generation methods.

The graphic editing allows WPTs to be created, moved and deleted. When points connecting leg with different configurations are created and deleted, the re-drawing is made according to the following principle:



ATTENTION! When editing the route, you should remember that changes in the route parameters cause all the schedules generated on the basis of this route to be deleted.

Schedule Calculations

Schedule Generation and Editing

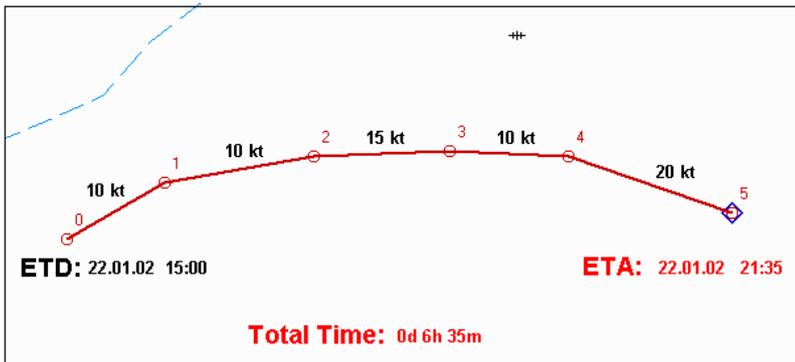
A schedule is a pre-calculated ship sailing timetable based on the created route. There are the following schedule elements:

- ETD – Estimated Time of Departure;
- ETA – Estimated Time of Arrival;
- Stay – time of stay in a WPT;
- Time Zone – it is set as required for each WPT which the ETA should be calculated for, the time zone of the place where this WPT is located, taken into account; for the start point of the route, the time zone should also be set;
- Speed – speed on a route leg;
- TTG – calculated time enroute from one waypoint to another (Time To Go);
- Total Time – pre-calculated total time of proceeding according to the schedule (Stay time not taken into account).

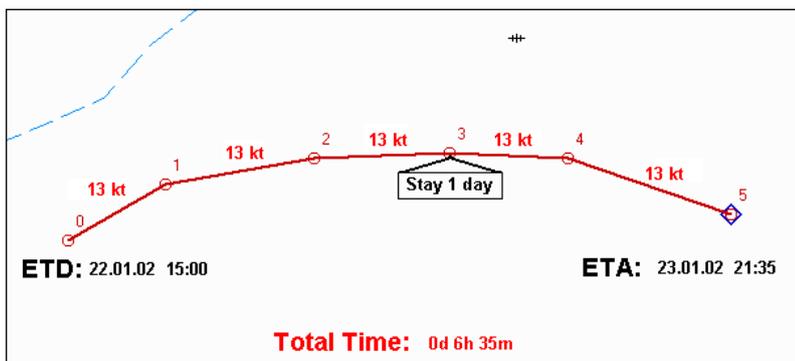
ATTENTION! TTG and Total Time schedule elements are calculated automatically and cannot be changed by an operator in the table.

Depending on the initial data, three types of schedules for motion along the route can be created (see the picture, entered parameters are shown in black, calculated parameters are shown in grey):

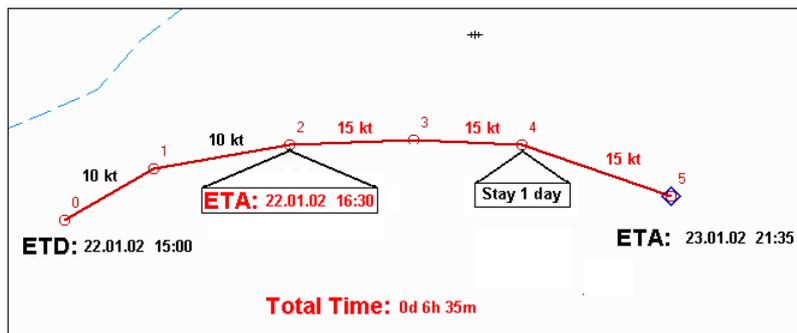
- ETD and speed on each route leg (Speed); in this case TTG, Total Time and ETA are calculated:



- ETD and ETA (+Stay) in the route start and end points. TTG, Total Time and Speed (Average Speed) are calculated:



- Combined schedule – with the set speeds (Speed) and ETA in the selected intermediate WPT's:



Check of the Schedule

A check of the generated or edited schedule for the correctness of parameters is made automatically. If an error is identified (e.g., ETA time is larger than the ETD), the probable incorrect parameter will be specified in the message about an error in the schedule calculations.

In addition, before saving a schedule, it is necessary to ascertain that all the conditions for the schedule monitoring enroute in the navigation mode will be fulfilled:

- The route which the schedule is based on, has been saved;
- The required voyage schedule has been generated;
- The time will agree with the turn-on criterion, i.e. it will be within $[t_1; t_2] \pm 10\%$ interval (where t_1 is ETD from the start WPT; t_2 is ETA in the last WPT). This condition may be noted in a different way:

$$[ETD - (ETA - ETD)/10] < [ETD + Total_Time + Stay] < [ETA + (ETA - ETD)/10]$$

Route Checking

As the route is planned, especially in the case of a long route leg, it is necessary to ascertain that the route has not been plotted through dangers to navigation. To facilitate the route planning taking into account dangers to navigation encountered on vector charts, the ECDIS task implements the mode enabling the check of a route for the availability of dangers to navigation, with a capability to edit the route at the same time.

Dangers Taken into Account During Route Check

The charts under the route are checked taking into account the "Best scale" criterion (see *Chapter 4*, section *Main Alerts Generation Principles*, paragraph *Safety Alerts*).

The route is checked for the presence of the following groups of dangers to navigation within the zone limited by the XTD (set on the **Route Planning** panel):

- Safety parameters set and activated on the **Safety Alerts** page of the **Monitoring** panel:
 - **Safety contour.**
- Line and area type objects activated on the **Safety Alerts** page of the **Monitoring** panel:
- **IMO Areas;**
- **Additional Areas.**
- Updating objects with "Danger" and/or "Depth" attributes (charts should be loaded on the **Man Corr** panel);



If the check of a route leg taking into account the set XTD has revealed some of the aforementioned dangers to navigation, the **Check** page of the **Route Planning** panel displays a message containing the following information:

- Number of the danger to navigation in the order starting from the beginning of the checked route segment;
- Total number of dangers detected on the checked route leg;
- Route leg on which the danger to navigation has been detected (start WPT – end WPT);
- Number of the chart where the danger was detected (updating objects are not displayed);
- Type of the detected danger to navigation or the word **Danger** if the type is not identified;
- Source of the danger (for the updating objects and NAVTEX message symbols).

Quick Dangers Review

After the dangers to navigation have been detected on the set route segment, they can be promptly viewed. The detected dangers are displayed on the Chart panel by pressing the  button. As this is done, the danger is displayed on the chart where it was detected. The chart is loaded on the original scale. The danger to navigation is shown as described in *Chapter 4, section Main Alerts Generation Principles, paragraph Safety Alerts*.

To view successively dangers to navigation detected on the checked route segment, use the  and  buttons.

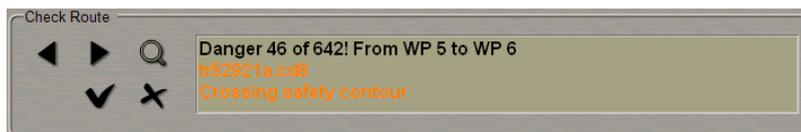
All the other functions of the **Route Planning** panel are disabled until the  button is pressed.

Editing Previously Created Route

To check and edit a previously created route, load it in the **Route Planning** panel.

The check of a previously created route is made by pressing the  button in the **Check Route** group. The check process is shown by the Progress bar and can be interrupted at any moment by pressing the  button.

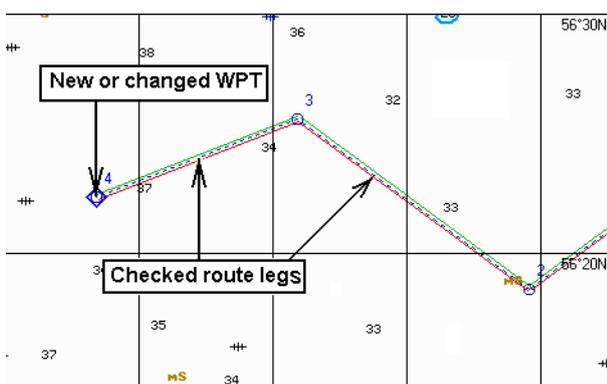
After the end of the check, the **Check Route** page displays a message about the identified dangers to navigation, or to the effect that no dangers have been detected:



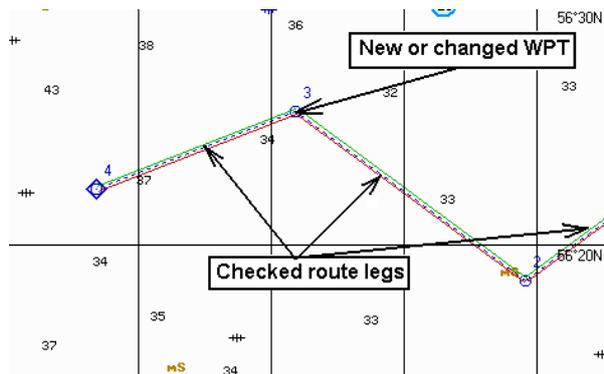
To edit a previously created route, it is necessary to press the **WPT Editor** button of the **Route Planning** panel.

During the route editing, its check for the availability of dangers to navigation is made according to the following rules:

- The start or end WPT has been moved or added. After the change of the WPT position, two legs after it will be automatically checked for dangerous to navigation.

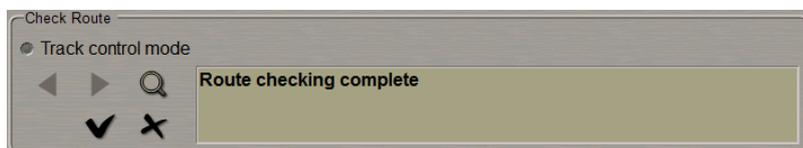


- A WPT in the middle of the route has been moved or added. After the change of the WPT position, two legs before the changed point and two legs after it will be automatically checked.



- XTD has been changed without change in the WPT position. The check which carried out takes into account the altered XTD.

If there are no dangers to navigation on the route, the **Check Route** group will display an appropriate message.



To accept the route checking results and exit from the checking mode, press the  button. The "checked" attribute will be assigned to the route. Check results will be entered in the voyage plan, the following window will open up.

Handling Multiroutes

During the ECDIS task operation, as many routes can be created as the user may require.



Depending on their purpose, the routes created by the user can be displayed on the Chart panel in the following way:

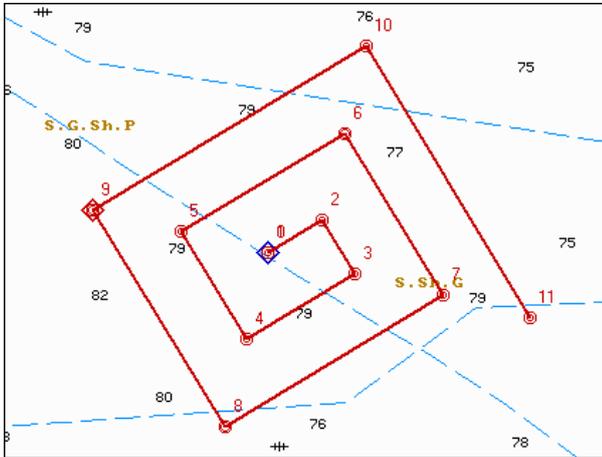
- Brown – all the routes loaded in the **Route Planning** panel;
- Blue – one of the routes loaded in the **Route Planning** panel, which is currently active. To activate the route, press the button with its name. As this is done, its data is displayed in the table, and the route can be edited. For each route, you can select one of associated (created) schedules whose data will appear in the relevant table columns;
- Red – one of the routes created in the **Route Planning** panel, which is currently being monitored. It is used for the navigation mode (permanent monitoring of the ship position) and is loaded in this mode on the **Route Monitoring** page of the **Monitoring** panel. You can unload this route as required and load any other route for the Navigation mode. In the course of the voyage, the user can edit the monitored route on the **Route Planning** panel.

The aforementioned routes can be simultaneously displayed on the ECDIS task screen.

SAR Routes

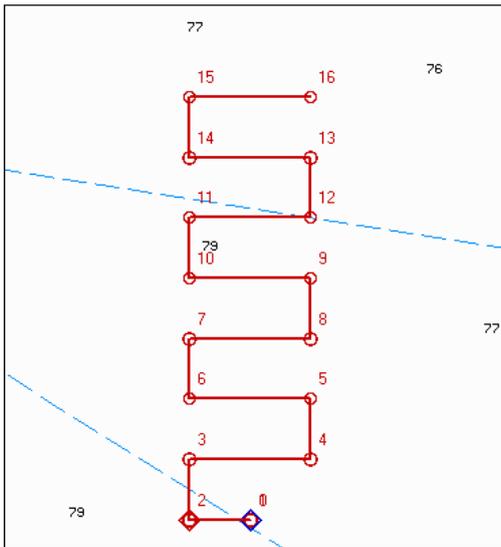
With the use of the SAR function, routes are generated in accordance with patterns recommended for search and rescue (SAR routes):

- **Expanding Square:**



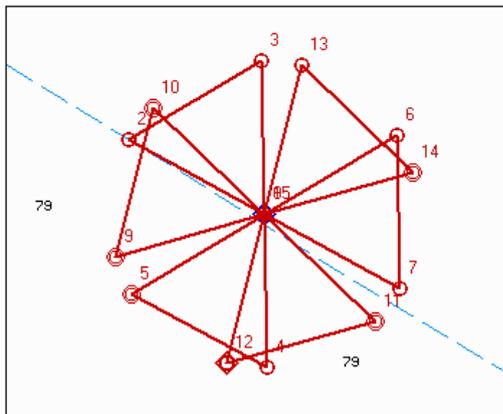
To generate this SAR pattern, it is necessary to enter additional data on the **Number of Legs** in the pattern and length of the initial WPT1-WPT2 segment (**Length of Starting Leg**).

- **Parallel Track/Creeping Line:**



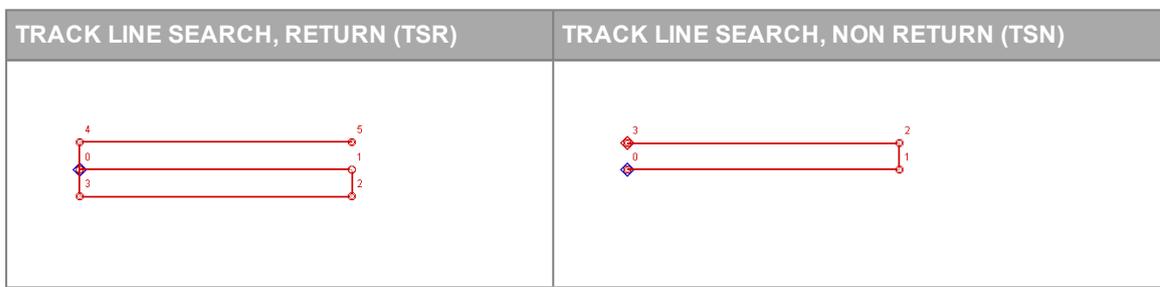
To generate this search pattern, it is necessary to enter some additional data: on the **Number of Legs** in the pattern, each **Leg Length** and distance between the adjacent legs (**Track Spacing**).

• **Sector Search:**



To generate this search pattern, it is necessary to enter some additional data on the **Number of Sectors**, **Search Radius** and angle between the adjacent sectors (**Turn Angle**).

• Track Line Search;

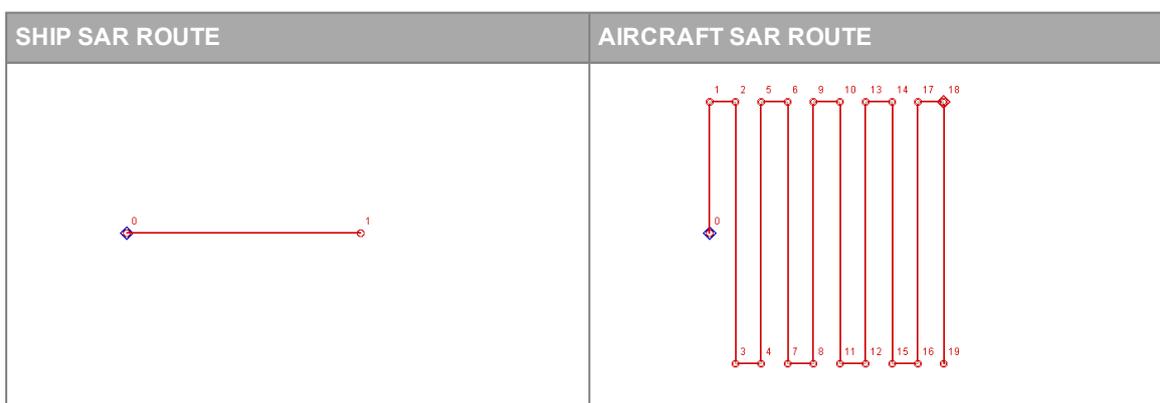


To generate this search pattern, it is necessary to enter some additional data: on each **Leg Length** and distance between the adjacent legs (**Track Spacing**).

It is possible to select two search pattern types:

- Search may be along one side of a track line and return in the opposite direction on the other side (TSR);
- Search may be along the intended track and once on each side, then search facility continues on its way and does not return (TSN).

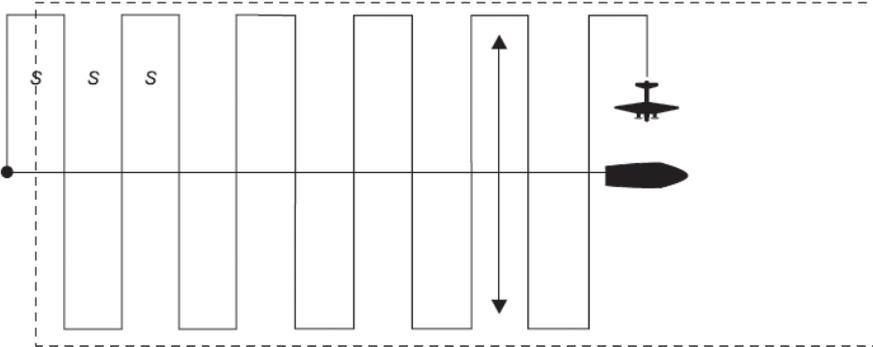
• Creeping Line Search;



This search pattern type is used in the joint ship/aircraft rescue operations. To generate this search pattern, it is necessary to enter some additional data: on the **Number of Legs** in the pattern, each **Leg Length** and distance between the adjacent legs (**Track Spacing**). Ship speed varies according to the aircraft speed and the of the pattern. The relationship of the surface facility speed, aircraft speed, track spacing and search legs length is defined by the following equation:

$$V_s = (S \times V_a) / (L + S)$$

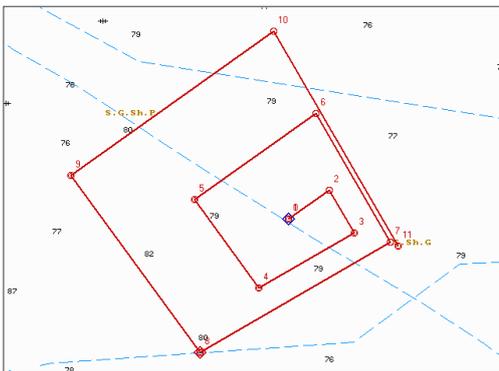
Where V_s is the speed of the surface facility in knots, S is the track spacing in nautical miles, V_a is the aircraft true air speed in knots, and L is the length of the aircraft route leg in nautical miles.



Before the route generation start, it is necessary to specify the initial points:

- Operation start point (**Own Ship Coordinates**) – this is a point where the course is expected to be altered for proceeding to the search area. This point is the start of the generated route. Coordinates are set manually or automatically. If the **Current** function is enabled, the start point will automatically acquire the own ship coordinate values (from the ECDIS task) and will be automatically updated until the route is saved;
- Search start point (**Commence Search Point**) – it is from this point (WPT1) that the ship starts proceeding along the selected **Search Pattern**.

Input of values in the **Drift** and **Set** fields is required if there is a constant considerable current in the area, and this is known to the operator. If speed is taken into account (expected **Speed** during the search operations), this will enable calculations of the search pattern over the ground so that the pattern will retain its recommended form relative to the water.



Route Monitoring

Sailing Along the Route

The route loaded for sailing is displayed on the ECDIS task screen in red.

An attempt to load a route, whose elements do not correspond to the set values in the monitoring mode, generates a relevant warning.



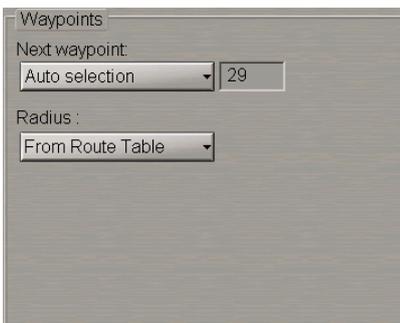
From the moment of route loading, the system starts generating data on the mutual positions of the route elements and the ship, whilst from the time of the schedule count off (turn ON criterion) the ship's progress relative to the schedule is calculated.

Information on the sailing along the route is shown on the **Route Data** and **Schedule** pages on the **Route data** display of Control Panel.

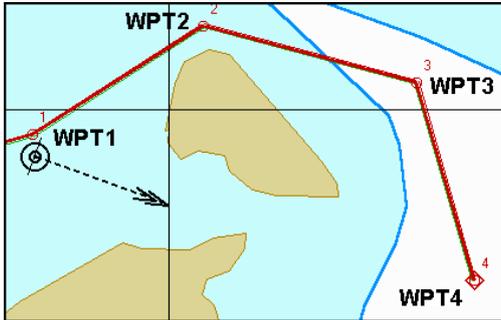
Route Data	
Route Data	Schedule
Route	St-Petersburg-Hamburg
To WPT 20	
BWW	216.5°
XTD	1 m - STBD
BWOL	216.5°
DWOL	168.90 NM
ETA (UTC)	25-03-16 23:42:18
TTG	0 d 14 h 04 min
Next WPT 21	
BWW	232.5°
RAD	0.30 NM

Route Data	
Route Data	Schedule
To WPT:	20
Schedule	
ETA (UTC)	25-03-2016 23:42:18
TTG	0 d 14 h 02 min
DWOL	168.6 NM
PTA (00:00)	30-01-2009 11:46:13
Quick calculation	
STG (kn)	PTA (UTC time)
0.0	
0.0	

For the operator's convenience, the following parameters of the ship motion along the route can be set and changed during the voyage on the **Route Monitoring** page, in the **Waypoints** group:



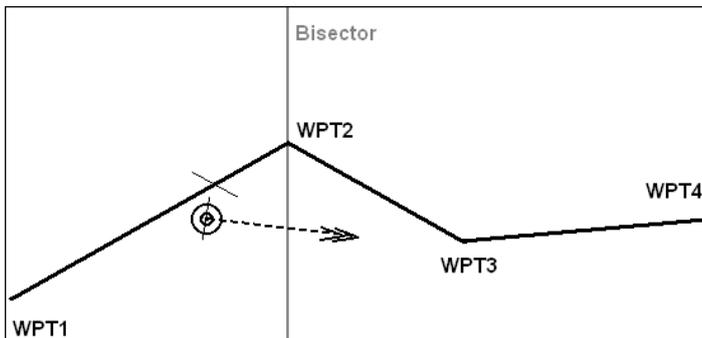
- **Next waypoint** – the mode of automatic (successive) or manual change of WPT's. In case of the manual mode, a window for the input of the next WPT number is activated. The principle underlying such change is shown in the drawing below:



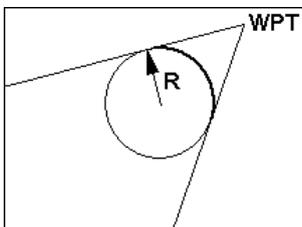
Here, in the manual mode, WPT4 is set as the next WPT instead of WPT2 as might be expected. In this case, the ECDIS task takes into account parameters set for the route leg between WPT3 and WPT4. Accordingly, calculations are made for the mutual positions of the ship and this leg elements. The schedule is thus recalculated: the actual time is taken into account as in case of proceeding along WPT3–WPT4 leg.

It is advisable to use this functionality instead of route editing functions (deleting of a point), as in the case when the schedule is retained.

- The current WPT is changed as the WOL line is crossed. If the ship is beyond the XTD and does not cross the WOL, the current WPT is changed when the ship crosses the bisector of the angle between the adjacent legs of the monitored route:



- **Radius** – (turn radius arc) arc of the turning circle planned for the turn in the given WPT with a set radius. Such arc is part of a circle inscribed in the angle formed by the adjacent route legs as shown in the drawing:



Obtaining Information on Voyage Schedule

During the sailing along the route, **ETA** and **TTG** calculations for any WPT can be made by using a voyage calculator on the **Data** and **Schedule** pages of the **Route Data** display.

There may be two versions of the **ETA** and **TTG** calculations:

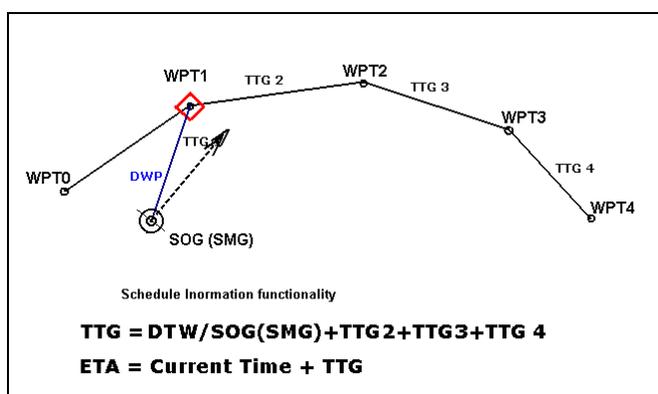
- The voyage schedule is loaded on the **Route Monitoring** page of the **Monitoring** panel.

In this case, **TTG** to the next WPT (specified in the **Next waypoint** line) is calculated from the following formula:

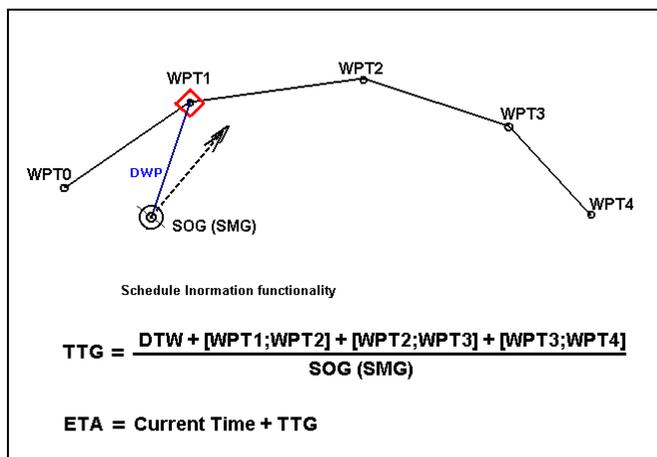
$$\text{TTG} = \text{DTW} / \text{SOG}(\text{SMG})$$

A thus calculated **TTG** is summed with **TTG's** of other route legs from the loaded schedule up to the WPT selected in the voyage calculator.

ETA is calculated as a sum of the current time and of all the **TTG's** to the selected WPT:



- The voyage schedule is not loaded. **TTG** is calculated as a sum of **DTW** and all the route legs up to the selected WPT, divided by **SOG (SMG)**:



There may be two versions of the **PTA** and **STG** calculations:

- The voyage schedule is loaded on the **Route Monitoring** page of the **Monitoring** panel. By default, or after a press on the **Schedule** button on the **Schedule** panel of the **Route data** display, the closest WPT which **ETA** is set for is selected. **PTA** for this point is taken from the loaded schedule. If **ETA** has not been set, **PTA** to the end point is taken. In this case, **STG** will be equal to the speed at which the ship should proceed to the next WPT in order to reach it on schedule. The point, which **ETA** is calculated for, is sailed to according to the loaded schedule. As the **PTA** is changed, **STG** will be equal to the speed at which the ship should proceed to the next WPT in order to arrive in the point which **ETA** is calculated for, with the changed **PTA** taken into account;
- The schedule is not loaded. By default, the last WPT is taken. In this case, the "Click to enter" message appears in the **PTA** line. After the input of **PTA**, the **STG** line shows the speed at which the ship should proceed along the entire route in order to arrive in the set WPT at the time (**PTA**). If the speed is set in the **STG** line, the **PTA** line displays the time of arrival in the set WPT if proceeded to at the set speed (**STG**).

Logging Functions

This chapter provides a description of principles underlying the maintaining of the electronic logbook, archiving and playback of the own ship and target track information, and of the radar picture.

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General

The data obtained as a result of the MFD operation and saved for the subsequent viewing, enables situations, which occurred earlier during the voyage, to be archived and reconstructed.

The following functionality is used for the recording and display of archived data on the ECDIS task operation results:

- Ship logbook;
- Electronic system logbook;
- Ownship track;
- Target tracks;
- Radar overlay.

The archived system parameters are saved onto the computer hard disk and can be available for viewing in the ECDIS task, Play Back or Data Tool utilities. The data is saved locally on each WS individually, and is not synchronized. The table shows the groups of data archived by the ECDIS task.

ARCHIVED PARAMETERS	ARCHIVING DISCRETION	MEASUREMENT UNITS	PRECISION
Detailed track, if it is enabled in the System Configuration utility. Coordinates from the primary positioning system	1 sec	Degrees, minutes	0_ 0.000000
Coordinates from the primary positioning system	10 sec	Degrees, minutes	0_ 0.000000
Coordinates from the secondary positioning system	10 sec	Degrees, minutes	0_ 0.000000
COG	10 sec	Degrees	0.000
SOG	10 sec	Knots	0.000
HDG	10 sec	Degrees	0.000
STW	10 sec	Knots	0.000
Echosounder	10 or 20 sec ¹	Meters	0.0
Wind	10, 20, 30 or 60 sec ¹	Knots	0.000
Temperature	20, 30 or 60 sec ¹	Degrees	0.0
Target (ARPA and AIS) pos. and their status (by CPA/TCPA parameter) and GZ	10, 20 or 60 sec ¹	Degrees, minutes	0_ 0.000000
Radar overlay	1–60 sec ¹		-
Route Monitoring Data (monitored route name, monitored WPT, XTD, WPT selection mode)	10 or 20 sec ¹	XTD – Meters	0

The size of archive files containing the logs, own ship track and target tracks, comes to about 50 MB a month. The size of files with the recording of radar picture is about 1 GB a day; it should be noted that the time of radar picture recording cannot exceed 5 days, whereupon the files are rewritten. Therefore, the maximum HDD memory size for the storage of system archive information for 3 months, as per the IMO requirement, is about 6 GB. This is commensurate with capabilities of computers required by the manufacturer for the installation of the MFD program. To prevent overfilling of the hard disk, the System Configuration utility provides a capability on the **Tracks** page to set the archive data storage time in days, whereupon the old data is deleted and new information is recorded in its place.

¹– recording interval set by the service engineer during the installation.

In doing this, please note that it is only the operating time of the station with the MFD installed which is taken into account (i.e., files will start to be deleted if the MFD was not switched off during the set period).

The MFD data archiving capability by the aforementioned functions:

ARCHIVED PARAMETERS	ELECTRONIC SHIP LOGBOOK	OWN SHIP TRACK	TARGET TRACKS	RADAR PICTURE
Primary Position	√	√		√
Secondary Position	√	√		
COG	√	√		√
SOG	√	√		√
HDG	√	√		
STW	√	√		
Depth	√	√		
Wind	√	√		
Temperature	√	√		
Target position			√	
Radar overlay				√
Route Monitoring Data	√	√		

The capability to display (in a graphic or text form) archived data in the ECDIS task and the Play Back and Data Tools utilities by the functions:

- T – text form;
- G – graphic form.

ARCHIVED PARAMETERS	ELECTRONIC SHIP LOGBOOK			OWN SHIP TRACK			TARGET TRACKS			RADAR PICTURE		
	ECDIS	PB	DT	ECDIS	PB	DT	ECDIS	PB	DT	ECDIS	PB	DT
Primary Position	T	T	T	G	G	T					G	
Secondary Position	T	T	T		G	T						
COG	T	T	T	G	G	T					G	
SOG	T	T	T	G	G	T					G	
HDG	T	T	T	G	G	T						
LOG	T	T	T	G	G	T						
Depth	T	T										
Wind	T	T	T									
Temperature	T	T	T									
Targets position								G				
Radar overlay												G
Route Monitoring Data	T	T		G	G							

Principles underlying the saving and display of archived parameters and some other data are presented in the utilities, in the description of relevant functions.

Ship Logbook

Ship Logbook Formation Principles

Voyage data is entered in the electronic standard form Ship Logbook meeting the requirements of IMO Resolution A.916(22). The Ship Logbook is shown on the **Ship Logbook** page of the **Logbook** panel.

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Press. hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST_NM by LOG, SMG	RPM
13:00:00 (04:00 E)	Position	57° 31.520 N 019° 42.620 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	15.5 16.7	***
12:56:21 (04:00 E)	Chart	57° 31.766 N 019° 42.958 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	15.2 16.3	***
12:49:06 (04:00 E)	Out of XTD	57° 32.251 N 019° 43.627 E	GPS1 GYRO1	226.3°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	14.6 15.8	***
12:48:55	New track	57° 32.264 N	GPS1	226.3°	216.5°	216.5°	***	***	119.9°	14.6	***

Comment: Out of XTD. Route "St-Petersburg-Hamburg". Leg WP 19 to WP 20.

Ship Logbook is designed for recording events which occurred during the ECDIS task operation. The table is a set of rows (events) and columns (event parameters). Events in the Ship Logbook are arranged chronologically from the bottom to the top. Each event is associated with the following set of parameters:

- Time Local – event date and time (local time is specified (+ Time Zone));
- Event – event name;
- LAT\LON – event latitude and longitude;
- Source – sources of coordinates and the heading, their number specified;
- Chart Track – direction of the current monitored route leg;
- GYRO (ERR) – own ship course from the gyro and gyro correction;
- MAG (ERR) – own ship course from the magnetic compass and the magnetic compass correction;
- Press – atmospheric pressure;
- Temp. (air, sea) – ambient and water temperature;
- Wind (dir, speed) – wind direction and velocity;
- DIST (by LOG, SMG) – distance travelled since the beginning of the watch, data from the speed-through-water and speed-over-ground sensors taken into account;
- RPM – main engine rpm value.

If some sensor is not connected or its data is not available, the cells display the “****” symbol.

Events are entered in the log automatically, there is also a capability to enter the events manually by selecting them from the available set of events in the **Enter Event** drop-down list.

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Press. hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST	RPM
09:00:00 (04:00 E)	Position	***	***	229.7°	***	***	***	***	***	***	***
08:01:00 (04:00 E)	LOG failure	***	***	229.7°	***	***	***	***	***	***	***
08:01:00 (04:00 E)	GYRO fail...	***	***	229.7°	***	***	***	***	***	***	***
08:01:00	GPS failure	***	***	229.7°	***	***	***	***	***	***	***

Enter Event dropdown menu options:

- Default
- At anchor
- Change of command
- Checks on departure
- Event
- Hand over watch
- In the port
- Inspection control
- Loading completed
- Pilot change
- Enter event in log book
- Create custom event

There is a capability to select an event either from the **Default** list or from the **Custom** list. The customer can him/herself add events to the **Custom** list.

The Log Book data with user-created events is readable in any other MFD application in the Log Book table only.

Each time an event is recorded manually in the Ship Log Book it is necessary to enter a personal password, rank and name of the operator who made the entry.

For compiling a list of persons authorized to edit the log, the **Logbook accounts** tab of the **Logbook Settings** page is used.

For each event, recorded automatically or manually, a full set of event parameters (if available) is entered in the Ship Logbook. The table below shows a list of events and records made in the **Comment** field at the event occurrence time.

EVENT	SHIP LOGBOOK ENTRY	RECORDING MODE	COMMENTS
Position	Frequency selected by user (5, 10, 15, 20, 30 and 60 min)	Automatically	Empty
Loading monitored route	Loaded Route	Automatically	"Name" route loaded for monitoring. Chart XXXXX
Loading monitored route checked for safety	Loaded Route	Automatically	"Name" route checked for safety parameters (DD.MM.YYYY, HH:MM:SS) loaded for monitoring
Unloading monitored route	Loaded Route	Automatically	"Name" route unloaded from monitoring. Chart XXXXX
Change of a WPT on the monitored route	New track	Automatically	WPT "XX", "Name" route, New track XXX,X° Chart XXXXX
Exit beyond the route	Out of XTD	Automatically	Out of XTD. "Name" route, Leg WPT XX to WPT XX
End of monitored route	End of monitoring	Automatically	End of monitored "Name" route
Man Over Board	MOB	Automatically	<ul style="list-style-type: none"> Man overboard – ON; Position: <LAT – LONG> Date: XX-XX-XX, Time: XX:XX:XX; Man overboard – MOB position changed by operator; Position: <LAT – LONG> Date: XX-XX-XX, Time: XX:XX:XX; Man over board – OFF

EVENT	SHIP LOGBOOK ENTRY	RECORDING MODE	COMMENTS
Reception of a manually obtained position	Position Fix	Automatically	Position Fix accepted at XX/XX/XX XX:XX:XX Calculated position offset: X.X NM – XXX.X° Calculated position: <LAT – LONG> The following lines of position were used: XX:XX:XX, BRG=XXX.X°, bound to <LAT – LONG> XX:XX:XX, BRG=XXX.X°, bound to <LAT – LONG> Primary position has not been updated (in case of valid GPS) Primary position has been updated (in case of invalid GPS)
Change of Time zone	Time zone changed	Automatically	Time set back “XX.XX hrs” Time set forward “XX.XXhrs”
End of watch	End of watch	Automatically	Chart under the ship “XXXXX Alarms: only common ones for the entire system at the event occurrence time Monitored “Name” route Total watch distance Total voyage distance Watch officer: Rank, family name
Noon entry	Noon entry	Automatically	Chart under the ship “XXXXX Alarms: only common ones for the entire system at the event occurrence time Monitored “Name” route Total daily distance (distance covered from 12 noon of the previous day until 12 noon of the current day) Total voyage distance
Change of safety contour	Safety contour	Automatically	Safety contour: Previous value=XXm, New value=XXm
Change of safety depth	Safety depth change	Automatically	Safety depth: Previous value=XXm, New value=XXm
GPS failure	GPS failure	Automatically	GPS failure
Log failure	LOG failure	Automatically	LOG failure – No input
GYRO failure	GYRO failure	Automatically	GYRO failure – No input
TCS mode turned ON	TCS mode	Automatically	Track control turned ON
TCS mode turned OFF	TCS mode	Automatically	Track control turned OFF
System start	System start	Automatically	Empty
Pilot on board	Pilot on board	Manually	Pilot on board

EVENT	SHIP LOGBOOK ENTRY	RECORDING MODE	COMMENTS
Pilot Off	Pilot off	Manually	Pilot off
Pilot change	Pilot change	Manually	Pilot change
Reporting point	Reporting point	Manually	Empty
Commence cargo operations	Start loading	Manually	Empty
Checks on departure	Departure status	Manually	Empty
Loading completed	Loading completed	Manually	Empty
Inspection control	Inspection control	Manually	Empty
At anchor	At anchor	Manually	Empty
In the port	In the port	Manually	Empty
Safety record	Safety record	Manually	Empty
Event	Event	Manually	Empty
Change of command	Change of command	Manually	Captain XXX has handed over command. Captain YYYY has taken over command..

Records in the Ship Logbook are stored for 90 days, during this time they can be edited, and comments can be entered. The records are then sent to the archive (see below).

The Ship log book is available on 3 bridge stations only (backup-0, backup-1, backup-2). The priority backup-0, etc. is set in the System Configuration utility during the installation (see the document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration, paragraph MFD Settings*). The Ship Logbook is written from the station with backup-0 and backup-1 priority and synchronised with the backup-2 station. When events, custom events and user accounts are added in the Ship Logbook, whether from the WS with the backup-0 priority or the WS with the backup-1 priority, they will be displayed on all three WS's (backup-0, backup-1, backup-2). In the case of the network breakdown and its subsequent recover, the Ship Logbooks on all the WS's will be synchronised with Ship Logbooks of both the WS with backup-0 priority and the WS with backup-1 priority. The events from the WS with backup-1 priority which are not available on the WS with backup-0 priority will appear there, and the other way round. When the WS with the backup-0 priority is turned off, its role is passed to the WS with the backup-1 priority, and after it has been turned on, the Ship Logbook will be synchronized with the Ship Logbook of the WS with backup-1 priority.

Making Corrections and Safety

General

The ECDIS task provides a capability to make corrections in some event parameters and enter comments on the event; the watch schedule can also be edited. To do this, you have to enter the user login and password.



This operation can only be performed by the authorised user who is entered in the list of persons authorized to edit the log on the **Logbook accounts** tab of the **Logbook Settings** page.

Editing Event Parameters

Corrections of event parameters are made by authorised users direct in the cells of the Ship Logbook table. No correction of parameters can be made for **Time UTC**, **Event**, **LAT\LON** and **Source**. After the input of corrections in the Ship Logbook, the name of the edited event and the cell where the editing was done are shown in bold type. When the cursor is positioned on this cell, a hint appears showing the parameter's original value, i.e., the value which the parameter had at the moment when the event was entered in the Ship Logbook.

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Press. hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST. NM by LOG, SMG	RPM
13:30:37 (04:00 E)	At anchor	57° 29.422 N 019° 39.730 E	GPS1 GYRO1	226.9°	216.5° +0.0	216.5° +0.0	750	*** 18.0	119.9° 10.0	18.1 19.3	***
13:00:00 (04:00 E)	Position	57° 31.520 N 019° 42.620 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	15.5 16.7	***
12:56:21 (04:00 E)	Chart	57° 31.766 N 019° 42.958 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	15.2 16.3	***
12:49:06	Out of VTD	57° 32.251 N	GPS1	226.3°	216.5°	216.5°	***	***	119.9°	14.6	***

Comment: 6 shackles in the water

The history of making corrections is arranged chronologically on the **History list** tab.

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Press. hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST. NM by LOG, SMG	RPM
13:30:37 (04:00 E)	At anchor	57° 29.422 N 019° 39.730 E	GPS1 GYRO1	226.9°	216.5° +0.0	216.5° +0.0	750	*** 18.0	119.9° 10.0	18.1 19.3	***
13:00:00 (04:00 E)	Position	57° 31.520 N 019° 42.620 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	15.5 16.7	***
12:56:21 (04:00 E)	Chart	57° 31.766 N 019° 42.958 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	*** 18.0	119.9° 10.0	15.2 16.3	***
12:49:06	Out of VTD	57° 32.251 N	GPS1	226.3°	216.5°	216.5°	***	***	119.9°	14.6	***

Created by: Chief officer Pereira

Edited by: Chief officer Pereira [16/10/13 09:31:54]
Press: - Changed from *** to 750

The **History list** tab shows the following information:

- time and date when the correction was made;
- name of the user who entered the correction;
- edited parameter name;
- initial and corrected value of the edited parameter.

When the Ship Logbook is printed out, the event in which the parameter was corrected, is marked with a reference to the footnote; the correction will look as follows:

Print Preview

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Ship name: KOLA
Voyage N: From: To: IMO No.: 000999999
Date: 16 October 2013

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Pres: hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST. NM by LOG, SMG	RPM	Comment
13:30:37 (04:00 E)	At anchor	57° 29.422 N 019° 58.730 E	GPS1 GYRO1	228.0*	246.5* +0.0	216.5* +0.0	750	18.0	110.9* 10.0	18.1 19.3	***	6 shackles in the water Created by: Chief officer Pereira
13:53:13 (04:00 E)	GPS failure	***	***	227.2*	***	***	***	18.0	110.9* 10.0	19.0 21.1	***	GPS failure
13:53:13 (04:00 E)	GYRO failure	***	***	227.2*	***	***	***	18.0	110.9* 10.0	19.0 21.1	***	GYRO failure
13:53:13 (04:00 E)	LOG failure	***	***	227.2*	***	***	***	18.0	110.9* 10.0	19.0 21.1	***	LOG failure
14:00:00 (04:00 E)	Position	***	***	227.2*	***	***	***	***	***	20.5	***	
15:00:00 (04:00 E)	Position	***	***	227.2*	***	***	***	***	***	21.1	***	
16:00:00 (04:00 E)	End of watch	***	***	227.2*	***	***	***	***	***	25.5 21.1	***	Chart under the ship "..." Alarms: * Out of XTD * SOUNDER: no input * LOG: no input * GYRO: no input * Wind sensor: no input * Temp sensor: no input * AIS: Name warning * AIS: CALL warning * AIS: no input * Prim: CDG/SDG no data * Prim sensor: no input Monitoring route "St Petersburg-Hamburg" Total daily distance 21.1 nm Total voyage distance 3793.1 nm
16:00:00 (04:00 E)	Position	***	***	227.2*	***	***	***	***	***	30.5 21.1	***	
16:01:00 (04:00 E)	Out of XTD	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	Out of XTD. Route "St Petersburg-Hamburg". Leg WP 19 to WP 20.
16:01:00 (04:00 E)	GPS failure	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	GPS failure
16:01:00 (04:00 E)	GYRO failure	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	GYRO failure
16:01:00 (04:00 E)	LOG failure	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	LOG failure

Printed: 17/10/13 16:47:16 (04:00 E) Checked by Master: Jack Short Page 6

At the end of each day, the program generates a **History list** page containing all the references.

Print Preview

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Ship name: KOLA
Voyage N: From: To: IMO No.: 000999999
Date: 16 October 2013

History list

1)
16/10/13 09:31:54 Edited by: Chief officer Pereira
Pres.: - Changed from *** to 750

Printed: 17/10/13 16:54:10 (04:00 E) Checked by Master: Jack Short Page 8

Entering Comments

Comments on the events are made by authorised users when the event is entered in a free text format.

The **Comment** tab only shows the most recent version of comments on the given events.

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Press. hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST_NM by LOG, SMG	RPM
(04:00 E)	GPS failure		***		***	***		18.0	10.0	21.1	
13:53:13 (04:00 E)	LOG failure		***	227.2°	***	***	***	***	119.9°	19.9	***
13:30:37 (04:00 E)	At anchor	57° 29.422 N 019° 39.730 E	GPS1 GYRO1	226.9°	216.5° +0.0	216.5° +0.0	750	18.0	119.9° 10.0	19.3	18.1
13:00:00 (04:00 E)	Position	57° 31.520 N 019° 42.620 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	18.0	119.9° 10.0	15.5	16.7

Comment	History list
Comment:	7 shackles in the water

The **Comment** tab only shows the most recent version of a comment on the given event. The name of the event which a comment was made manually for is shown in the bold type.

The history of making comments is arranged chronologically on the **History list** tab.

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Press. hPa	Temp. air, °C sea, °C	Wind dir. speed, m/s	DIST_NM by LOG, SMG	RPM
(04:00 E)	GPS failure		***		***	***		18.0	10.0	21.1	
13:53:13 (04:00 E)	LOG failure		***	227.2°	***	***	***	***	119.9°	19.9	***
13:30:37 (04:00 E)	At anchor	57° 29.422 N 019° 39.730 E	GPS1 GYRO1	226.9°	216.5° +0.0	216.5° +0.0	750	18.0	119.9° 10.0	19.3	18.1
13:00:00 (04:00 E)	Position	57° 31.520 N 019° 42.620 E	GPS1 GYRO1	226.4°	216.5° +0.0	216.5° +0.0	***	18.0	119.9° 10.0	15.5	16.7

Comment	History list
Created by:	Chief officer Pereira
Edited by:	Chief officer Pereira [16/10/13 09:31:54] Press. - Changed from *** to 750
Edited by:	2nd officer Sparrow [17/10/13 13:18:20] Comment - Changed from:

The **History list** tab displays the following information:

- time and date when the comment was entered;
- name of the user who entered the comment;
- initial and corrected comment.

If the comment was deleted, the corrected value will have a form of a vacant "****" field.

When the Ship Logbook is printed out, comment on the event in which the parameter was corrected, is marked with a reference to the footnote; the correction will look as follows:

Print Preview

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Ship name: KOLA, Voyage N: From: To: IMO No.: 00099999, Date: 16 October 2013

Time Local	Event	LAT LON	Source	Chart Track	GYRO (ERR)	MAG (ERR)	Pres: hPa	Temp: at: °C sea, °C	Wind dir: speed, m/s	DIST_NM by LOG, SMC	RPM	Comment
13:30:27 (04:00 E)	At anchor	57°29'42.2 N 019°39'7.30 E	GPS 1 GYRO 1	226.0*	216.5*	216.5*	750	18.0	119.0* 10.0	18.1 19.3	***	7 shackles in the water Created by: Chief officer Pereira
13:53:13 (04:00 E)	GPS failure	***	***	227.2*	***	***	***	18.0	119.0* 10.0	18.9 21.1	***	GPS failure
13:53:13 (04:00 E)	GYRO failure	***	***	227.2*	***	***	***	18.0	119.0* 10.0	19.9 21.1	***	GYRO failure
13:53:13 (04:00 E)	LOG failure	***	***	227.2*	***	***	***	18.0	119.0* 10.0	19.0 21.1	***	LOG failure
14:00:00 (04:00 E)	Position	***	***	227.2*	***	***	***	***	***	20.5 21.1	***	***
15:00:00 (04:00 E)	Position	***	***	227.2*	***	***	***	***	***	26.5 21.1	***	***
16:00:00 (04:00 E)	End of watch	***	***	227.2*	***	***	***	***	***	30.5 21.1	***	Chart under the ship "..." Alarms: * Out of XTD * SOUNDER: no input * LOG: no input * GYRO: no input * Wind sensor: no input * Temperature: no input * AIS: Name warning * AIS: CALL warning * AIS: no input * Prim: COG/SOG no data * Piv sensor: no input Monitoring route "St. Petersburg-Hamburg" Total daily distance 21.1 nm Total voyage distance 3793.1 nm
16:00:00 (04:00 E)	Position	***	***	227.2*	***	***	***	***	***	30.5 21.1	***	***
16:01:00 (04:00 E)	Out of XTD	***	***	227.2*	***	***	***	***	***	0.1	***	Out of XTD. Route "St. Petersburg-Hamburg". Leg WP 18 to WP 20
16:01:00 (04:00 E)	GPS failure	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	GPS failure
16:01:00 (04:00 E)	GYRO failure	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	GYRO failure
16:01:00 (04:00 E)	LOG failure	***	***	227.2*	***	***	***	***	***	0.1 0.0	***	LOG failure

Printed: 17/10/13 17:26:27 (04:00 E) Checked by Master: Jack Short Page 6

At the end of each day, the program generates a **History list** page containing all the references.

Print Preview

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Ship name: KOLA, Voyage N: From: To: IMO No.: 00099999, Date: 16 October 2013

History list

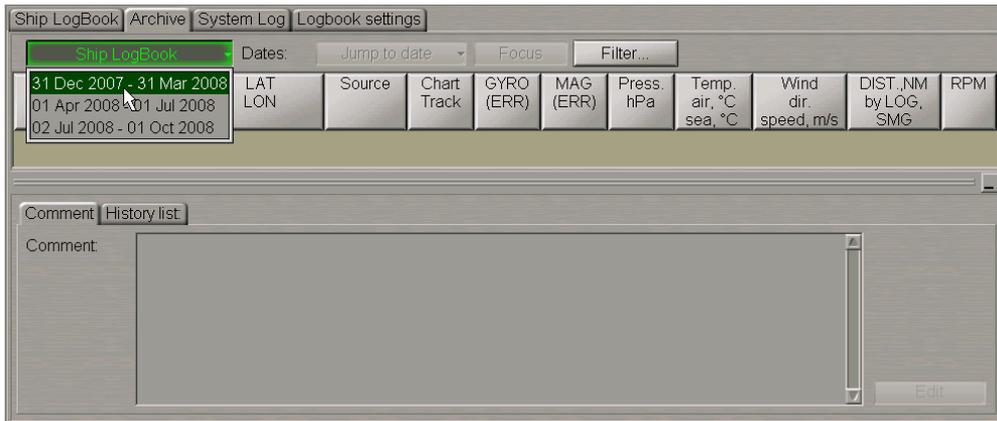
1)
16/10/13 09:31:54 Edited by: Chief officer Pereira
Eggs: Changed from "" to 750
17/10/13 13:16:20 Edited by: 2nd officer Sparrow
Comment: Changed from:
6 shackles in the water
Changed to:
7 shackles in the water

Printed: 17/12/13 14:48:33 (00:00) Checked by Master: Page 29

Archiving Ship Logbook

Records over the last 90 days are stored in the Ship Logbook. With the beginning of each new day, the record for the 90th day is copied to the archive Ship Logbook. Access to these records can only be obtained from the **Archive** page. There can be no editing of the archive Ship Logbook.

After entries for 90 days are accumulated in the Ship Logbook, it is automatically packaged and will be stored in the archive form. Each archive Ship Logbook has a heading: DD Month YYYY – DD Month YYYY. Archive logs are numbered in the chronological order.



The logbook archiving is performed in a self-extracting file. The archive logbooks are stored in the MFD for two years.

The archive Ship Logbooks can be printed out from the **Print Settings** page by using the **Date** filter. Provided in the filter are dates from the first record in the Ship Logbook, stored in the MFD.



Electronic System Logbook

Electronic System Logbook Formation Principles

Electronic system logbook is a file where both, navigational and system events are automatically recorded. It should be noted that any possibility of making changes in or manipulating with this data, is ruled out. In addition, the navigator can at any moment make a manual entry, enter data on weather and his/her own comments in the **Remarks** column. Access to this data and a capability to supplement it is provided both from the ECDIS task and from the Play Back utility.

An electronic system logbook file is formed every 24 hours (with the change of date by UTC time). If the ECDIS task was switched on and off several times during the date, the data is recorded to a file with an appropriate date. As this is done, each switching on and off is recorded as an individual event ("START/STOP"). Operations (deleting, copying, viewing, etc.) on the data file are performed in the Data Tool utility.

The System logbook is presented in the form of a table consisting of horizontal rows (event parameters) and vertical columns (events). For the convenience sake and in order to provide sorting capability, all the events are divided into groups:

- **Main** group: events always reflected in the ship log;
- **Sensors** group: events connected with the status of external sensors;
- **Network** group: events connected with the change of the network configuration status;
- **Charts** group: events connected with the changing chart collection;
- **Route** group: events connected with motion along the route and according to the schedule;
- **Alarms** group: events connected with alarm messages;
- **Layers** group: events connected with the chart object classes;
- **Settings** group: events connected with the ECDIS task settings made by the operator.

The **System Log** page of the **Logbook** panel on the ECDIS task screen can display any set of event parameters set in **Fields** window. The display of event groups (except the main group which is always displayed) is set in the **Filter** window.

Date	15-10-12	15-10-12	
Time	00:00:00(UTC)	00:00:00(UTC)	01:00
Event	ON HOUR	WATCH	
Primary Sensor	GPS 1	GPS 1	
Secondary Sensor	None	None	
L/L	58°56'630 N, 018°27'915 E	58°56'630 N, 018°27'915 E	58°56'630 N, 018°27'915 E
Offset L/L	00°00'000 N, 000°00'000 E	00°00'000 N, 000°00'000 E	00°00'000 N, 000°00'000 E
Prim/Sec Diverge			
COG - SOG	270.0°-9.0 kn	270.0°-9.0 kn	270.0°-9.0 kn
HDG - LOG	270.0°-9.0 kn	270.0°-9.0 kn	270.0°-9.0 kn
Average speed	0.0 kn	0.0 kn	0.0 kn
WatchDist-Log	0.0 nm-36.0 nm	0.0 nm-36.0 nm	0.0 nm-36.0 nm

A full set of parameters implies recording of all the relevant data in the table, if the set includes only part of parameters, then only part of them is recorded (see an example of the “START” event display on the drawing above).

With any of the event groups enabled for the display in the ship log (**Filter** window), the time when any event from this group occurs is recorded automatically on the own ship track which is being plotted. Therefore, to declutter the track display (remove superfluous data), it is advisable to turn off the event groups not required for the graphic display.

Contents of the Electronic Ship Log

The electronic ship logbook consists of the following groups:

- **Main** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
START	Full	Turning the ECDIS task on
STOP	Full	Turning the ECDIS task off
EVENT	Full	Event recording at the navigator's command
WATCH	Full	End of watch
TIME	Full	Automatic recording at the set time

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
GMT DAY	Full	Change of date by the UTC
TIME ZONE	Part	Change of time zone
WAY POINT	Full	Passing of a WPT
PRIMARY OFFSET ¹	Full	Information on the user entered offset to the ship position coordinates received from the positioning system

- **Sensors** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
SENSOR CONNECTION	Part	Connection of a navigation sensor
SENSOR DISCONNECTION	Part	Disconnection of a sensor

- **Network** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
CONNECT TO MASTER	Full	Connection to the MASTER station
DISCONNECT FROM MASTER	Full	Connection with the MASTER station lost

- **Charts** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
CHART COLLECTION CHANGED	Part	Any change in the chart collection

- **Route** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
LOAD ROUTE	Part	Loading of a passage route to be proceeded by in the Navigation mode
UNLOAD ROUTE	Part	Unloading of a route from the Navigation mode

¹ – event recorded with the “START” event.

- **Alarms** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
ALARM SET	Part	Alarm generation
ALARM RESET	Part	The safety parameter whose exceeded value caused this alarm generation, normalised
ALARM REACT	Part	Alarm acknowledged by the operator
ALARM ENABLE	Part	Monitoring of the safety parameter for the alarm generation enabled
ALARM DISABLE	Part	Monitoring of the safety parameter for the alarm generation disabled

- **Layers** group;

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
SET OFF object class	Part	Presentation of an individual object class of the additional information display turned off
SET ON object class	Part	Presentation of an individual object class of the additional information display turned on

- **Settings** group.

EVENT	SET OF DOCUMENTED PARAMETERS	NOTES
(Setting type) SET (function indicator position)	Part	Settings of the safety parameters and chart display (autoloading and scaling) made by the operator

Display of Electronic Ship Logbook in Data Tool Utility

The electronic system logbook data (**System Log Book/Traks/Targets** file group) is stored in the day folders DD-MM-YYYY, (where: DD – day; MM – month; YYYY – year).

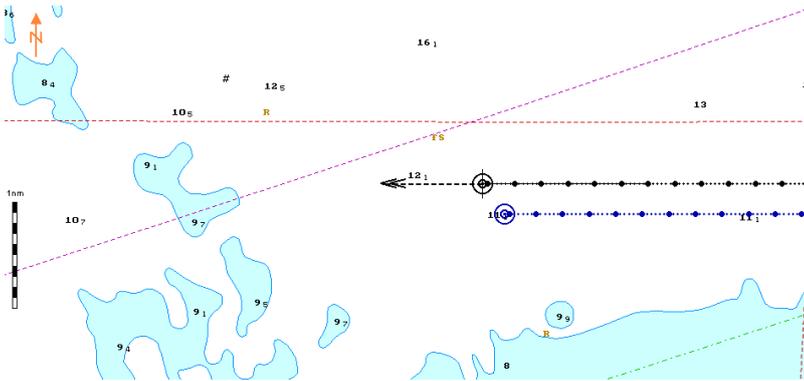
The following operations can be performed on these folders:

- copying onto the external carrier and the other way round;
- moving (these functions are available for the files more than 7 days old; up to this time, rows with the files are highlighted);
- deleting (these functions are available for the files more than 7 days old; up to this time, rows with the files are highlighted);
- converting to text format;
- viewing and printing out.

Own Ship Track

Display of Own Ship Track in ECDIS Task

The ECDIS task operation in the navigation mode implies the display of the own ship symbol on the screen, whilst the ECDIS task ship track plotting function, referred to as the own ship track function, serves for monitoring the ship motion. The track parameters are archived automatically:



The ship's primary track is reproduced from the archive data and provides the navigator with a set of data on the voyage history in an easy-to-read form. The archive data provides day files `InsTrack.trk`. Such files store information on the ship motion parameters and colour assigned to the tracks at each integer-valued minute, as well as the coordinates from the primary and secondary positioning systems every 10 seconds.

There is also a capability to concurrently record the detailed track; to do this, it is necessary to make appropriate settings in the System Configuration utility during the installation (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, section MFD Configuration, paragraph MFD Settings*). The Detailed Track records coordinates from the primary and secondary positioning systems every 1 second. Duration of the detailed track storage can be set from 5 to 15 days.

For the reproduction of information in the ECDIS task and the Play Back utility, there is a facility for the display of an archive track for the date selected from the list provided by the **Track history** function (**Track date** in the Play Back utility).

The operator can also select the displayed track plot interval. In this case, it is the detailed track available for the selected time interval which is played back first, and when it is over, the standard track is played back.

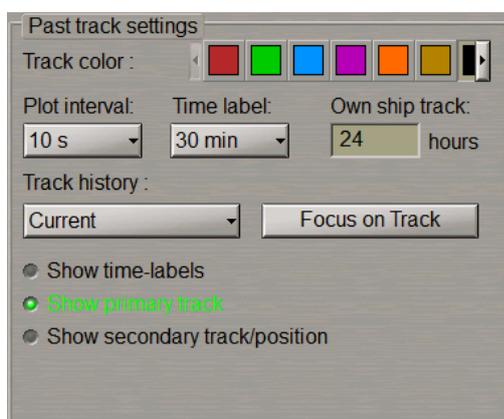
The own ship position and its motion parameters (HDG/STW/COG/SOG) are reconstructed from the day folder.

The display of the own ship track is static (points with archived coordinates are displayed).

Track Elements

A track displayed in the real time is created from the data of the file for the selected date and contains the following elements:

- Track colour allows different track segments to be shown in a certain colour assigned to this segment. It should be noted that the set colour will be used for the display of the track segment created after the colour is assigned via Track Colour function. The colour of the segment is determined during the voyage and remains unchanged;
- Track plot interval is distance of the track points from each other. The track may be displayed with a plot interval of 10 sec (by default) or 1 min at the user's choice. The selection is made via the Plot Interval function;
- Displayed track length: the ECDIS task screen displays the ship track with time tags corresponding to the events entered in the ship logbook in the specified period of time. A period from 1 hour to 24 hours can be set via the Own ship track function. If zero is set, the display of the track and time tags is stopped.



Display of Own Ship Track in Data Tool Utility

Ownship tracks (**System Log Book/Tracks/Targets** file group) are stored in the day folders DD-MM-YYYY, (where: DD – day; MM – month; YYYY – year).

The following operations can be performed on these folders:

- copying onto the external media and the other way round;
- moving (these functions are available for the files more than 7 days old; up to this time, rows with the files are highlighted in yellow);
- deleting (these functions are available for the files more than 7 days old; up to this time, rows with the files are highlighted in yellow).

Target Data

Archiving Target Tracks in MFD

Information on the targets' motion is displayed on the ECDIS task screen. For the saving of this information, day folders are created, where the targets' identifiers, coordinates and motion parameters are recorded over intervals set on the **Tracks** page in the System Configuration utility. 10, 20 and 60 seconds intervals can be set.

It should be noted that the recorded information reduces the free disk space on the computer which may be overfilled in case of a lengthy recording. The deleting of unnecessary files is performed in the Data Tool utility.

File Handling in Data Tool Utility

Target tracks (**System Log Book/Tracks/Targets** file group) are stored in the day folders DD–MM–YYYY, (where: DD – day; MM – month; YYYY – year).

The following operations can be performed on these folders:

- copying onto the external media and the other way round;
- moving (these functions are available for the files more than 7 days old; up to this time, rows with the files are highlighted);
- deleting (these functions are available for the files more than 7 days old; up to this time, rows with the files are highlighted).

Radar Overlay

Archiving Radar Picture in MFD

The radar image is supplied by the RIB hard and software module. The saving of the radar image depends on the recording interval set in the System Configuration utility (from 1 to 60 sec).



It is necessary to note that the recorded information takes up much space (memory) on the computer hard disk, which may become overfilled if a large recording duration is set.

The radar overlay recording duration is set from 1 to 5 days on the **Tracks** page of the **INS** panel in the System Configuration utility.

ATTENTION! To avoid data loss, the recording interval parameters may be automatically changed.

File Handling in Data Tool Utility

The radar image (**System Log Book/Tracks/Targets** file group) are stored in the day folders DD–MM–YYYY, (where: DD – day; MM – month; YYYY – year).

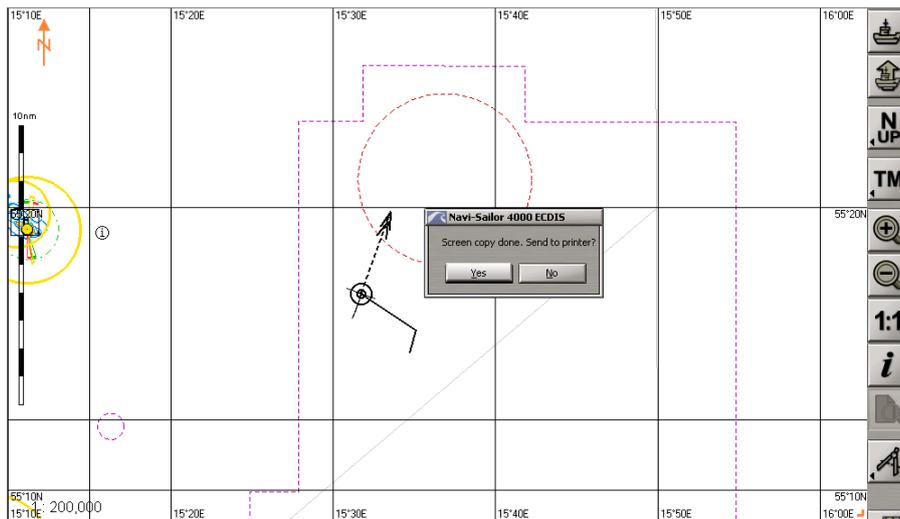
The following operations can be performed on these folders:

- copying onto the external media and the other way round;
- moving;
- deleting.

Log Book, Route and Screenshot Printout

Graphic Screen Copy

The instant recording of the screen graphic copy is obtained by using the <CTRL> + <P> hotkey combination. In the process, the screen copy is saved in YYYYMMDDTHHMMSS.png format (where, YYYY - years, MM - months, HH-hours, MM-minutes, SS-seconds, when the screenshot was made). The screen graphic copies are stored in the **Screenshot** feature in the Data Tool utility. The file can be exported for subsequent use with the aid of the Data Tool utility.



Printing Out Information

A facility for printing out some types of information has been provided for the documenting purposes. Some data can be printed out directly in the ECDIS task environment and the Play Back utility, other data is printed out via the Data Tool utility:

- The following data can be printed in the ECDIS task environment and in the Play Back utility:
 - ship logbook;
 - system logbook; with the use of the **Print** function, events and event parameters, loaded and displayed in the table as set by the operator, are printed out;
 - route; with the use of the **Print** function, data from the planned route table is printed out;
 - data of the received NAVTEX navigational warnings.
- The Data Tool utility allows the following groups of files to be printed out:
 - **log book** (printing out is possible after the electronic ship logbook file conversion to the text format);
 - **add info** (printing out is possible after the map file conversion to the text format);
 - **route** (printing out is possible after the route file conversion to the text format).

Navigation Databases

This chapter provides a description and formation principles of databases on tides, tidal and surface currents, as well as the algorithm for the reception and processing of weather forecasts.

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Tides and Tidal Currents

Information on Tides

The tides calculation in MFD is performed on the basis of four Main harmonics as well as shallow water corrections. The calculation process is based on the Simplified Harmonic Method of Tidal Predictions that can be found in different publications, for example Admiralty Tide Tables.

NOTE: Results of the method in use maybe slightly different from data in the published Admiralty Tide Tables or other prediction software, which can use more harmonic constituents; and the result may be expected to be greater.

This function allows the following to be displayed:

- Tidal curve specifying the tidal height (in metres and feet) depending on the time (local of ship time);
- Tidal level value which is set by the navigator proceeding from the ship draught and the minimum passage depth;
- Time intervals marked with vertical lines and highlighted with colour when the tidal height level is higher than the set one.

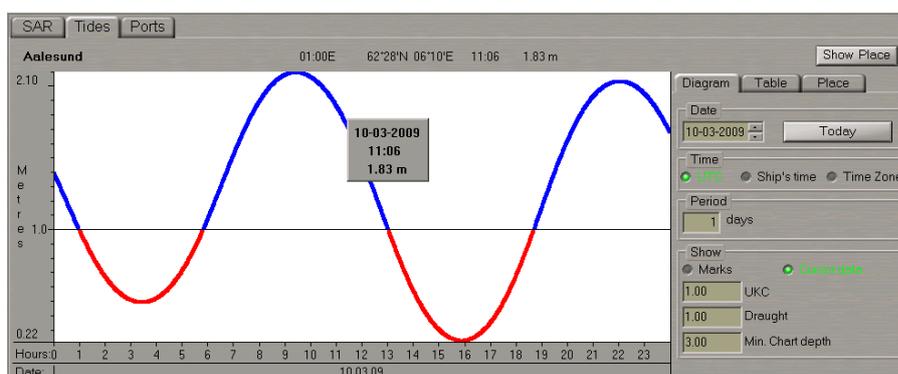
Information on tides is selected from the provided table by the reference point. To determine the closest reference points, it is necessary to set the radius of the area coverage (**By Choice** function) where the reference points are located, and to select the centre of the coverage circle by using the cursor (**Select**). As this is done, the table and the chart display the names of such points.

Place	Coordinates	Time Zone
Aalesund	62°28'N 06°10'E	01.00E
Abeiang Atoll	01°49'N 173°02'E	12.00E
Abashiri Ko	44°01'N 144°17'E	09.00E
Abbot Point	19°53'S 148°05'E	10.00E
Abemama	00°29'N 173°52'E	12.00E
Aber Benoit	48°35'N 04°37'W	01.00E
Aberdaron	52°48'N 04°43'W	00.00
Aberdeen	46°58'N 123°51'W	08.00W
ABERDEEN	57°09'N 02°05'W	00.00
Aberdovey	52°32'N 04°03'W	00.00
Aberporrh	52°08'N 04°33'W	00.00
Aberystwyth	52°24'N 04°05'W	00.00
Abidjan Entrance	05°15'N 03°60'W	00.00

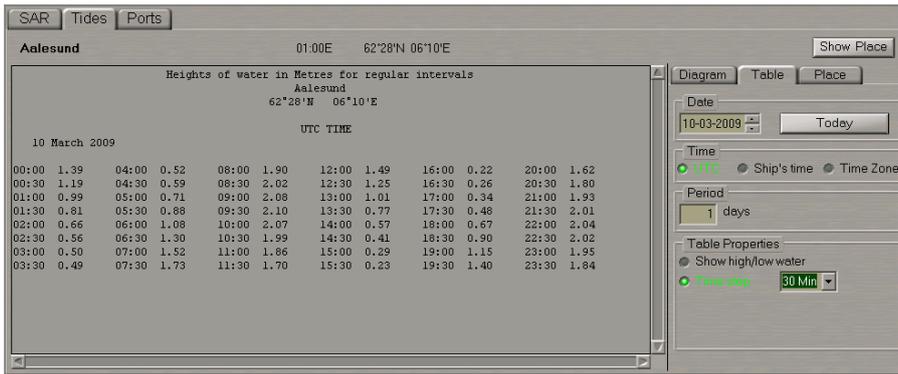
Data on the tides in the selected reference point is displayed in the graphic (**Diagram** tab) and text form (**Table** tab).

To determine the tidal height at any set time, use the following procedure:

- In case of a diagram – turn on Cursor data function, then on the curve use the up-and-down motion (of the trackball/mouse) to move the cursor to the required moment of time and get the reading of the tidal height in the additional information section:



- In case of a table – make a setting in the **Time Step** input box and select the tidal height calculations discretion:

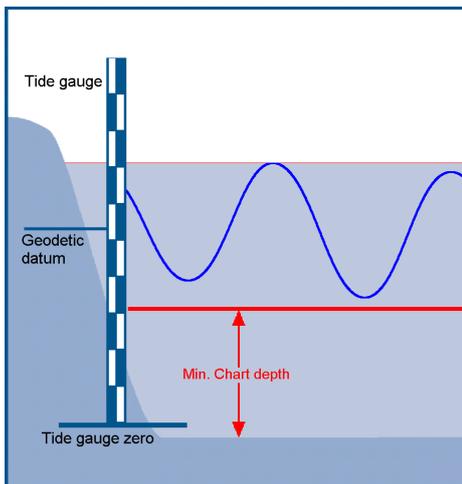


The following inequality is used for calculating the safe passage level:

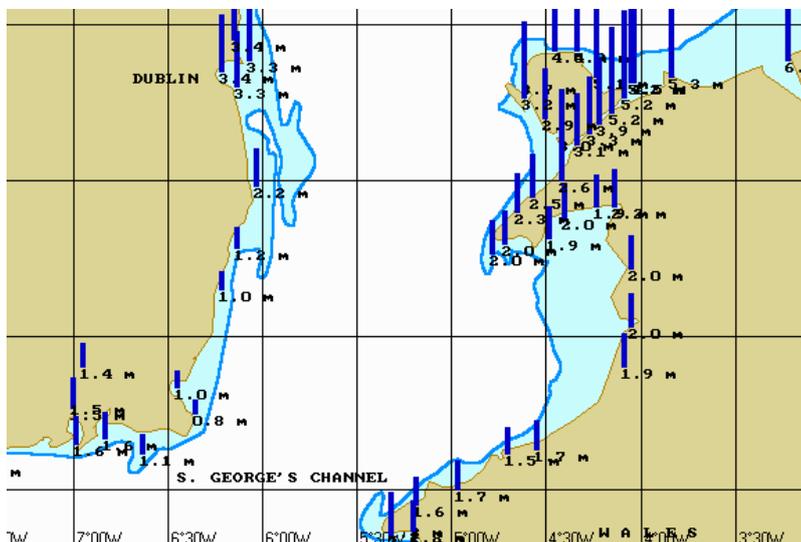
$$\text{Min. Chart depth} + \text{Tidal Height} > \text{Draught} + \text{UKC}$$

The **Min. Chart depth**, **Draught** and **UKC** values are set by the user, the **Tidal Height** is taken from the database. The safe passage level is shown in blue on the diagram, the dangerous passage level is shown in red.

Min. Chart depth is the actual chart sounding specified in the passage point.



Besides, the ECDIS task allows viewing the dynamics of changes in the tidal height in all the reference points available in the MFD database with an hour discretion (the **Animate** function on the Control Panel **Environment Data** display):



Information on Tidal Currents

The MFD tidal current database was generated on the basis of information provided on paper nautical charts, in the official editions of atlases and tables. In these publications, tidal current vectors for individual points of the sailing area covered by the given chart or table, are calculated for every hour.

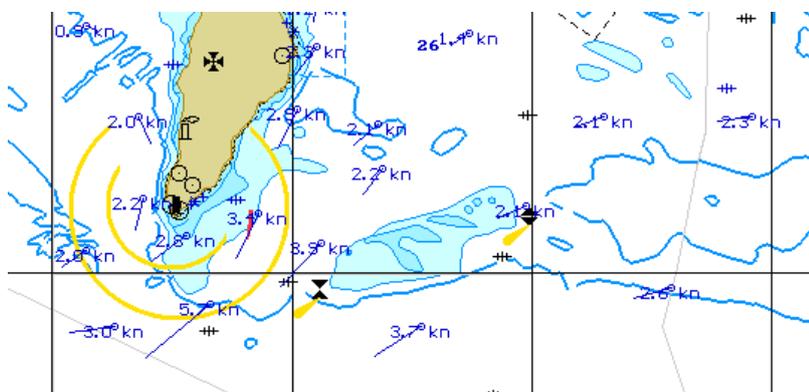
The ECDIS task features a capability to display vectors and take into account the tidal current effect (in the schedule calculations). Tidal current vectors are shown on the ECDIS task screen in dark blue colour. Vectors issue from the reference point whose coordinates and current parameters were taken from the aforementioned sources. For the current ship position, the effective current is determined by the interpolation between the closest reference points. The Control Panel **System Information** display shows the summary tidal and surface current:

System Information	
Drift	336.0° - 0.0 kn
Current	192.5° - 0.2 kn
SF CNT	30 m - 200 m
True wind	120.0° - 5.0 m/s
Rel. wind	094.5°(P) - 3.6 m/s
Water t°	18.0 °C
Depth	15.9 m
ECHOSOUNDER 1	
Tide height	
2.6 m	Ventnor

In addition to the display of current vectors for the current moment of time, the ECDIS task provides a capability to view the current change dynamics with a discretion of one hour (the **Animate** function on the Control Panel **Environment Data** display). It should be noted that the viewing of the tidal current change dynamics may be combined with the simultaneous display of tidal height change dynamics in all the reference points available in the MFD database.

To turn on the display of tidal current speed values, select the **Current Velocity Values** checkbox in the **Environment Data** display.

In this case, the speed values are displayed on scales of 1:400,000 and larger.



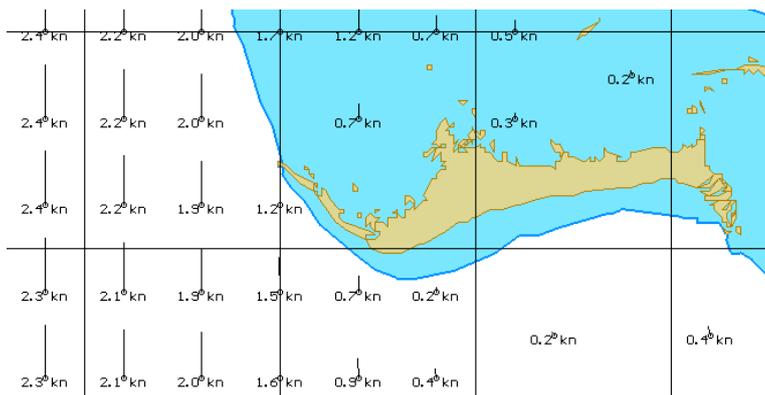
Surface Currents

Information on the surface current was generated from processing the primary (observed) data from the American National Ocean Data Centre (NODC and NOAA).

The ECDIS task features a capability to display vectors and take into account the surface current effect (in the schedule calculations). Surface current vectors are shown on the ECDIS task screen in black. Vectors issue from the reference point whose coordinates and current parameters were taken from the aforementioned sources. For the current ship position, the effective current is determined by the interpolation between the closest reference points. The Control Panel **System Information** display shows the summary tidal and surface current:

System Information	
Drift	336.0° - 0.0 kn
Current	192.5° - 0.2 kn
SF CNT	30 m - 200 m
True wind	120.0° - 5.0 m/s
Rel. wind	094.5°(P) - 3.6 m/s
Water t°	18.0 °C
Depth	15.9 m
ECHOSOUNDER 1	
Tide height	
2.6 m	Ventnor

In addition to the display of current vectors for the current moment of time, the ECDIS task provides a capability to view the current change dynamics with a discretion of one month (the **Animate** function on the Control Panel **Environment Data** display).



Ports

Information on ports is based on the document PUB 150, “World Port Index” published by the Defense Mapping Agency, USA. It should be noted that this is only approximate information, which does not necessarily include all the navigational and other features affecting the safety at sea, or the latest updates. To make any additions to this data, use the ECDIS task facility for maps and updating objects.

The screenshot shows the ECDIS task screen with the following information displayed:

- Port:** LIMERICK
- Country:** Ireland
- Region:** IRELAND
- Location:** 52°40' N 008°38' W
- General info tab:**
 - Harbour:** Type: river tide gate; Size: medium; Shelter: good
 - Pilotage:** Compulsory; Available; Advisable; Local assistance
 - Entrance restrictions:**
 - Depths: Main channel: 1.8 m - 3.0 m; Cargo piers: 1.8 m - 3.0 m; Oil terminal: 12.4 m - 13.7 m; Anchorage: 6.4 m - 7.6 m
 - Mean level of tide: 4.3 m; Max. size vessel: over 152 m in length
 - Tide; Swell; Ice; Other; Ovh'd. Lis.
 - Formalities:** ETA message; 1st port of entry; Wharves; Anchor; Med moor; Beach moor; Ice moor
 - Quarantine:** Derat certificate; Pratique
 - Load/offload:** Anchor; Med moor; Beach moor; Ice moor
 - Tugs:** Salvage; Assist

Information on the selected port is displayed in a window in the bottom part of the ECDIS task screen, and contains the following information:

- Name of the port, country and area which the port belongs to (in the top line of the information window);
- **Location** – port location;
- **General info** tab contains the following groups of data:
 - **Harbour** – harbour type and size;
 - **Pilotage** – the necessity or advisability of taking a pilot;
 - **Entrance restrictions** – list of natural factors restricting the vessels' entrance;
 - **Formalities** – port formalities;
 - **Load/offload** – cargo handling operations;
 - **Quarantine** – quarantine procedures and documents;
 - **Tugs** – the availability the tugs for docking or anchorage assistance.
- **Facilities & services** tab contains the following groups of data:
 - **Communications** – available communications;
 - **Services** – port services provided ;
 - **Cranes & Lifts** – availability of cranes and their type, and their lifting power in tons;
 - **Supplies** – availability of provisions, water and fuel oil;
 - **Other** – other information.

NAVTEX Messages

General

WARNING! The **Navtex** panel of the ECDIS task which the NAVTEX functionality is handled from, is not available unless this option is licensed and its correct configuring has been made in the System Configuration utility (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I*).

The MFD allows real-time reception and processing of text messages from the NAVTEX receiver. The automatic processing allows the coordinates to be extracted from the text message, and this position to be displayed on the electronic chart.

The following functions are performed:

- Reception of messages sent from the NAVTEX receiver to the MFD serial port in ASCII and NMEA format compatible with IEC 61097-6, Second Edition, 2005-12 (for the message format see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 4, section NAVTEX Sensor Data Exchange Format*);
- Archiving of NAVTEX messages in the NAVTEX messages database on the each WS; the database synchronising is performed automatically on all the workstations;
- Readout of information from the database, filtering and formation of the Message Table;
- Display of a particular message in the viewing window by selecting it:
 - From the message table;
 - By “MSI” symbol (NAVTEX message symbol) displayed in the ECDIS task screen and viewing of information contained in NAVTEX messages with the use of the **Info** functionality.
- User updating of coordinates contained in the messages;
- ECDIS task chart area display of a symbol in the coordinates specified in the message;
- Message printout;
- NAVTEX receiver alarm management (see *Chapter 4, section Main Alerts Generation Principles*, paragraph *Safety Alerts*).

NAVTEX Messages Database

In the MFD, the NAVTEX messages database is available in each WS and is automatically synchronised on all the WS's. If the **Update Database** button is pressed, a certain time interval (from 5 to 60 min) later these databases are automatically updated. This time interval is set in the System Configuration utility on the **Navtex** panel in the **Device polling timeout** input window. By making comparison with the NAVTEX receiver database and adding missing messages, perform the updating. Some NAVTEX receivers have a function for the automatic relay of new messages; in this case, new NAVTEX messages will be sent to the MFD even with the **Update Database** button released.

Special attention should be paid to the **Navtex Out Monitor** function, which is turned on by using the button with the same name. This function allows all the received messages to be requested from the NAVTEX receiver, regardless of the filter settings in the NAVTEX receiver itself. If the filter settings have been changed in the NAVTEX receiver, the button is released automatically, and it should be pressed again to avoid losing part of the messages.

Messages are deleted from the database in the manual mode by pressing the **Delete** button. It is also possible to delete all the messages received before some moment of time with the aid of the **Delete till** button. The time specified in the box to the right of this button. After the deleting of messages, databases in all the WS's are synchronised:

The screenshot shows the Navi-Sailor 4000 ECDIS interface. At the top, there are buttons for 'Update Database', 'Navtex Out Monitor', 'Delete', 'Delete till: 06-12-06 11:56', 'To PDF', and 'Print'. Below these are filter settings: 'Filter: ON', 'Stations', 'Subjects', 'Max error rate = 100%', and a 'Find' button. The main area is a table with columns: Date Time, Stn, Subj, Freq, Serial Num, Text, Err. Rate, and Status. The table contains several rows of messages, with one row highlighted in green. Below the table, there is a section for 'Received: 22.11.06 11:29:24' with 'Subject: L - navigational warnings - additional to letter A' and 'Station: C'. To the right of this section are radio buttons for 'Polygon', 'Examined', 'Danger' (selected), and 'Protected', along with an 'Apply' button. Below this is a table with columns 'Latitude' and 'Longitude', containing the values '1 45° 01.000 N' and '035° 23.000 E'. At the bottom of this section are 'Add', 'Delete', and 'Highlight' buttons.

▲	Date Time	Stn	Subj	Freq	Serial Num	Text	Err. Rate	Status
!	22.11.06 11:28:14	A	A	490	30	091729 LMT EKIM 06 SAMSUN TURK RADIO	1 %	
!	22.11.06 11:29:24	C	L	490	34	131730 UTC NOV 06 UKRAINE COASTAL WARNING 613/06 ODESA	0 %	
!	22.11.06 11:29:44	C	L	490	15	031430 UTC NOV 06 UKRAINE COASTAL WARNING *TIJ**EZ**ZESA	1 %	
!	22.11.06 11:29:54	C	A	490	73	070500 UTC OCT 06 UKRAINE COASTAL WARNING 533*06 ODESA	1 %	

Received: 22.11.06 11:29:24
Subject: L - navigational warnings - additional to letter A Station: C

	Latitude	Longitude
1	45° 01.000 N	035° 23.000 E

NAVTEX messages from the database are displayed in the Message Table on the **Navtex** panel. The use of the filter allows displaying messages in accordance with the set filter parameters.

The following message filtering parameters can be set in the **Filter** row for the display in the database:

- Permission to display messages selected by the NAVTEX stations;
- Permission to display the selected message subjects (NAVTEX messages of a certain type: navigational warnings, meteorological warnings, ice reports, etc.); messages with the following subjects will always be displayed regardless of the filter settings:
 - A – navigational warnings;
 - B – meteorological warnings;
 - D – SAR messages;
 - L – navigational warnings in addition to those under “A”.
- Permission to display messages selected by the error rate.

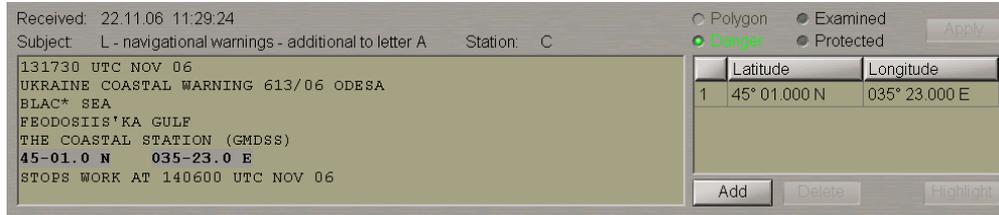
To select messages received (due to inadequate reception) with a large number of errors, the **Max error rate** in the received message is required to be set. Messages whose reception error per cent exceeds this value are not displayed. Setting of the maximum error per cent at 100% means the display of all the messages.

For the operator's convenience, messages can be sorted. Using the buttons with column names in the Message Table performs the message sorting. This function allows the following types of sorting:

- By “Danger” attribute – all the messages in the table are sorted by the availability or absence of the “Danger” attribute;
- By date and time – all the messages in the table are sorted by the reception dates and time;
- By station – all the messages in the table are sorted by stations; messages received from a single station are sorted by types; messages from a single station and of a single type are sorted by numbers (from the message heading);
- By subject – all the messages in the table are sorted by subjects;
- By frequency – all the messages in the table are sorted by frequency which they were received on (for NMEA NAVTEX only);
- By serial number – all the messages in the table are sorted by serial numbers (from the message heading);
- By status – all the messages in the table are sorted by their status (“Protected” or not).

NAVTEX Messages Viewing and Editing

The MFD features a capability to view a NAVTEX message, and also to edit it: to correct coordinates sent in the messages and to change the message status:



After the message has been displayed in the viewing window, it becomes possible to change the NAVTEX message status.

The selected **Examined** checkbox **Examined** means that the user has read the text of this message. Messages with the “Examined” status are shown in the Message Table in regular fonts, otherwise in the bold fonts.

The selected **Protected** checkbox **Protected** means that the user has protected this message. In this case, the word “Protected” is shown in the **Status** column of the Message Table. This kind of message cannot be deleted from the database.

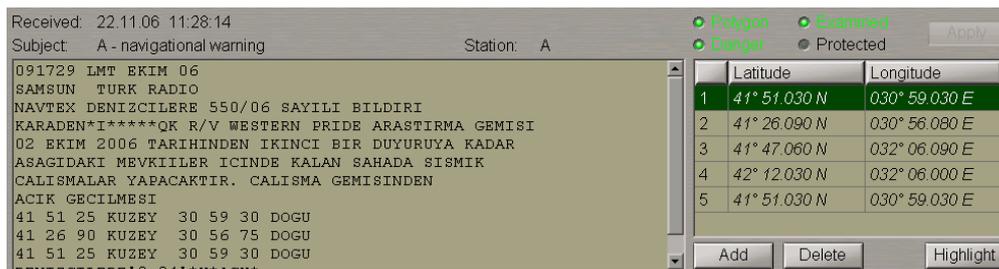
In addition to the status, the NAVTEX message can have “Danger” and “Polygon” attributes which affect alarm generation. In this case, only positions with the “Danger” attribute are processed. This attribute is assigned via the **Danger** function in the **Navtex** panel. By default, this attribute is assigned to all messages, which contain valid coordinates. In this case, position, extracted from the message, is processed in the MFD as a danger to navigation. Therefore, when the message symbol is approached at a distance determined by the safety parameter, the **Nav. Danger** alert is generated (see *Chapter 4, section Main Alerts Generation Principles*, paragraph *Safety Alerts*).

The user can assign the “Polygon” attribute to a NAVTEX message, which contains more than one pair of coordinates. All the NAVTEX symbols available in this message are connected successively with a line. If the “Approach to area” vector crosses this line, the **NAVTEX polygon** warning appears. The triggering off of this warning can also be turned on in the **Additional Areas** window on the **Navigational Alarms** page of the **Monitoring** panel (see *Chapter 4, section Main Alerts Generation Principles*, paragraph *Safety Alerts*).

The received valid coordinates from NAVTEX messages which are processed in the MFD, are highlighted in the message text and are shown to the right of the message in a special window. If the coordinates are received with errors (“*” symbols), which can be corrected (e.g., errors are insignificant or there are additional data sources), the ECDIS task has a capability to edit them. The following operations can be performed:

- Editing of coordinate values; at this stage the coordinate value in the table is shown in italic indicating that the field has been edited by the user;
- Adding of a new symbol position in the message text, a new pair of coordinates is shown in italic indicating that the field has been edited by the user;
- Deleting a symbol position.

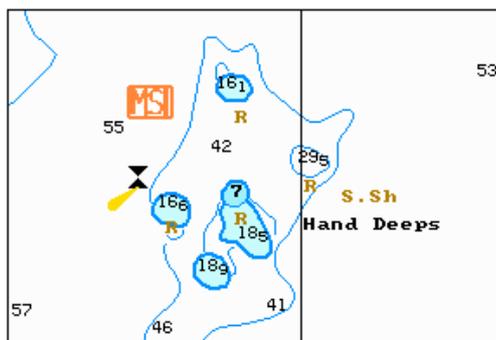
The example below shows edited coordinates which were supplied by the NAVTEX message in an incorrect form:



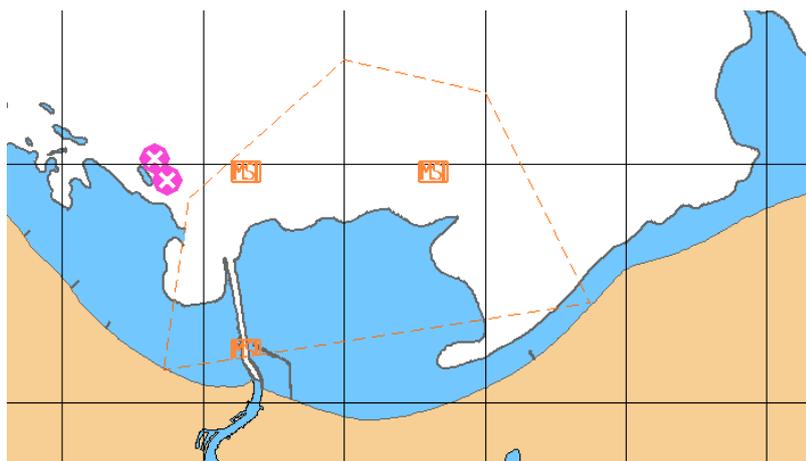
After the editing of selected coordinates is completed, it is necessary to confirm the changes you have made by pressing **Apply**: the updating information will be saved in the NAVTEX message database.

Position Display on an Electronic Chart

It should be noted that the ECDIS task allows positions whose coordinates are contained in a message to be displayed on the electronic chart, and to be shown in the form of orange coloured “MSI” symbol – NAVTEX message symbol.



If a message contains several coordinate pairs, it is possible to present them on the electronic chart in the form of a polygon (positions are connected with lines). This capability is implemented via the **Polygon** function of the **Navtex** panel. An example of such polygon is shown in the figure below:



The ECDIS task features a capability to view the text of the message whose position is displayed on the electronic chart. This functionality is implemented via the Info function (see *Chapter 1, section Info*):



Radar Overlay and Targets in the ECDIS Task

This chapter provides a description of the ECDIS task capabilities in handling the radar picture and targets.

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Radar Overlay

If there are two scanners connected to MFD network configuration, you can select the display of a radar picture from any of them:



There are some limitations in the selection of a radar picture source. E.g., if a station with the ECDIS task is connected to several scanners, the ECDIS task screen can only display the radar picture from the running scanner. If the scanner is set to the STANDBY mode, it becomes possible to display a radar picture from another scanner.

Some of the radar functions are controlled by the operator on the Control Panel **Radar Settings** display:



The following parameters can be changed:

- Radius of an area within which the radar picture is formed (**Range**). The area radius is selected. This radius can be arbitrarily set by the operator. The following range scales can be set: 0.25 mile, 0.5 mile, 0.75 mile, 1.5 mile, 3 miles, 6 miles, 12 miles, 24 miles, 48 miles. The setting does not depend on the range selection on the scanner;
- Fixed range rings (**Rings**) are set with regard to the radius of the radar picture formation area (**Range**) with the following values:

RANGE AREA VALUES (NM)	DISCRETION OF THE RANGE RINGS DISPLAY (NM)
0–2	0.5
2–6	1
6–12	2
12–24	4
24–48	8

The following radar picture parameters are set on the **Radar Settings** display:

- Radar picture transparency (**Transparency**). This is set to enable the display of electronic chart features under the radar picture layer. Transparency levels from “0” – opaque, to “3” – almost transparent, are provided. As the “Standard display” is selected on the ES6 keyboard, transparency is automatically set to “2”:



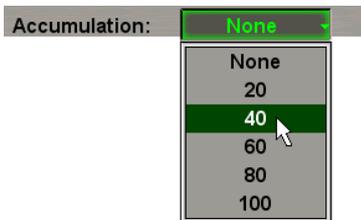
- Parameters of an area on the screen within which the radar picture will be displayed (**Overlay window**). The operator sets a rectangular area which will delineate the radar picture:



- Radar picture display colour (**Echo color**). One of the three colours can be set: green, yellow or red:



- Radar picture scan-to-scan correlation and smoothing out mode (**Accumulation**). This is set for its clearer and more contrast display on the screen. It is not advisable to use this function in case of a considerable ship yaw and on the routes connected with active manoeuvring:



ARPA

The ECDIS task allows the display of an ARPA target from two external ARPA’s which information on is provided in the TTM sentences, and the acquisition and processing of a radar target from the radar picture.

The ARPA targets received from ARPA-A/ARPA-B are displayed in the ECDIS task only with different identifiers containing the source index and number. Targets received from and tracked by the ARPA are identified as follows:

- “A” index – targets received from the ARPA connected on ARPA-A channel;
- “B” index – targets received from the ARPA connected on ARPA-B channel.

ARPA targets are handled on the **Acquisition** page of the Control Panel **Targets** display:



The following functions are used for handling ARPA targets on the given WS:

- **Acquire** – to call the cursor for target acquisition; after the target acquisition, it's motion parameters are shown on the Chart panel and in the target table;
- **Cancel** – to call the cursor for canceling the target acquisition; after the target acquisition cancelling, its motion parameters are not shown any more;
- **Cancel All** – to cancel acquisition of all targets on the ECDIS task screen:



- **Guard Zone 1, Guard Zone 2** – to set the guard zone manually; as the target enters such zone, this target is automatically shown on the screen, and its parameters in a table (after its exit from the zone, the display remains):



- **Enable "Lost tgt" warning** – to set the range and turn on the filter for the **Lost target** warning generation:



With the filter turned on, the warning is only generated for lost ARPA and active AIS targets within the circle of a set radius.

Display and Naming of ARPA Targets

Symbols of ARPA targets are displayed on the ECDIS task screen in accordance with the following rules:

- Acquired targets are shown in the form of a dashed line circle centered in the target acquisition position ;
- Steadily tracked targets are shown as green coloured thick solid line circles 3 mm in diameter (with the radar picture display ON, ARPA targets are shown in green) .

An acquired target is automatically given an ID number. The numbering starts with 1. Every new target is given the next number (the maximum is 80). If a target is lost, some unoccupied numbers appear, which are then not assigned to new targets until the maximum number is reached.

If the number of targets exceeds 95% of the maximum number of targets, the **95% ARPA capacity** caution is generated (for alerts description see *Chapter 4, section Main Alerts Generation Principles, paragraph Target Alerts*).

With the number of targets decreasing to less than 85%, this caution disappears.

If the number of targets exceeds the maximum, the **100 % ARPA capacity** warning is generated.

Handling of ARPA-acquired targets includes display of all the tracked targets on the ECDIS task screen and display of their parameters in the **Target table** page of the **Targets** panel.

ARPA targets acquired and processed in the ECDIS task have a number only, without any index.

ARPA targets received from ARPA-A are displayed in the ECDIS task with different identifiers containing the source index and number. Targets received from the ARPA connected on ARPA-A channel are identified with "A" index and targets received from ARPA-B are identified with "B".

ATTENTION! ARPA targets received from ARPA-A and ARPA-B are only displayed in the ECDIS task, and are not covered by alerts generated for targets processed in the MFD. For these ARPA targets (ARPA_A, ARPA_B) CPA/TCPA alerts can't be triggered. No danger status for such a target is displayed.

Dangerous ARPA Targets

Considered dangerous are CPA/TCPA values, which are simultaneously equal to or smaller than safe CPA/TCPA value set by the user on the **Targets** panel. As a dangerous target appears, the **Wxx CPA/TCPA Tgt ID** alarm is generated.

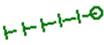
WARNING! The **Wxx CPA/TCPA Tgt ID** alarm can be triggered by RADAR task (Navi-Radar 4000 application) only. This alarm generation doesn't depend on radar scanner current mode (TX/Standby/Failure). If the RADAR task is not available (has not started), the **Wxx CPA/TCPA Tgt ID** alarm cannot be triggered.

The symbol of a dangerous target is a red coloured 5 mm diameter circle .

The dangerous target symbol is flashing until the **Wxx CPA/TCPA Tgt ID** alarm is acknowledged.

ARPA Targets Vectors

Vectors indicate the projected direction and speed of a tracked target. The end of the target vector shows where that target will be in "n" minutes (where "n" stands for the vector time set in the **Vectors** combo box in the **Operational Panel** window of the Control panel) if the target maintains the current speed and course.

Vectors of ARPA targets are displayed automatically for all the acquired targets . The minute notch is not shown unless a certain vector length is set.

Vectors are shown in green colour. Vectors of dangerous targets are shown in the red colour.

Guard Zones

Two guard zones can be defined. Parameters of the Guard Zones are counted from the scanner. The user can set the dimensions of these zones. The following limitations are imposed in this case:

- Distance to the inner boundary of the Guard Zone shall not be less than 0.1 mile;
- Guard Zone dimensions shall not be less than 5° by angle and less than 0.5 miles by width.

As a target enters a guard zone, the **Wxx GZ Tgt ID** warning is generated. Before the alarm acknowledgement, ARPA targets are shown as follows:

- Radar targets in acquisition state acquired automatically in the Guard zone, are shown as a flashing red 5 mm diameter dashed line circle. 
- Steadily tracked targets acquired automatically in the Guard zone, are shown as a flashing red 3 mm diameter thick solid line circle. 
- Steadily tracked targets in the Guard Zone, are shown as a flashing 3 mm diameter thick solid line circle. 

The symbol is flashing until **Wxx GZ Tgt ID** warning is acknowledged.

Boundaries of the ring shaped zones are set by using the cursor. There may be the following setting options:

- Change of the ring width;
- Circular motion of the zone relative to the own ship mark (without changes in the dimensions or shape);
- Change of the coverage angle;
- Moving the zone closer to or farther from the own ship mark (with a change of the zone width).

Lost Targets

Tracking is cancelled, and the target is considered to be lost according to the following algorithm:

- Up to 1 minute after the acquisition – target missed 6 times;
- From 1 to 3 minutes after the acquisition – target missed 11 times;
- 3 and more minutes after the acquisition – target missed 18 times.

A lost target is shown as red coloured crossed lines centred in the target symbol .

With the **Enable "Lost tgt" warning** checkbox cleared, ARPA targets stop to be displayed on the ECDIS task screen immediately after the timeout expiry.

With the **Enable "Lost tgt" warning** checkbox selected, ARPA targets which are not within the circle of a radius specified in the filter settings, stop to be displayed on the ECDIS task screen immediately after the timeout expiry. Applicable to the ARPA targets within the circle, after 30 seconds the timeout expiry, or after the warning acknowledgement, the display of the ARPA lost target is stopped.

AIS

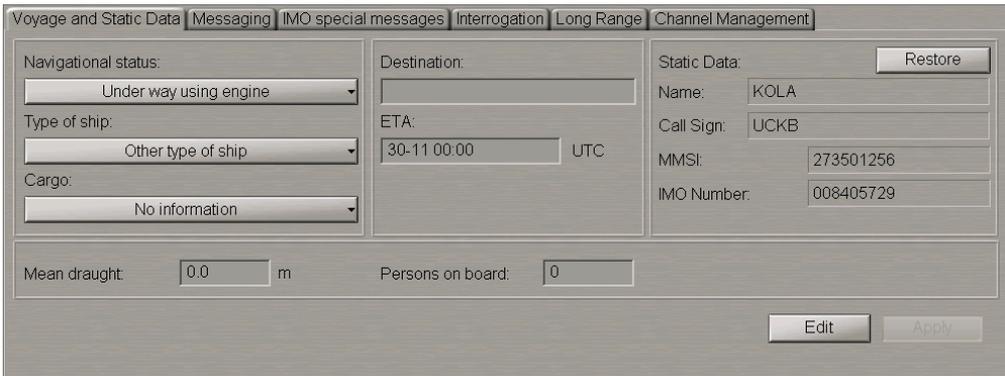
AIS Transponder Interface

AIS (Automatic Identification System) is used for the automatic data exchange with ships and various coastal objects fitted out with this system, via the VHF channel.

Interfacing of this device with the MFD produces the following capabilities:

- To receive and display data on other targets using the AIS (coordinates, name, MMSI, IMO number, ship's navigation status, ship's type and nature of cargo, speed, etc.);
- To receive and display additional data transmitted by ships and coastal AIS;
- To transmit own ship data (coordinates, name, MMSI and IMO number, type of cargo, type and navigation status of the ship, course, speed, etc.);
- To transmit messages with different status to other AIS system objects.

Own ship information transmitted to other AIS system ships, is displayed on the **Voyage and Static Data** page:



Voyage and Static Data		Messaging		IMO special messages		Interrogation		Long Range		Channel Management	
Navigational status: Under way using engine		Destination: 		Static Data: Name: KOLA		Call Sign: UCKB		MMSI: 273501256		IMO Number: 008405729	
Type of ship: Other type of ship		ETA: 30-11 00:00 UTC		Restore							
Cargo: No information											
Mean draught: 0.0 m		Persons on board: 0									
										Edit Apply	

In the **Static Data** group, ship data is provided for reference and cannot be changed.

Messages are compiled and sent on the **Messaging** page of the **AIS** panel.

NOTE: If the AIS class B is selected during the installation the set of possible settings is limited.

Display of AIS Targets

The MFD processes and displays “Vessels class A&B” type AIS targets only (VDM 1, 2, 3, 5, 18, 19, 24 sentences); information on these targets is received by the AIS transponder without any limitations. These targets transmit information with the intervals specified in the following tables.

Class A shipborne mobile equipment reporting intervals:

TYPE OF SHIP	REPORTING INTERVAL
Ship at anchor or moored and not moving faster than 3 knots	3 min
Ship at anchor or moored and moving faster than 3 knots	10 sec
Ship with a speed of between 0–14 knots	10 sec
Ship with a speed of between 0–14 knots and changing course	3 1/3 sec
Ship with a speed of between 14–23 knots	6 sec
Ship with a speed of between 14–23 knots and changing course	2 sec
Ship with a speed of over 23 knots	2 sec
Ship with a speed of over 23 knots and changing course	2 sec

Reporting intervals for equipment other than class A shipborne mobile equipment:

PLATFORM'S CONDITION	NOMINAL REPORTING INTERVAL
Class B Shipborne Mobile Equipment moving not faster than 2 knots	3 min
Class B Shipborne Mobile Equipment moving at 2–14 knots	30 sec
Class B Shipborne Mobile Equipment moving at 14–23 knots	15 sec
Class B Shipborne Mobile Equipment moving at > 23 knots	5 sec
Search and Rescue aircraft (airborne mobile equipment)	10 sec
Aids to Navigation	3 min
AIS base station	10 sec

These targets are not displayed unless the own ship coordinates are available (Lat/Lon), as AIS target position is referenced to the absolute geographic coordinates.

ATTENTION! Up to 1024 AIS targets can be processed simultaneously. AIS targets are processed in turn, so there may be a loss of a target due to the excessive traffic.

If the number of targets exceeds 95% of the maximum number, the **95% AIS capacity** caution is generated (for alerts description see *Chapter 4, section Main Alerts Generation Principles, paragraph Target Alerts*).

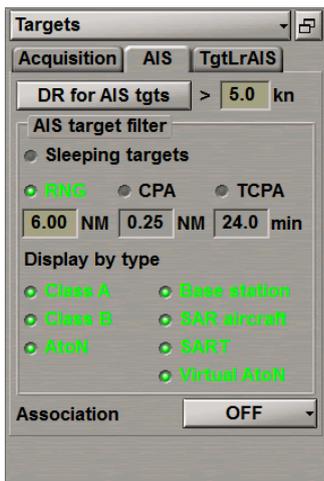
With the number of targets decreasing to less than 85%, this caution disappears.

If the number of targets exceeds the maximum number, the **100% AIS capacity** warning is generated.

After this warning has been triggered off, the operator can decrease the AIS targets processing radius (see document *Multifunctional Display (v. 3.02.350). ECDIS User Manual, Chapter 10, section AIS, paragraph Handling AIS Targets, item AIS Target Display*), thus reducing the number of the processed AIS targets.

Different filters are used for reducing the number of displayed targets.

The filter is controlled from the **AIS** page of the **Targets** panel.



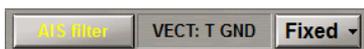
By default, the filter for sleeping AIS targets is OFF. It is possible to select criteria for filtering sleeping AIS targets which will not be displayed on the PPI:

- **RNG** – to filter targets beyond the user set limits;
- **CPA** – to filter targets whose CPA is larger than the user-set value;
- **TCPA** – to filter targets whose TCPA is larger than the user-set value.

You can also use the **Display by type** group to turn off presentation of the EDIS task screen (which is turned on by default) for the following AIS target types:

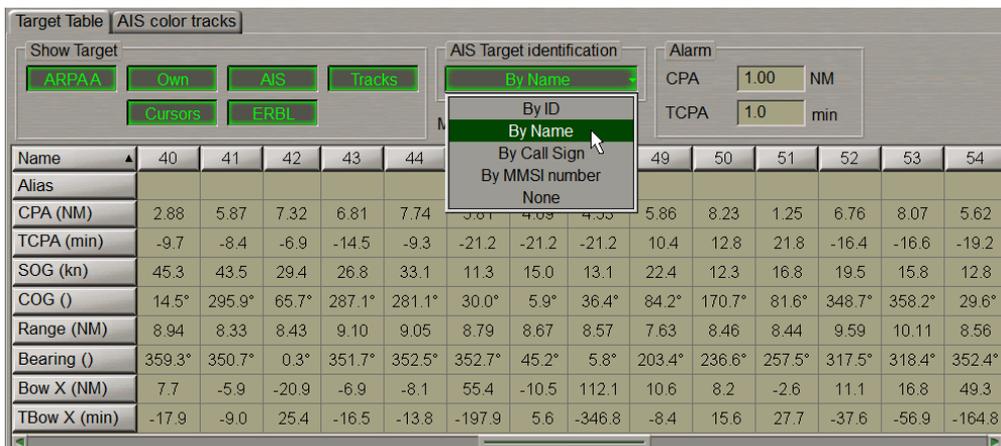
- Class A;
- Class B;
- AtoN;
- Base station;
- SAR aircraft;
- SART;
- Virtual AtoN.

If the sleeping AIS targets filtering is enabled, or the display of some AIS targets type is turned off, the **AIS filter** important indication is displayed in the **Vectors** window of the Control Panel (see also document *Multifunctional Display (v. 3.02.350). Functional Description, Chapter 4, section Indications, paragraph Display of Important Indications*).



WARNING! It should be noted that dangerous AIS targets can also be filtered off for display with the aid of the AIS filter. Nevertheless, the **Wxx CPA/TCPA Tgt ID** alarm will be generated for AIS targets.

Targets received from the AIS are displayed in the ECDIS task with identifiers which can be selected by the operator on the **Targets Table** page of the **Targets** panel.



The following types of identifiers are available:

- By ID;
- By MMSI number;
- By Call Sign;
- By Name.

Naming of AIS Targets

Targets are named in accordance with the same rules as ARPA targets. The name of an AIS target is formed of the 'T' prefix (from transponder) and its unique identifier, i.e., T1, T2, T10, etc.

AIS Target Symbol Types, Orientation

AIS targets are displayed on the ECDIS task screen according to the following rules:

- Sleeping AIS targets are presented as acute isosceles triangles oriented along the targets' reported heading (or COG if heading is not reported) and centred in the targets' reported positions. The triangle base is 3 mm and the height is 4.5 mm. The triangles are drawn using a thick solid green line. 
- Sleeping AIS targets with neither a reported heading nor COG are shown as dashed-line green coloured triangles oriented toward the top of the operational display area. 
- Activated AIS targets are presented as acute isosceles triangles oriented along the targets' reported heading (or COG if heading is not reported) and centred in the targets' reported positions. The triangle base is 4 mm and the height is 6 mm. The triangles are drawn using a thick solid green line. 
- If information on AIS target dimensions is available, and the current scale permitting (the appropriate range scale is selected), AIS targets are shown in the form of a ship contour. Ship contours are drawn around the AIS target symbol triangles relative to the targets' reported position according to the offsets, beam and length. The contour is drawn using a thick solid green line. 
- If there is no information on the target's COG/SOG vector or the own ship's COG/SOG vector affecting the CPA/TCPA calculations, the AIS targets are shown as a dashed-line green coloured triangle (contour) oriented toward the top of the operational display area. 
- AIS aids to navigation (ATON) are presented as green diamonds with crossed lines centred in the reported ATON position. 
- A virtual AIS ATON has the green letter 'V' superimposed on the symbol so that it does not extend beyond the diamond and does not intersect with the crossed lines. 
- An AIS search and rescue transmitter (AISSART) is drawn as a green circle with a cross. 

AIS aids to navigation symbols:

AIS ATON	PHYSICAL	VIRTUAL
• Basic shape;		
• Racon;		
• Emergency wreck mark;		

AIS ATON	PHYSICAL	VIRTUAL
• North cardinal mark;		
• East cardinal mark		
• South cardinal mark		
• West cardinal mark		
• Port hand mark		
• Starboard hand mark		
• Isolated danger		
• Safe water		
• Special mark		
• Off position (AIS AtoN indicates off position of floating aid with yellow text "Off Posn")	Off Posn 	
• The absence of a charted physical AtoN is communicated as a combined state of 'virtual' and 'off position'. This is indicated with yellow text "Missing" above the dotted outline diamond using yellow colour.		Missing

Target symbols are oriented along the ship's valid gyro heading (HDG), and where the HDG is not available, along the ship's valid course over the ground (COG).

Activated and Non-Activated AIS Targets

All the AIS targets displayed on the ECDIS task screen (including dangerous targets) are considered non-active (sleeping) from the moment they are first displayed on the screen.

Sleeping targets are displayed in the form of an appropriate symbol without vectors.

The user can activate any displayed AIS target. The target is considered to be activated until:

- It is deactivated manually by the user;
- It is lost (in this case, if new data on the lost target arrived before its deleting, the target is considered to be active again).

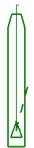
Active AIS targets are displayed as an appropriate symbol and vectors. Vectors are not displayed unless there is relevant valid data.

Heading lines originate in the apex of the AIS triangle. Turn indicators are presented as a single line perpendicular to the heading line in the direction of turn.



The COG/SOG vector is shown with a dashed line whose length depends on the selected vector length value (in minutes).

When an AIS target is shown as a ship contour, vectors originate in its AIS antenna fixing point (ABCD parameters).



The previously activated target can be switched to sleeping/non-active status.

The filter on the **Acquisition** page of the **Targets** panel is used for the automatic activation of targets.



By default, the filter for activation of sleeping AIS targets is OFF. It is possible to select criteria for sleeping AIS targets activation:

- **RNG** – to activate AIS targets beyond the user set limits;
- **CPA** – to activate AIS targets whose CPA is larger than the value set by the user;
- **TCPA** – to activate AIS targets whose TCPA is larger than the value set by the user.

Dangerous AIS Targets

Considered dangerous are targets whose CPA/TCPA values, both, are equal to or smaller than CPA/TCPA safe values set by the user in the **Alarm** group on the **Target Table** page of the **Targets** panel.

As soon as the CPA/TCPA values become smaller than the settings, **CPA/TCPA AIS Target ID** alarm is generated.

WARNING! The **CPA/TCPA AIS Target ID** alarm can be triggered by RADAR task (Navi-Radar 4000 application) only. This alarm generation doesn't depend on radar scanner current mode (TX/Standby/Failure). If the RADAR task is not available (has not started), the **CPA/TCPA AIS Target ID** alarm cannot be triggered. If there is no licensed Navi-Radar 4000 application (License option OID=561 is OFF) no **CPA/TCPA AIS Target ID** alarm can be triggered (see *Chapter 4*, section *Main Alert Generation Principles*, paragraph *General*).

Each new dangerous target causes the alarm to be triggered off anew.

The symbol (contour) of a dangerous target is always shown as a red coloured larger triangle, with a base of 5 mm and a height of 7.5 mm. The COG/SOG vector is shown in the red colour. The HDG vector is displayed according to the general rules for the display of an HDG vector for activated targets and is shown in the red colour.



The dangerous target is automatically activated, and the symbol of this target is flashing until **Wxx CPA/TCPA Tgt ID** alarm is acknowledged.

AIS Target in Guard Zone

As an AIS target enters the GZ, **Wxx GZ Tgt ID** warning is generated.

The AIS target is automatically activated and starts flickering. After the warning acknowledgement, the flickering stops. Each new target causes the warning to be generated anew.

Lost AIS Targets

If no data on the AIS target has been received from MFD within a certain time interval which depends on the target category, such target is considered to be lost. The timeout for various target categories is shown in the table below.

CATEGORY OF SHIP	ALARM AFTER TIMEOUT
Ship at anchor or moored and moving not faster than 3 knots (class B moving not faster than 2 knots)	380 sec
Ship at anchor or moored and moving at more than 3 knots	41 sec
Ship 0–14 knots (class B 2–14 knots)	41 sec
Ship 0–14 knots and changing course	41 sec
Ship 14–23 knots	41 sec
Ship 14–23 knots and changing course	40 sec
Ship > 23 knots	30 sec
Ship > 23 knots and changing course	30 sec
Class B moving not faster than 2 knots	380 sec
Class B 2–14 knots	300 sec
Ship 14–23 knots	150 sec
Ship > 23 knots	50 sec

Lost targets are shown on the ECDIS task screen in the last accepted coordinates.

The sleeping lost AIS targets stop to be displayed on the ECDIS task screen without any warning after the timeout expires.

Effective for the active AIS targets are filter settings on the **Acquisition** page of the **Targets** display.

With the **Enable "Lost tgt ID" warning** checkbox is cleared, AIS targets stop to be displayed on the ECDIS task screen immediately after the timeout expiry.

With the **Enable "Lost tgt ID" warning** checkbox is selected, AIS targets which are not within the circle of a radius specified in the filter settings, stop to be displayed on the ECDIS task screen immediately after the timeout expiry. Applicable to the active AIS targets within the circle, after 30 seconds the timeout expiry the display of the AIS lost target is stopped. **Wxx Lost Tgt ID** warning is triggered off.

A lost target is shown as red crossed lines centered in the AIS target symbol 

Lost AIS targets and the warning disappear automatically from the ECDIS task screen 30 sec later or after the warning acknowledgement.

Associating AIS and ARPA Targets

The AIS and ARPA targets are associated if both targets meet certain criteria, and it is highly probable that this is one and the same target. The association criteria vary with the target speed:

- for low-speed targets (below 5 knots) – target position;
- for high-speed targets (5 knots and higher) – position and COG.

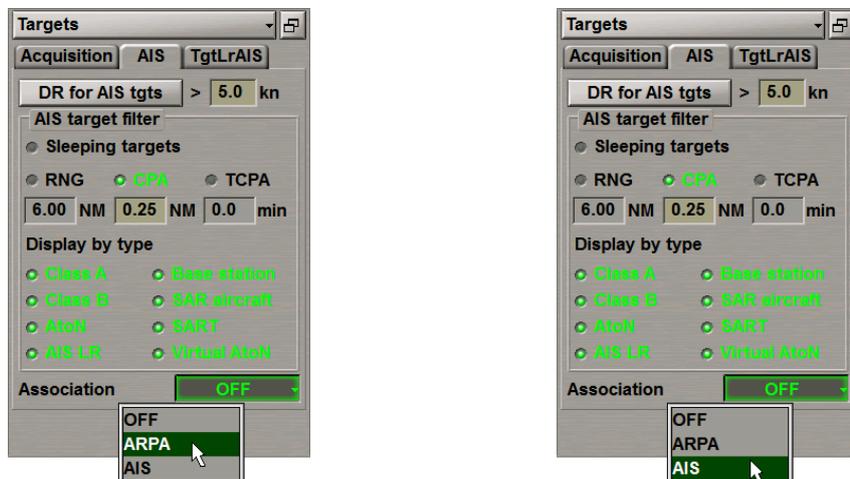
The by-position association is not possible unless the target is tracked steadily for at least 60 seconds, and for at least 180 seconds in the case of the by- COG association.

The by-position association is made by comparing the ARPA and AIS target position in both, range and bearing. If the disagreement does not exceed a certain threshold value, targets are associated. The threshold range value depends on the set radar scale, whereas the threshold azimuth value – on the target range.

The by-course association is made by comparing the COG of ARPA and AIS targets.

The targets are disassociated if the disagreement is more than twice the threshold value.

The targets association mode is controlled from the **AIS** page of the **Targets** display. The association mode is enabled simultaneously with the selection of a priority for displaying AIS or ARPA targets after the association from the **Association** drop-down list.



If an ARPA target is lost, the association is disabled, and the ECDIS task screen shows the AIS target only.

If the AIS functionality is disabled, or the **AIS** button is deselected, the association is disabled, and the ECDIS task screen shows the ARPA target only.

DR Mode of AIS Targets

To switch on DR mode for AIS targets, use the **DR for AIS targets** button on the **AIS** page of the **Targets** display after the input of the minimum speed from which DR calculations are started.

In this case, the following specific features of dead reckoning for AIS targets should be taken into account:

- Dead reckoning of targets is made from the latest true course and speed (COG/SOG) data. As the rate of data transmission from the targets is dependent on their speed, manoeuvring and navigation status, time before the data arrival may be as much as 10 sec;
- As the target data is updated by the transponder and the MFD, it is displayed on the screen in accordance with the last received coordinates;
- There can be no dead reckoning of AIS targets with the “At anchor” and “Moored” status.

Obtaining Information on AIS Targets

Parameters of AIS targets are displayed in the **Target Table** page of the **Targets** panel.

Name	A2	671641000	273002414
Alias		Fellow	
CPA (NM)	1.90	0.77	3.23
TCPA (min)	XXXX	-18.4	13.7
SOG (kn)	12.0	0.0	9.0
COG (°)	216.5°	000.0°	210.0°
Range (NM)	2.39	3.75	3.31
Bearing (°)	228.1°	048.4°	157.8°
Bow X (NM)	XXXX	XXXX	10.2
TBow X (min)	XXXX	XXXX	-166.6

To promptly obtain more detailed information on a certain target, use a free cursor which displays a card with AIS target data:

VESSEL CLASS A	
CPA:	3.23 NM
TCPA:	12.8 min
COG:	210.0°
SOG:	9.0 kn
HDG:	210°
ROT:	0.0°/min Port
BRG:	156.9°
RNG:	3.30 NM

Accuracy:	Low
Draught:	No Data
A:	70m
B:	10m
C:	5m
D:	5m
Length:	80m
Width:	10m

MMSI:	273002414
CALL:	UNDF
NAME:	NOTHERN STAR
IMO:	008015432
STATUS:	Under way using engine
TYPE:	Undefined
CARGO:	Undefined
DTE:	Available

Place:	Destination
ETA:	00.00 00:00 (UTC)

CPA and TCPA of dangerous targets are displayed in the data card in the red colour.

Target Table

The ARPA, AIS and Seetrac targets tracked and displayed on the ECDIS task screen, are entered in the table on the **Target Table** page of the **Targets** panel, where they can be sorted by Name, CPA, TCPA, Alias and Range.

Name	40	41	42	43	44	37	47	48	49	50	51	52	53	54
Alias														
CPA (NM)	2.88	5.87	7.32	6.81	7.74	5.81	4.09	4.53	5.86	8.23	1.25	6.76	8.07	5.62
TCPA (min)	-9.7	-8.4	-6.9	-14.5	-9.3	-21.2	-21.2	-21.2	10.4	12.8	21.8	-16.4	-16.6	-19.2
SOG (kn)	45.3	43.5	29.4	26.8	33.1	11.3	15.0	13.1	22.4	12.3	16.8	19.5	15.8	12.8
COG (°)	14.5°	295.9°	65.7°	287.1°	281.1°	30.0°	5.9°	36.4°	84.2°	170.7°	81.6°	348.7°	358.2°	29.6°
Range (NM)	8.94	8.33	8.43	9.10	9.05	8.79	8.67	8.57	7.63	8.46	8.44	9.59	10.11	8.56
Bearing (°)	359.3°	350.7°	0.3°	351.7°	352.5°	352.7°	45.2°	5.8°	203.4°	236.6°	257.5°	317.5°	318.4°	352.4°
Bow X (NM)	7.7	-5.9	-20.9	-6.9	-8.1	55.4	-10.5	112.1	10.6	8.2	-2.6	11.1	16.8	49.3
TBow X (min)	-17.9	-9.0	25.4	-16.5	-13.8	-197.9	5.6	-346.8	-8.4	15.6	27.7	-37.6	-56.9	-164.8

Each target is assigned with a certain status according to its speed and calculated CPA and TCPA parameters. A dangerous target vector (both CPA and TCPA values are smaller than the operator settings) is highlighted in the red colour. With the alert enabled for each tracked dangerous target, **Wxx CPA/TCPA Tgt ID** alarm message is generated.

To make a fast search for targets on the ECDIS task screen, press the button with the target's name. As this is done, the ECDIS task screen is re-drawn so that the necessary target is displayed in its centre. For 10 seconds the target is highlighted with a flashing circle.

Network Configuration

This chapter provides a description of special MFD operation features in network configuration.

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Network Configuration

General

Networking of several WS's produces additional MFD use capabilities:

- Navigation Data Management;
- Data Synchronization.

Navigational Data Management

Different tasks on the same WS have different privileges with regard to control of navigation data. There is always one task only which has full control of the navigation data. This task has the Navigation MASTER status.

This functionality is also possible in a network configuration, in this case the system can make a centralised use of data connected either to one or another station. Control of navigation data from other tasks is limited. These tasks have the Navigation SLAVE status. This being the case, the sensors in use can be assigned with the Navigation MASTER status task only, the task with the Navigation SLAVE status only shows which sensors are used.

ATTENTION! In case of the network break, each station will be operating independently providing a full set of features as a standalone system.

The navigational data which can be used on each WS, in this case is the data from sensors physically connected to this station. The capability to assign sensors to the tasks with the Navigation SLAVE status on this WS will be automatically unlocked, both stations will have one task with the Navigation MASTER status. As the network connection is restored, assigned with the Navigation MASTER status will be the task which had this status at the moment of the break (when the stations are restarted, the highest priority task will be appointed the task with the Navigation MASTER status (see document *Multifunctional Display (v. 3.02.350). Installation Guide Part I, Chapter 2, MFD Configuration* section, *MFD Settings* paragraph).

Functions available from the station with the Navigation MASTER status only:

- Selection of navigation data sources (Position, COG/SOG, HDG, STW);
- Setting reference points;
- Setting position offset, gyro error;
- Setting navigation alarm parameters, and turning these alarms on:
 - Antigrounding alarm and parameters;
 - Safety Depth.

Data Synchronization

Within a network configuration, collections required for operation of different WS's are equalised by software facilities. I.e., the following collections will be identical on all the WS's:

- Electronic Navigational Charts;
- Maps and Manual correction;
- Routes;
- Navtex database;
- Alarm management.

The chart collection is installed with the aid of the Navi-Planner 4000 application on one WS and is then synchronised on another WS by using the functions of this utility. In case of a network break, each station operates in the Standalone mode, so all the chart handling operations (installation of licenses, charts, their update, etc.) have to be performed on each WS individually.

The collection of radar maps is synchronised automatically as they are handled on all the WS's (installed, edited and deleted). In case of a network break, operations on radar maps should be performed on each WS separately.

Routes are supplied to the MFD from external devices, e.g., GPS or ECDIS which are connected to one WS and then synchronised on all the WS's throughout the network. When the network is broken, it is only the WS which is directly connected to the external route source device which retains the capability to receive routes.

ECDIS Master and Slave

If the ECDIS task is assigned Navigation MASTER, the following functions are available:

- Selection of essential data sources (Position, HDG, STW, COG/SOG, Depth);
- Setting position offset, gyro error, magnetic variation, ships' draught;
- Setting a time zone and its change time;
- Setting navigation alarm parameters, and turning these alarms on:
 - Navigation danger (alarm and parameter);
 - Safety Contour (alarm and parameter);
 - Sounder Depth (warning and parameter);
 - Anchor Watch (alarm and parameter);
 - Safety Contour (value in metres);
 - Safety Depth;
 - Approach to Area (value in minutes);
 - Shallow Contour (parameter);
 - Deep Contour (parameter);
 - Area warnings.
- Loading monitored route and schedule;
- Setting the following route components for monitoring:
 - Next WPT;
 - Arrival circle;
 - Radius.
- Setting parameters for alarms related to motion along the route according to a schedule, and turning these alarms on:
 - Off Chart;
 - End of Route;
 - Out of Schedule (in minutes);
 - WPT Approach (in minutes);
 - Off leg course (in degrees);
 - Out of XTD.
- Setting of a time zone and its change time;
- Setting time-related alarms:
 - End of Watch;
 - Timer off.
- Sending AIS messages (AIS Control).

Integrated Task Control and Monitoring

The ECDIS task provides general control of operation modes for different WS's within the entire network configuration, i.e., a change of a parameter on one WS causes synchronous change of this parameter on other WS's.

NAME	ECDIS	ES6 KEYBOARD	NAME	ECDIS	ES6 KEYBOARD
Name	ECDIS	ES6 Keyboard	Name	ECDIS	ES6 Keyboard
Monitored route	Yes	N/A	Arrival circle	Yes	N/A
Monitored schedule	Yes	N/A	Radius	Yes	N/A
Time	Yes	N/A	BTW	Yes	N/a
Time zone	Yes	N/A	XTD, display of Port Side/ Starboard Side settings for the current leg of the route loaded in the ECS-Master for monitoring	Yes	N/A
Safety Contour (alarm and parameter)	Yes	N/A	DTW	Yes	N/A
Navigation danger (warning and parameter)	Yes	N/A	ETA	Yes	N/A
Sounder Depth (alarm and parameter)	Yes	N/A	TTG to the current point	Yes	N/A
Anchor Watch (alarm and parameter)	Yes	N/A	CRS to the current point	Yes	N/A
Safety Contour (value in metres)	Yes	N/A	AIS message	Yes	N/A
Safety Depth	Yes	N/A	End of Watch	Yes	N/A
Approach to Area (value in minutes)	Yes	N/A	Timer off	Yes	N/A
Area alarms	Yes	N/A	Off Chart	Yes	N/A
Shallow Contour (parameter)	Yes	N/A	End of Route	Yes	N/A
Deep Contour (parameter)	Yes	N/A	Out of Schedule (in minutes)	Yes	N/A
Position Offset	Yes	N/A	WPT Approach (in minutes)	Yes	N/A
Gyro error	Yes	N/A	Off leg course (in degrees)	Yes	N/A
Magnetic variation	Yes	N/A	Out of XTE	Yes	N/A
Draught	Yes	N/A	MOB	Yes	Yes
Monitored points (Next WPT)	Yes	N/A	EVENT	Yes	Yes

Annex A. Additional Information

Hot Keys

HOT KEYS	ES6 FUNCTIONAL KEY	BRIEF DESCRIPTION OF PURPOSE
<F4>	<Event>	To make an instant position recording in the electronic log
<F8>	<Ahead>	To turn on the Navigation mode
<Shift> + <F7>	<St. Display>	To show chart objects belonging to the Standard Display
<Shift> + <F8>	<Show all Layers>	To turn on the display of all the chart object classes
<Shift> + <F11>		To turn on/off the display of ARPA targets
<Ctrl> + <A>	<Alarm>	To acknowledge an alarm
<Alt> + <F1> <Alt> + <F2> <Alt> + <F3> <Alt> + <F4>	<Night/Day>	To switch successively the screen colour palette to suit the time of the day
<Alt> + <H>	<N/H/C Up>	To switch successively to North Up/Heading Up/Course Up motion mode
<Alt> + <Q>	<Overlay On/Off>	To turn on/off the Overlay mode
<Alt> + <Y>	<Rings On/Off>	To turn on/off the display of range rings
<+>	<Zoom In>	To increase the chart display scale in the ECDIS task
<->	<Zoom Out>	To reduce the chart display scale in the ECDIS task
	<SHOW RADAR>	To select the radar picture (with the button kept depressed): <ul style="list-style-type: none"> • to turn on the overlay; • transparency value – 0; • Chart Base display
	<SHOW CHART>	To select chart information (with the button kept depressed): <ul style="list-style-type: none"> • transparency value – 3; • no targets are displayed; • no tides or currents are displayed; • no Add Info objects are displayed
	<Targets On/Off>	To turn on/off the display of ARPA and AIS targets
	<TM/RM>	To switch between the True and Relative motion modes
	<EBL>	To adjust the electronic bearing line value
	<On/Off>	To turn on the display of electronic bearing lines 1 and 2 (to switch between the electronic bearing lines press the EBL knob)
	<VRM>	To adjust the variable range marker value
	<On/Off>	To turn on the display of variable range markers 1 and 2 (to switch between the variable range markers, press the VRM knob)

HOT KEYS	ES6 FUNCTIONAL KEY	BRIEF DESCRIPTION OF PURPOSE
<Ctrl> + <P>		To create a graphic screen copy with an offer to send the graphic screen copy to the printer installed by default
<Alt> + <L>		To turn on/off the display of light (lighthouse) sectors on the TX-97 format charts
<Ctrl>+<Shift>		While the keys are held, the display of the target vectors is switched from true to relative mode

NOTE: For ES8 keyboard, when using the function keys (F1, F2, etc.), it's necessary additionally press the <Fn> key. For example, to change the screen colour palette, press <Alt>+<Fn>+<F1>.

For the Hot Keys setup, see document *Multifunctional Display (v. 3.02.350). Utilities, Chapter 11*.

Annex B. MFD Failure Mode and Effect Analysis

FMEA Table

SW fault includes: 1. Application fault. 2. Application does not respond. 3. Connection to application fault.

HW fault includes: 1. Power failure. 2. Station/Sensor damage. 3. Connection break.

Sensor fault includes: 1. Power failure. 2. Sensor damage. 3. Connection break.

Corrupted message includes: 1. Wrong checksum. 2. Wrong sentence formation.

Invalid data: status obtained by a character in the message.

STATION/SENSOR	SCENARIO (POSSIBLE FAULT)	FUNCTIONAL LIMITATIONS DUE TO FAULT	SYSTEM'S AUTOMATIC RESPONSE	RECOMMENDED PROCEDURE
ECDIS master station fault	ECDIS SW fault	<ul style="list-style-type: none"> One of ECDIS displays is out of order; Radar picture from X-band Radar will disappear on others workstations (if the RIB is in use) 	First Backup ECDIS station switched to the Master mode	<ul style="list-style-type: none"> Check ship position, course and speed; Restart application; Call the service engineer if the station is not operational
	Station HW fault	<ul style="list-style-type: none"> One of ECDIS displays is out of order; Radar picture from X-band Radar will disappear on others workstations (if the RIB is in use) 	First Backup ECDIS station switched to the Master mode	<ul style="list-style-type: none"> Check ship position, course and speed; Restart application; Call the service engineer if the station is not operational
ECDIS backup (planning) station fault	ECDIS SW fault	<ul style="list-style-type: none"> One of ECDIS stations is out of order; Radar picture from S-band Radar will disappear on others workstations (if the RIB is in use); Digitizer is inaccessible 	No	<ul style="list-style-type: none"> Restart application; Call the service engineer if the station is not operational

STATION/SENSOR	SCENARIO (POSSIBLE FAULT)	FUNCTIONAL LIMITATIONS DUE TO FAULT	SYSTEM'S AUTOMATIC RESPONSE	RECOMMENDED PROCEDURE
	Station HW fault	<ul style="list-style-type: none"> • One of ECDIS displays is out of order; • Radar picture from S-band Radar will disappear on others workstations (if e RIB is in use); • SPOS Weather Module is out of order (optionally); • Digitizer is inaccessible 	No	<ul style="list-style-type: none"> • Restart application; • Call the service engineer if the station is not operational
ECDIS slave station fault	ECDIS SW fault	<ul style="list-style-type: none"> • One of ECDIS station is out of order 	No	<ul style="list-style-type: none"> • Restart application; • Call the service engineer if the station is not operational
	Station HW fault	<ul style="list-style-type: none"> • One of ECDIS displays out of order 	No	<ul style="list-style-type: none"> • Restart application; • Call the service engineer if the station is not operational
DGPS (GPS/GLONASS) (Primary)	Sensor fault	Limitation during fallback to valid PS system: <ul style="list-style-type: none"> • Ship symbol related to positioning system is unreliable on the Chart panel; • Coordinate values are unreliable; • COG – SOG values are unreliable; • Drift calculations are unreliable; • RIB/ARPA Target data is inaccessible 	Fallback to the next valid positioning sensor in 10 sec	<ul style="list-style-type: none"> • Use an alternative source (PS2) as the Primary positioning system to restore the function; • Check the sensor operation and connection; • Call the service engineer. • If an alternative EPFS sensor is not available, change positioning source to the DR or ER mode
	DGPS mode lost	Position accuracy is reduced to GPS SPS values	Primary/Secondary diverge value changed	No
	Corrupted message	Limitation during fallback to valid	Fallback to the next valid	<ul style="list-style-type: none"> • Use an alternative source (PS2) as the

STATION/SENSOR	SCENARIO (POSSIBLE FAULT)	FUNCTIONAL LIMITATIONS DUE TO FAULT	SYSTEM'S AUTOMATIC RESPONSE	RECOMMENDED PROCEDURE
		PS system: <ul style="list-style-type: none"> • Ship symbol related to positioning system is unreliable on the Chart panel; • Coordinate values are unreliable; • COG – SOG values are unreliable; • Drift calculations are unreliable; • RIB/ARPA Target data is inaccessible 	positioning sensor in 10 sec	Primary positioning system to restore the function; <ul style="list-style-type: none"> • Check the sensor operation and connection; • Call the service engineer. • If an alternative EPFS sensor is not connected, change positioning source to the DR or ER mode
	Invalid data	Limitation during fallback to valid PS system: <ul style="list-style-type: none"> • Ship symbol related to positioning system is unreliable on the Chart panel; • Coordinate values are unreliable; • COG – SOG values are unreliable; • Drift calculations are unreliable; • RIB/ARPA Target data is inaccessible 	Fallback to the next valid positioning sensor in 10 sec	<ul style="list-style-type: none"> • Use an alternative source (PS2) as the Primary positioning system to restore the function; • Check the sensor operation and connection; • Call the service engineer; • If an alternative EPFS sensor is not connected, change positioning source to the DR or ER mode.
Gyrocompass	Sensor fault	Limitation during fallback to valid heading system: <ul style="list-style-type: none"> • ARPA function is inaccessible; • Only Head Up mode in Radar; • DR mode is inaccessible; • Drift calculations are unreliable 	Radars changed to the Head Up mode. Fallback to the next valid gyrocompass in 10 sec	<ul style="list-style-type: none"> • Switch to an alternative heading source; • Check the sensor operation and connection; • Call the service engineer
	Corrupted message	Limitation during fallback to valid	Radars changed to Head	<ul style="list-style-type: none"> • Switch to an alternative heading source;

STATION/SENSOR	SCENARIO (POSSIBLE FAULT)	FUNCTIONAL LIMITATIONS DUE TO FAULT	SYSTEM'S AUTOMATIC RESPONSE	RECOMMENDED PROCEDURE
		heading system: <ul style="list-style-type: none"> • ARPA function is inaccessible; • Only Head Up mode in Radar; • DR mode is inaccessible; • Drift calculations are unreliable 	Up mode. Fallback to the next valid gyrocompass in 10 sec	<ul style="list-style-type: none"> • Check the sensor operation and connection; • Call the service engineer
	Invalid data	Limitation during fallback to valid heading system: <ul style="list-style-type: none"> • ARPA function is inaccessible; • Only Head Up mode in Radar; • DR mode is inaccessible; • Drift calculations are unreliable 	Radars changed to Head Up mode. Fallback to the next valid gyrocompass in 10 sec	<ul style="list-style-type: none"> • Switch to an alternative heading source; • Check the sensor operation and connection; • Call the service engineer
Log	Sensor fault	Limitation during fallback to valid speed measuring system: <ul style="list-style-type: none"> • ARPA function is inaccessible; • Radar Sea stabilization mode is inaccessible; • DR mode is inaccessible; • Drift calculations are unreliable 	Fallback to the next valid speed sensor in 10 sec	<ul style="list-style-type: none"> • Switch to an alternative speed source; • Check the sensor operation and connection; • Call the service engineer
	Corrupted message	Limitation during fallback to valid speed measuring system: <ul style="list-style-type: none"> • ARPA function is inaccessible; • Radar Sea stabilization mode is inaccessible; • DR mode is inaccessible; • Drift calculations are unreliable 	Fallback to the next valid speed sensor in 10 sec	<ul style="list-style-type: none"> • Switch to an alternative speed source; • Check the sensor operation and connection; • Call the service engineer
	Invalid data	Limitation during fallback to valid speed measuring system:	Fallback to the next valid speed sensor in 10 sec	<ul style="list-style-type: none"> • Switch to an alternative speed source; • Check the sensor operation and connection; • Call the service engineer

STATION/SENSOR	SCENARIO (POSSIBLE FAULT)	FUNCTIONAL LIMITATIONS DUE TO FAULT	SYSTEM'S AUTOMATIC RESPONSE	RECOMMENDED PROCEDURE
		<ul style="list-style-type: none"> • ARPA function is inaccessible; • Radar Sea stabilization mode is inaccessible; • DR mode is inaccessible; • Drift calculations are unreliable 		
Sounder	Sensor fault	No sounding data	No	<ul style="list-style-type: none"> • Check the Sounder operation and connection; • Call the service engineer
	Corrupted message	No sounding data	No	<ul style="list-style-type: none"> • Check the Sounder operation and connection; • Call the service engineer
	Invalid data	No sounding data	No	<ul style="list-style-type: none"> • Check the Sounder operation and connection; • Call the service engineer
Anemometer	Sensor fault	No wind data	No	<ul style="list-style-type: none"> • Check the Anemometer operation and connection; • Call the service engineer
	Corrupted message	No wind data	No	<ul style="list-style-type: none"> • Check the Anemometer operation and connection; • Call the service engineer
	Invalid data	No wind data	No	<ul style="list-style-type: none"> • Check the Anemometer operation and connection; • Call the service engineer
Water temperature sensor	Sensor fault	No temperature data	No	<ul style="list-style-type: none"> • Check the temperature sensor operation and connection; • Call the service engineer
	Corrupted message	No temperature data	No	<ul style="list-style-type: none"> • Check the temperature sensor operation and connection; • Call the service engineer
AIS	Sensor fault	<ul style="list-style-type: none"> • No AIS target data; 	No	<ul style="list-style-type: none"> • Check the AIS operation and connection;

STATION/SENSOR	SCENARIO (POSSIBLE FAULT)	FUNCTIONAL LIMITATIONS DUE TO FAULT	SYSTEM'S AUTOMATIC RESPONSE	RECOMMENDED PROCEDURE
		<ul style="list-style-type: none"> • AIS message and own ship data exchange is inaccessible 		<ul style="list-style-type: none"> • Call the service engineer
	Corrupted message	<ul style="list-style-type: none"> • No AIS target data; • AIS message and own ship data exchange is inaccessible 	No	<ul style="list-style-type: none"> • Check the AIS operation and connection; • Call the service engineer
NAVTEX	Sensor fault	Navtex messages are not received	No	<ul style="list-style-type: none"> • Check the NAVTEX operation and connection; • Call the service engineer
	Corrupted message	Navtex messages are not received	No	<ul style="list-style-type: none"> • Check the NAVTEX operation and connection; • Switch off the Navtex message check; • Call the service engineer

Annex C. Alert List

Alert list

New alert ID in accordance to IEC62923-2:2018.

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3005	Invalid position	Geodetic datum is not WGS-84	ECDIS	Warning	B	
3007	TCS stopped	Track control stopped	TCS	Alarm	B	Escalated from 3008
3008	TCS stopped	Track control stopped	TCS	Warning	B	
3012	Integrity failed	Integrity not possible or failed	ECDIS	Warning	A	Aggregated header alert
3012	POSN monitor	Position difference limit exceeded				
3012	HDG monitor	GYROs Heading difference limit exceeded				
3012	No HDG monitor	HDG Monitor Impossible				
3014	Sensor failure	TCS has lost essential sensor input	TCS	Alarm	B	Aggregated header alert
3014	Position failure Heading failure LOG failure DLOG failure	Position failure Heading failure Speed (Log STW) failure Speed (DLOG STW) failure				
3015	Sensor failure	Main sensor failure	ECDIS	Warning	B	Aggregated header alert
3015	POSN: no data POSN: no input	No data from the primary POSN Primary POSN - no connection or switched off				

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3015	Sensor failure	Main sensor failure				Aggregated header alert
	AIS: no input DLOG: no input DLOG STW: no data GYRO: no data GYRO: no input LOG: no data LOG: no input					
3015	%scanner%: No Trigger %scanner%: No Heading %scanner%: No Bearing %scanner%: No Connect. %scanner%: No Video %scanner%: No Scanner %scanner%: VID timeout	%scanner%: Trigger failure %scanner%: Heading failure %scanner%: Bearing failure %scanner%: Connection failure %scanner%: Video failure %scanner%: Scanner control %scanner%: Video timeout	Radar	Warning	B	

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3016	AUX Sensor lost	Auxiliary sensor failure				Aggregated header alert
3016	DLOG%num%: no SOG DLOG%num%: no STW DLOG%num%: no input GYRO%num%: no data GYRO%num%: no input LOG%num%: no input LOG%num%: no data POSN%num%: no input POSN%num%: no data		TCS	Caution	B	
3016	AUX Sensor lost	Auxiliary sensor failure				Aggregated header alert
3016	%hostname%: VDR lost DLOG%num%: no SOG DLOG%num%: no STW DLOG%num%: no input GYRO%num%: no data GYRO%num%: no input LOG%num%: no input LOG%num%: no data POSN%num%: no input POSN%num%: no data SOUNDER%num%: no data SOUNDER%num%: no INP	VDR connection lost on %hostname% SOUNDER%num% no input	MFD	Caution	B	
3021	%hostname%: AP PWR fail	Autopilot Power Supply fail	MFD	Alarm	B	

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3022	Power Failure	General failure in Power Supply				Aggregated header alert
3022	%hostname%: Power Fail	TCS station %hostname%: Power Supply fail	TCS	Warning	B	
3022	%hostname%: Low Battery	TCS station %hostname%: Low Battery				
3022	Power Failure	General failure in Power Supply				Aggregated header alert
3022	%hostname%: Power Fail	%hostname%: Power Supply Fail	MFD	Warning	B	
3022	%hostname%: Low Battery	%hostname%: Low Battery				
3022	Power failure	Main Power failure	BNWAS	Warning	B	
3024	Off-Track	Out of monitoring route XTD limits	ECDIS	Alarm	A	
3024	Control limit	Control limit exceeded				Aggregated header alert
3024	Off-Track	Out of monitoring route XTD limits	TCS	Alarm	A	
3024	End of TCS track	End of TCS track in less than 5 min				Escalated from 3025
3025	End of TCS track	End of TCS track in less than 5 min	TCS	Warning	A	
3027	Act. CRS change	Actual course change	TCS	Alarm	A	Escalated from 3028
3028	Act. CRS change	Actual course change	TCS	Warning	A	
3031	Limit exceeded	Operator threshold exceeded				Aggregated header alert
3031	Safety contour	Crossing safety contour %contour% in %time% chart names: %chart_name%	ECDIS	Alarm	A	For transfer via ALF description cut to: Crossing safety contour %contour% in %time%
3031	Anchorage area x	Outside anchorage area x %dist%				Escalated from 3032
3032	Anchorage area x	Outside anchorage area x %dist%	ECDIS	Warning	A	
3032	CRS difference	Course difference	TCS	Warning	A	
3033	CRS difference	Course difference	ECDIS	Caution	B	

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3035/3036	Look ahead		ECDIS	Warning/Caution	B	Aggregated header alert
3035/3036	Traffic separation zone Inshore traffic zone Restricted area Caution area Offshore production area Areas to be avoided Military practice area Seaplane landing area Submarine transit lane Anchorage area Marine farm/aquaculture PSSA Anchoring prohibited Cable area Cargo transship area Deep water route Dumping ground ESSA Fairway Fishing ground Fishing prohibited Incineration area Precautionary area Rec. traffic lane	%area% in %xx% min>	ECDIS	Warning	B	Note: alert priority (Warning or Caution) can be set by the user in ECDIS GUI.

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3042	100% TGT capacity	Target processing capacity exceeded	Radar	Warning	A	Aggregated header alert
3042	100% AIS capacity %station%: 100% ARPA.	%station%: 100% ARPA capacity				
3043	95% TGT capacity	Target processing capacity about to be exceeded	Radar	Caution	B	Aggregated header alert
3043	95% AIS capacity %station%: 95% ARPA	%station%: 95% ARPA capacity				
3044	CPA/TCPA	Collision danger detected	Radar	Alarm	A	Aggregated header alert
3044	%station%: CPA/TCPA%Target_ID%	CPA/TCPA Tgt %Target_ID% Source: %ARPA_ID%				
3048	Guard zone	New target in acquisition zone	Radar	Warning	A	Aggregated header alert
3048	%station% GZ %Target_ID%	GZ Tgt %Target_ID% Source: %ARPA_ID%				
3052	Lost target		Radar	Warning	A	
3062	System fault	System device malfunction	MFD	Warning	B	Aggregated header alert
3062	%hostname%: KBD fail %hostname%: Display fail %hostname%: AUX KBD fail	%hostname%: Keyboard failure %hostname%: Display failure %hostname%: AUX keyboard failure				
3062	BNWAS malfunction.	BNWAS-WAGO connection lost				BNWAS
3065	Low Speed	Low STW. Restricted maneuverability	TCS	Warning	B	
3077	Backup navigator		ECDIS	Alarm	B	

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
3113	Fallback	Main sensor fallback in use				Aggregated header alert
3113	POSN Fallback Heading Fallback Speed Fallback	Position Fallback Heading Fallback Speed Fallback	TCS	Caution	B	
3113	Fallback	Main sensor fallback in use				Aggregated header alert
3113	POSN. Fallback Heading Fallback Speed Fallback	Position Fallback Heading Fallback Speed Fallback	MFD	Caution	B	
10002	STW data lost	Change the steering mode	TCS	Warning	A	
10006	Sec. POSN failure	Secondary Position failure				Aggregated header alert
10006	Sec. POSN no data Sec. POSN no INP	Secondary POSN: no data Secondary POSN: no input	TCS	Caution	B	
10008	Off chart		ECDIS	Warning	B	

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
10013	System degraded	Redundancy degradation				Aggregated header alert
10013	%hostname% POSN%num% lost %hostname% LOG%num% lost %hostname% DLOG%num% lost %hostname% GYRO%num% lost AIS TGT lost DCU%num% failure DCU%num% Net1 disconnect DCU%num% Net2 disconnect DCU450 %num% failure DCU450 %num% Net1 failure DCU450 %num% Net2 failure Wxx Net%num% fail		MFD	Caution	B	
10015	Route Alerts	Route Alerts				Aggregated header alert
10015	Ahead schedule Behind schedule End of track	Ahead the schedule Behind the schedule End of track	ECDIS	Warning	A	
10019	AIS Ship Name	Check AIS Ship Name	MFD	Caution	B	
10023	AIS Call Sign	Check AIS Call Sign	MFD	Caution	B	
10025	Seetrac: MOB		ECDIS	Warning	B	
10028	MOB BRG		ECDIS	Warning	B	

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
10033	Sec POSN failure	Secondary Position failure	ECDIS	Caution	B	Aggregated header alert
10033	Sec POSN no data Sec POSN no INP	Secondary POSN: no data Secondary POSN: no input				
10036	Sensor failure	Additional Sensor failure	MFD	Caution	B	Aggregated header alert
10036	ROT: no data ROT: no input TEMPER. no data TEMPER. no input WIND: no data WIND: no input MAG: no data MAG: no input SOUNDER no data SOUNDER no input UTC: no input UTC: no data	TEMPERATURE: no data TEMPERATURE: no input Magnetic heading: no data Magnetic heading: no input				
10046	WAGO failure		MFD	Caution	B	Aggregated header alert
10046	WAGO %num%: No input					
10052	DIS alerts		ECDIS	Warning	A	Aggregated header alert
10052	DIS Sounder	Measured UKC smaller than calculated				
	DIS data fail	DIS data not updated for more 12 min				
	DIS squat curve	Ship's water speed exceeds set limit				
	DIS UKC	Predicted UKC in GZ less than 30 cm				

ALERT ID	ALERT TITLE	ALERT DESCRIPTION	SOURCE	PRIORITY	CATEGORY	NOTES
10055	Radar no heating	Check radar heating power	Radar	Warning	B	
10057	Timer went off	Time set on the timer is over	ECDIS	Alarm	B	
10063	Radar error	Radar error	Radar	Caution	B	
	%scanner%: Storage value error %scanner%: Mag heater %scanner%: Trigger error %scanner%: VIDEO error %scanner%: FAN1 error %scanner%: FAN2 error %scanner%: MOD. high voltage %scanner%: Safety switch state %scanner%: Reverse error %scanner%: BP error %scanner%: BZ error					
10065	%Scanner%: Scanner failure	%Scanner%: Scanner failure	Radar	Warning	B	
10074	Clearing Bearing	Crossing clearing bearing	ECDIS	Alarm	A	
10077	Crossing LDL	Crossing limited danger line	ECDIS	Alarm	A	
10081	Sounder depth	Sounder Depth: %depth%. Set limit: %value%"	ECDIS	Alarm	B	
10201	Test Alarm	Description: Test alarm	MFD	Alarm	B	
10202	Test Warning	Description: Test warning	MFD	Warning	B	
10203	Test Caution	Description: Test caution %num%	MFD	Caution	B	

Multifunctional Display. Navi-Sailor 4000 ECDIS

Functional Description
Version 3.02.350

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