

Universal digital repeater DR-109, DR-109W

Operating manual

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INTRODUCTION

This operating manual (hereinafter referred to as the OM) covers the Universal digital repeaters DR-109 and DR-109W (hereinafter referred to as the Repeater or the Product).

The OM is intended to describe operating principles, technical specifications and rules for the safe Product operation.

Only those who have had general education in the area of electronic devices, and those who have read and understood this document shall be permitted to operate with the Repeater. In addition to the instructions given in this document, the safety regulations and rules applicable in the field shall be observed.

Terms and abbreviations:

OM – Operating Manual;

TS – Technical Service;

CL – Check List.

1 DESCRIPTION AND OPERATION OF THE PRODUCT

1.1 DESCRIPTION

The Product ensures display of digital data received in NMEA 0183 (NMEA) standard sentences through RS-232 and RS-422 serial interfaces.

The Product is designed for sea- and river-going vessels, and industrial application.

The Product's detailed specifications, environment conditions, overall and installation dimensions are represented in Technical description of the Product.

1.2 TECHNICAL SPECIFICATIONS

The Product ensures:

- a. transmission of input data through RS-422 and RS-232 ports;
- b. serial display of three different NMEA data types in accordance with Annex A;
- c. display of ship's turn rate data on a separate LED linear;
- d. equipment interfacing via two asynchronous serial galvanically isolated ports, RS-422 and RS-232, with NMEA standard support;
- e. display of data in digital format on the LED with the capabilities of:
 - settings of time intervals to display parameters;
 - continuous transmission (preselected, except ROT which are displayed not depending on the select) of input data to external ship systems from the selected ports;
 - data display in English;
- f. the Repeater is controlled using the relevant buttons on the front panel;
- g. the screen backlight brightness can be adjusted (11 levels).

1.3 OPERATION OF THE PRODUCT

The Repeater receives NMEA data through one of the serial interfaces RS-232 and RS-422, processes and selects data according to the settings and then displays data on the built-in LED. The functional diagram is represented in Figure 1.

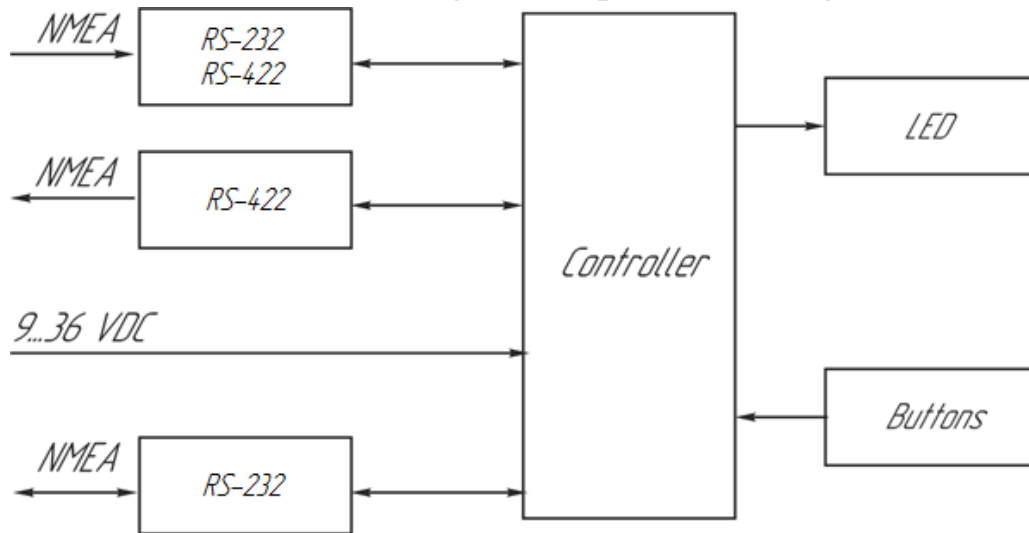


Figure 1 – Functional diagram of the Repeater

Input data of the ship's turn rate are displayed on the LED; the data are received not depending on the NMEA settings.

If a user selects more than one sentence type to be displayed, then input data are represented on the LED consequently: sentences are shown repeatedly with a preset time interval (specified by a user).

The Product may be also used as a repeater. The Product's controls and LEDs are represented in Figure 2, and the description is represented in Table 1.

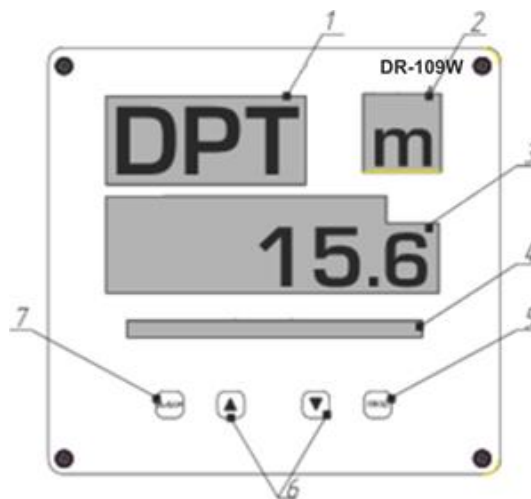


Figure 2 – The Product's controls and LEDs

Table 1 – The Product’s controls and LEDs*

№	Name	Description
1	Light-emitting-diode indicator	Displays NMEA data and menu items
2	Light-emitting-diode indicator	Displays parameter values
3	Light-emitting-diode indicator	Displays NMEA parameter value
4	Light-emitting-diode indicator	Displays object’s rate of turn (ship)
5	Menu button	Access to the selected submenu, input
6	Navigation button	Selects the menu item (submenu), transfers among the menu items
7	SELECT button	Exits the main menu (switches on the operating mode)

*Keys assignment is described for the main menu mode.

1.4 MEASUREMENT INSTRUMENTS, TOOLS AND APPLIANCES

Operability control of the Product is carried out using integrated controls and LEDs.

The TS of the Product is carried out using tools and consumables listed in Tables 2 and 3.

1.5 MARKING AND SEALING

The nameplates, where the user can find a serial number, date of manufacturing, weight, protection degree, input voltage and power consumption are located on the Product’s casing.

The sealing of the Product and package is not provided.

1.6 PACKAGING

The Product is packed in a corrugated board box and inner packaging ensuring its transportation and storage at the warehouse.

Transport packaging is also used as a returnable packaging for transportation of the Product to the repair location and back.

Table 2 – Tools and appliances

Name	Location
Strengthened screwdriver (cross) PH2	A duty officer station
Screwdriver with shortened handle type 2, 3.5 x 0.5 mm	
Screwdriver (cross) PH-1, 80 mm	

Table 3 – Amount of consumables required for TS

Name and identifier of consumables	Amount of consumables	Note
Cleaning cloth	0.10 kg	To clean contamination from the surfaces
Rectified hydrolytic technical ethyl alcohol	0.01 l	1 To clean severe contamination from the surfaces 2 To clean surfaces of the Product in case of paint coating damage
Varnish	0.05 kg	To cover surfaces of the Product in case of paint coating damage
Abrasive cloth	0.06 x 0.06 m	To polish surfaces of the Product in case of paint coating damage

2 USAGE OF THE PRODUCT

2.1 OPERATIONAL CONSTRAINTS

Connect the Product only according to the connection diagram and table of connections applicable for the installation site. The Product shall have proper grounding, all cables shall be insulated; non-insulated/bare ends shall be absent.

2.2 USAGE PREPARATIONS

2.2.1 Safety features

While preparing the Product for usage observe it visually and check the absence of mechanical damage.

Before the operation the user shall:

- a. train staff to use the Product and checkout equipment, as well as occupational safety applicable in the field;
- b. check proper grounding;
- c. only use fuses recommended by the Manufacturer;
- d. switch the power off before disconnecting cables and replacing fuses;
- e. follow “Rules for Operation of Customers’ Electrical Installations” and “Safety Rules for Operation of Customers’ Electrical Installations” while testing electrical circuits and insulation resistance of the Product.

2.2.2 Sequence of the Product’s visual check

Before powering the Product on the user shall:

- a. check visually the integrity of control elements on the front panel;
- b. clean any contamination or dust from the front panel with clean cloth, if present;
- c. check reliability of cable connections to the Product.

2.2.3 Switching the Product on

Once the user transfers the circuit breaker located on the switchboard to ON position, the Product switches on automatically.

Increase LED brightness using “▲” key, if necessary.

2.3 USAGE OF THE PRODUCT

The Product is delivered with factory settings; the settings may be changed if necessary.

2.3.1 Operating mode

In the operating mode data are represented on the built-in LED display. If the user selects more than one sentence type to be displayed, then input data are represented on the LED consequently: sentences are shown repeatedly with a specified time interval.

If no data are received, or there was a long pause in the reception of NMEA 0183, lower LED display shows “----”. New data are shown on the LED display again as soon as received.

CAUTION! Once the Product is switched on, it displays the last saved user settings from the non-volatile memory (a profile).

Control buttons ensure the following functions in the operating mode, see Table 4.

Table 4 – The functions of the control buttons in the operating mode

Name	Description
Select	Selects/transfers to the next sentence on the LED.
▲ (Brightness)	Increases the display brightness.
▼ (Brightness)	Decreases the display brightness.
SET (Menu)	Accesses the main menu.

2.3.2 Main menu mode

In the main menu the user can provide the Repeater’s settings, or download one of the saved profiles. Letters “MN” on the upper LED display show that DR-109WP operates in the main menu mode, the lower LED shows the current menu item, see Table 5.

Description of the control buttons in this mode:

- a. *Hand* – accesses the submenu of manual settings;
- b. *Load* – accesses the submenu of saved profiles.

2.3.3 Submenu *Load* of saved profile

Letters “LD” start glowing on the upper LED display when the user enters the submenu of saved profiles. The lower LED display shows a number of the memory cell where the profile is stored.

The functions of control buttons are represented in Table 5:

Table 5 – The functions of control buttons in the described submenu.

Name	Description
Select	Exits to the main menu
▲ (Brightness)	Selects a memory cell with the saved profile of settings
▼ (Brightness)	
Set (Menu)	Downloads the profile from the memory cell

CAUTION! After downloading the profile the Repeater immediately switches over to the operating mode!

2.3.4 Submenu *Hand* of saved profile

In this submenu the user can create a profile with settings and save it in the non-volatile memory.

In the settings mode the upper LED shows the current setting parameter, and the lower one – selected value, see Table 6.

Table 6 – Description of the control buttons in the menu to create a profile

Name	Description
Select	Selects the parameter to be set (circular scroll of all parameters)
▲ (Brightness)	Selects the parameter value
▼ (Brightness)	
Set (Menu)	Saves the selected value

CAUTION! The system of data display changes when settings for NMEA sentences are provided – the number of the sentence and its characteristic are shown on the **lower** LED display; name of NMEA sentence is shown on the **upper** one.

CAUTION! Select a value for the necessary parameter and then press “SET” to save it. After the settings are completed, save them using “SV” menu item. Press “SET” after the change of value, otherwise the selected value won’t be saved. Save the settings before exit the submenu, otherwise the unit will switch back to the previous settings.

2.3.5 NMEA sentence settings

Select menu items d-1, d-2 and d-3 to carry out the settings of NMEA sentences (for the 1st, 2nd and 3rd displayed sentence, respectively). Select the required sentence by using “▲” and “▼” buttons, then press “SET” to save the settings. Some NMEA sentences have several parameters, so the user shall select which parameter is to be shown on the LED display. In this case an additional digit appears on the lower LED on the right of the sentence number; this digit indicates a number of the selected NMEA sentence parameter.

When the sentence parameter is selected press “SET” to save the value. To provide correct settings, see Table 7 and Figures 3–6.

The list of NMEA sentences and their parameters is represented in Annex A.

Table 7 – Parameters of the Repeater settings

Code	Function
RS	Select the Product’s interface to receive NMEA 0183 signal. Possible values: 232 – interface RS-232 422 – interface RS-422
BR	Select data receive rate. Possible values (kbit/s): 4.8, 9.6, 19.2, 28.8, 38.4, 56.0, 57.6, 115.2
SBC	Select number of data bits, stop bits and parity bits. Possible values: 8 1 0 - 8 data bits, 1 stop bit, no parity bit 8 2 0 - 8 data bits, 2 stop bits, no parity bit 8 1 1 - 8 data bits, 1 stop bit, parity bit 8 1 2 - 8 data bits, 1 stop bit, odd parity check
d-1	Select 1 st displayed NMEA sentence
d-2	Select 2 nd displayed NMEA sentence
d-3	Select 3 rd displayed NMEA sentence
BAR	Dial indicator of ship’s rate of turn (degrees per minute per one scale division). Possible values: 1.5 and 4.5.
CDD	Duration of each NMEA sentence display on the LED. Possible values: 0–20 sec. Zero (0) shows that transfer will not occur (in this case switching among the sentences is carried out manually by pressing “SELECT” in the operating mode).
FRQ	Frequency of screen update. Possible values: 0, 4, 6, 8, 10 Hz. In order to reduce the load on the microcontroller it is recommended to decrease the frequency of screen update under the large number of input sentences.
SV	Number of memory cell, whereto the settings profile is saved. Possible values: 0–10. Select of zero value means that the settings are saved but not recorded to the memory cell.
OUT	If this item is selected, the repeater switches back to the operating mode.

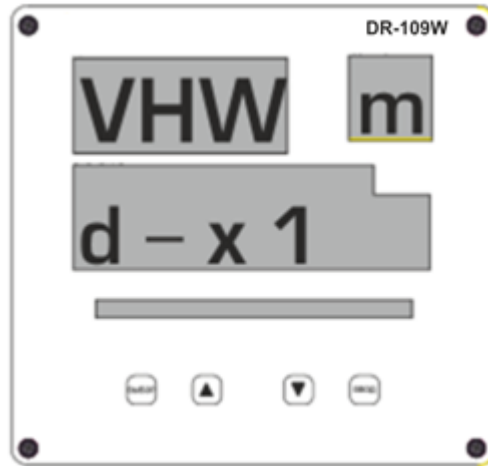


Figure 3 – Settings of NMEA sentence type

For instance, a user needs to set NMEA DPT sentence type, “Depth And Offset from Transducer”.

The sentence includes “Depth” parameter, which is displayed in meters.

On the screen layout 1 during data transmission the depth will be displayed in meters, see Figure 4.

On the screen layout 2 set the display of sentence DBT “Depth below transducer” in meters, see Figure 5.

Figure 6 shows screen layout 3, where “-----” means that VHW sentence “Water Speed And Heading” is not being received.



Figure 4 – Screen lay-out 1

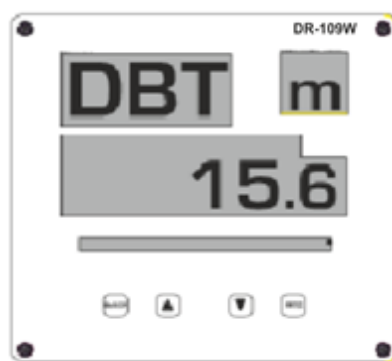


Figure 5 – Screen lay-out 2

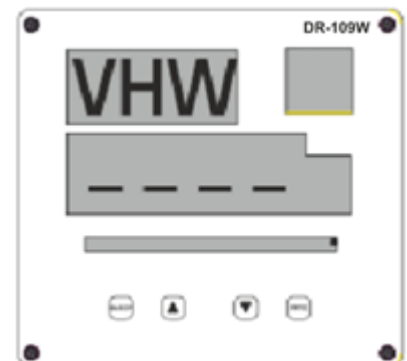


Figure 6 – Screen lay-out 3

Therefore, the user can simultaneously provide setting to:

- a. display three different parameters of one NMEA sentence;
- b. display not more than three NMEA sentences with one parameter for each;
- c. display no NMEA sentences.

3 TECHNICAL SERVICE OF THE PRODUCT

3.1 GENERAL DESCRIPTION

The TS shall be provided by the staff acquainted with the Product's composition, structure and operation features.

In order to provide safe and reliable operation for the System units, the staff shall maintain a schedule of the technical service:

- a. technical service №1 (TS-1) – monthly TS;
- b. technical service №2 (TS-2) – annual TS.

TS-1 is organized and controlled by a person in charge and carried out by the staff on the running equipment.

TS-2 is organized and controlled by a person in charge and carried out by the staff.

The recommended amount of consumables to provide TS is represented in Table 3.

3.2 SAFETY FEATURES

While carrying out the TS follow the instructions given in 2.1 of this OM.

3.3 MAINTENANCE ROUTINE

The list of works for all types of the Technical service is given in Table 8. Maintenance routine procedure is given in the CL, represented in Tables 9–11.

Table 8 – The list of TS works

CL №	Work	TS type	
		TS-1	TS-2
1	Visual check of the Product	+	+
2	Test for the unit operability	–	+
3	Check of completeness, SPTA kit and operational documents	–	+
Notes 1 “+” – work is obligatory. 2 “–” – work is not required.			

Table 9 – Check list № 1. Visual check of the Product

To be done	Routine	Man-hours per 1 Product
Visually examine the Product	1 Check completeness and appearance of the Product; mechanical damage, paint defects must be absent; legends are to be read easily; 2 Clean all surfaces by clean cloth; 3 Remove severe contamination, parts of corrosion, oil spots: – from metal surfaces: by suds, avoiding its penetration inside the device; all surfaces clean dry by clean cloth and dry up; – from LED: by alcohol soaked cloth; Do not use hard cloth, paper, glass cleaning liquids or chemicals; Do not press hard on the surface while cleaning; Do not spray liquid directly to the surface of the Product; 4 In case of varnish damage clean it with abrasive cloth, then alcohol soaked cloth, cover with varnish and let dry	1 person 5 minutes
Check reliability of cable and bus connection to the unit	Make sure that connectors and attaching screws are fastened tight, provide further fastening if needed	1 person 5 minutes

Table 10 – Check list № 2. Check of the Product operability

To be done	Routine	Man-hours per 1 Product
Check the Product's operability	1 supply power to the Product; 2 check that LEDs are glowing on the front panel: press and hold “▲” and “▼” buttons simultaneously	1 person 5 minutes

Table 11 – Check list № 3. Completeness and condition of SPTA kit and operational documents

To be done	Routine	Man-hours per 1 Product
Check the completeness and condition of SPTA kit and operational documents	1 check presence of SPTA kit and operational documents are compliant with those listed in section “Completeness”; 2 check every item in SPTA kit and storage time; if the kit has been used, recomplete it	1 person 10 minutes

3.4 PRESERVATION

The Product and set of operational documents are stored in preserved condition in Manufacturer’s packaging boxes.

The time of represervation – 2 years from the Manufacturer’s commissioning.

The Repeater’s preservation is done in full terms, for 2 years, according to the relevant regulatory documents.

The represervation is done in heated rooms in the same order as the preservation.

The represerved Product, SPTA kit and documents are placed in package. The time of storage – 2 years.

4 CURRENT REPAIR OF THE PRODUCT

4.1 GENERAL DESCRIPTION

The Repeater’s operability is controlled by the LEDs on the front panel.

To provide diagnostics of the problems and defects, use information in Table 12.

Please contact the Manufacturer’s service centre in case of other defects, which are not represented in the above mentioned table.

Within the terms of warranty coverage the opening of package is done with the witness of the manufacturing company representative, who makes the Act of opening.

4.2 CURRENT REPAIR

The personnel can only eliminate defects which are listed in Table 12.

All other defects shall be carried out only by the Manufacturer’s specialists or the Manufacturer’s representatives.

The Repeater’s malfunction may be caused by mechanical or electrical damage as well as by invalid settings. Some possible reasons of defects and possible solutions are represented in Table 12.

Table 12 – Possible problems/defects and troubleshooting

Problem/defect	Possible reasons	To do
The Product doesn’t switch on	Fuse’s malfunction (burnt)	Replace the fuse
	Ship power supply is absent	Provide the ship power supply
“-----” on LED	Input data is not valid or not being received	Provide correct input data, re-store the connection

5 STORAGE

The Product must be stored in packaging inside areas complying with the required storage conditions (+5 °C to +40 °C) with the concentration of dust, oil, moisture and aggressive impurities in the air within the required limits for the working areas of production facilities.

After storage or transportation of the Product below +10 °C, it must be unpacked only in heated premises and left in normal climate conditions for 12 hours beforehand.

6 TRANSPORTATION

The Product must be transported in the Manufacturer's transportation package in closed means of transport.

Types of shipment:

- a. motor vehicle and railroad transportation in closed means of transport (covered cars, multipurpose containers);
- b. air transportation (in sealed and heated compartments);
- c. sea transportation (in dry service premises).

The Product must be transported in compliance with transportation rules applicable for each means of transport.

During loading/unloading operations and transportation, the requirements indicated on warning labels on the boxes/packaging must be observed, and no impacts are permitted since they can affect the safety and performance of the Product.

Inside the means of transport, the packed device must be firmly secured/fastened.

7 DISPOSAL

New equipment, the parts of the Product damaged during operation, and any overage equipment must not be disposed as standard household wastes, since they contain the materials suitable for re-use.

Decommissioned and non-used components of the Product must be delivered to a special waste disposal center licensed by local authorities. You can also send an overage equipment/unit to the manufacturer for its further disposal.

Proper disposal of the Product components allows avoiding possible negative environmental and health impacts, and it also allows for proper restoration of components with substantial energy and resources saving.

During operation and upon completion of its service life, the equipment is not hazardous for health and environment

This unit must be disposed according to the rules for electronic devices in the country of the buyer



Any products marked with a crossed trash bin must be disposed separately from standard house-hold wastes

8 WARRANTY

The Manufacturer shall have warranty obligation in case of the Product's proper use, according to OM. In case of misuse of equipment the Manufacturer shall not accept damage claims.

For more warranty details visit our website www.unicont.com, section Support.

Address and contacts of Manufacturer's service centre:

NPK MSA LLC

26E, Kibalchicha Str., St Petersburg, Russia, 192174

Tel.: + 7 (812) 602-02-64, 8-800-100-67-19; fax: +7 (812) 362-76-36

e-mail: service@unicont.com

ANNEX A

NMEA PARAMETERS

Table A.1 – NMEA Parameters

Code	Description
DBK (Depth Below Keel) \$--DBK,x.x(1),f,x.x(2),M,x.x(3),F*hh	
d-x1	Depth, feet (1) ¹⁾
d-x2	Depth, meters (2)
d-x3	Depth, fathoms (3)
DBT (Depth Below Transducer) \$--DBT,x.x(1),f,x.x(2),M,x.x(3),F*hh	
d-x1	Depth, feet (1)
d-x2	Depth, meters (2)
d-x3	Depth, fathoms (3)
DPT (Depth And Offset from Transducer) \$--DPT,x.x(1)	
d-x1	Displayed value is a sum of values (1) and (2) in meters If value (2) is positive, therefore it is the distance from the transducer to waterline If value (2) is negative, therefore it is the distance from the transducer to keel
HDG (Heading, Deviation And Variation) \$--HDG,x.x(1),x.x(2),a(3),x.x(4),a(5)*hh	
d-x1	Displayed value is a sum of values (1), (2) and (4) in degrees If value (3) is letter "E", value (2) is set with the positive sign If value (3) is letter "W", value (2) is set with negative sign If value (4) is letter "E", value (5) is set with the positive sign If value (4) is letter "W", value (5) is set with negative sign For instance: 1 Input sentence: \$TEHDG,10.1,2.8,E,1.3,E*60 Displayed value: 14.2 (10.1+2.8+1.3) 2 Input sentence: \$TEHDG,257.2,3.1,W,0.2,E*48 Displayed value: 254.3 (257.3-3.1+0.2)
HDM (Heading, Magnetic) \$--HDM,x.x(1),M*hh	
d-x1	Heading Degrees, magnetic (1)
HDT (Heading, True) \$--HDT,x.x(1),T*hh	
d-x1	Heading Degrees, true (1)
MTW (Water Temperature, Celsius) \$--MTW,x.x(1),C*hh	
d-x1	Degrees (1)

Code	Description
MWV (Wind Speed And Angle) \$--MWV,x.x(1),a(2),x.x(3),a(4),A(5)*hh	
d-x1	Wind angle (1) in degrees Characteristic (2) can be represented by letters “R” or “T” meaning relative or theoretical wind. If characteristic (2) is not displayed or represented by any other letter, such characteristic (1) is considered incorrect and it is not displayed
d-x2	Wind speed (3) Characteristic (4) shows speed measurement units and represented by the letters above: K – km per hour; M – meters per second; N – knots If characteristic (4) is not displayed or represented by any other letter, such characteristic (3) is considered incorrect and it is not displayed
Characteristic (5) shows whether the sentence is correct. The sentence is considered correct, only if this characteristic is shown by letter “A”. If characteristic (5) is not displayed or represented by any other letter, such characteristic is considered incorrect and it is not displayed	
ROT (Rate Of Turn) \$--ROT,x.x(1),A(2)*hh	
d-x1	Rate Of Turn (1), degrees per minute
Characteristic (2) shows whether the sentence is correct (1). Characteristic (1) is considered correct, only if this characteristic (2) is shown by letter “A”. If characteristic (2) is not displayed or represented by any other letter, characteristic is considered incorrect (1), it is not displayed (1)	
RSA (Rudder Sensor Angle) \$--RSA,x.x(1),A(2),x.x(3),A(4)*hh	
d-x1	Starboard (or single) rudder sensor (1)
Characteristic (2) shows whether the sentence is correct (1). Characteristic (1) is considered correct, only if this characteristic (2) is shown by letter “A”. If characteristic (2) is not displayed or represented by any other letter, characteristic is considered incorrect (1), it is not displayed (1)	
d-x2	Port rudder sensor (3)
Characteristic (4) shows whether characteristic (3) is correct. Characteristic (3) is considered correct, only if this characteristic (4) is shown by letter “A”. If characteristic (4) is not displayed or represented by any other letter, characteristic is considered incorrect (3), it is not displayed (3)	
VBW (Dual Ground/Water Speed) \$--VBW,x.x(1),x.x(2),A(3),x.x(4),x.x(5),A(6)*hh or \$--VBW,x.x(1),x.x(2),A(3),x.x(4),x.x(5),A(6),x.x(7),A(8),x.x(9),A(10)*hh	
d-x1	Longitudinal water speed, knots (1)
d-x2	Transverse water speed, knots (2)
Characteristic (3) shows whether characteristics (1) and (2) are correct. Characteristics (1) and (2) are considered correct, only if this characteristic (3) is represented by letter	

Code	Description
	“A”. If characteristic (3) is not displayed or represented by any other letter, characteristics (1) and (2) are considered incorrect, and data of characteristics (1) and (2) are not displayed
d-x3	Longitudinal ground speed, knots (4)
d-x4	Transverse ground speed, knots (5)
	Characteristic (6) shows whether characteristics (4) and (5) are correct. Characteristics (4) and (5) are considered correct, only if this characteristic (6) is represented by letter “A”. If characteristic (6) is not displayed or represented by any other letter, characteristics (4) and (5) are considered incorrect, and data of characteristics (4) and (5) are not displayed
d-x5	Stern transverse water speed, knots (7)
	Characteristic (8) shows whether characteristic (7) is correct. Characteristic (7) is considered correct, only if this characteristic (8) is shown by letter “A”. If characteristic (8) is not displayed or represented by any other letter, such characteristic (7) is considered incorrect and it is not displayed (7)
d-x6	Stern transverse ground speed, knots (9)
	Characteristic (10) shows whether characteristic (9) is correct. Characteristic (9) is considered correct, only if this characteristic (10) is shown by letter “A”. If characteristic (10) is not displayed or represented by any other letter, such characteristic (9) is considered incorrect and it is not displayed (9)
VHW (Water Speed And Heading) \$--VHW,x.x(1),T(2),x.x(3),M(4),x.x(5),N(6),x.x(7),K(8)*hh	
d-x1	Heading, degrees True (1)
	If characteristic (2) is not displayed or represented by any other letter except “T”, such characteristic (1) is considered incorrect, and data of characteristics (1) are not displayed
d-x2	Heading, degrees Magnetic (3)
	If characteristic (4) is not displayed or represented by any other letter except “M”, such characteristic (3) is considered incorrect, and data of characteristics (3) are not displayed
d-x3	Speed, knots (5)
	If characteristic (6) is not displayed or represented by any other letter except “N”, such characteristic (5) is considered incorrect, and data of characteristics (5) are not displayed
d-x4	Speed, km/hr (7)
	If characteristic (8) is not displayed or represented by any other letter except “K”, such characteristic (7) is considered incorrect, and data of characteristics (7) are not displayed
VLW (Dual Ground/Water Distance) \$--VLW,x.x(1),N(2),x.x(3),N(4),x.x(5),N(6),x.x(7),N(8)*hh	
d-x1	Total cumulative water distance, nautical miles (1)
	If characteristic (2) is not displayed or represented by any other letter except “N”, such characteristic (1) is considered incorrect, and data of characteristics (1) are not displayed

Code	Description
d-x2	Water distance since reset, nautical miles (3)
	If characteristic (4) is not displayed or represented by any other letter except “N”, such characteristic (3) is considered incorrect, and data of characteristics (3) are not displayed
d-x3	Total cumulative ground distance, nautical miles (5)
	If characteristic (6) is not displayed or represented by any other letter except “N”, such characteristic (5) is considered incorrect, and data of characteristics (5) are not displayed
d-x4	Ground distance since reset, nautical miles (7)
	If characteristic (8) is not displayed or represented by any other letter except “N”, such characteristic (7) is considered incorrect, and data of characteristics (7) are not displayed
VPW (Speed Measured Parallel To Wind) \$--VPW,x.x(1),N(2),x.x(3),M(4)*hh	
d-x1	Speed, knots (1)
	If characteristic (2) is not displayed or represented by any other letter except “N”, such characteristic (1) is considered incorrect, and data of characteristics (1) are not displayed
d-x2	Speed, meters/second (3)
	If characteristic (4) is not displayed or represented by any other letter except “M”, such characteristic (3) is considered incorrect, and data of characteristics (3) are not displayed
VTG (Course Over Ground and Ground Speed) \$--VTG,x.x(1),T(2),x.x(3),M(4),x.x(5),N(6),x.x(7),K(8),a(9)*hh	
d-x1	Course over ground, degrees True (1)
	If characteristic (2) is not displayed or represented by any other letter except “T”, such characteristic (1) is considered incorrect, and data of characteristic (1) are not displayed
d-x2	Course over ground, degrees Magnetic (3)
	If characteristic (4) is not displayed or represented by any other letter except “M”, such characteristic (3) is considered incorrect, and data of characteristics (3) are not displayed
d-x3	Speed over ground, knots (5)
	If characteristic (6) is not displayed or represented by any other letter except “N”, such characteristic (5) is considered incorrect, and data of characteristic (5) are not displayed
d-x4	Speed over ground, km/hr (7)
	If characteristic (8) is not displayed or represented by any other letter except “K”, such characteristic (7) is considered incorrect, and data of characteristic (7) are not displayed
	Characteristic (9) shows whether the sentence is correct. The sentence is considered correct, only if this characteristic is shown by the letters “D”, “E”, “M”, “S”. If characteristic (9) is not displayed or represented by any other letter, the whole sentence is considered incorrect, and data of such sentence are not displayed
VWR (Relative Wind Speed And Angle) \$--VWR,x.x(1),a(2),x.x(3),N(4),x.x(5),M(6),x.x(7),K(8)*hh	
d-x1	Wind direction magnitude in degrees (1)
	Characteristic (2) represents wind direction and can be displayed by the letters “L” or “R”.

Code	Description
	If characteristic (2) is not displayed or represented by any other letter except “L” or “R”, such characteristic (1) is considered incorrect, and data of characteristic (1) are not displayed
d-x2	Speed, knots (3)
	If characteristic (4) is not displayed or represented by any other letter except “N”, such characteristic (3) is considered incorrect, and data of characteristic (3) are not displayed
d-x3	Speed, meters per second (5)
	If characteristic (6) is not displayed or represented by any other letter except “M”, such characteristic (5) is considered incorrect, and data of characteristics (5) are not displayed
d-x4	Speed, kilometers per hour (7)
	If characteristic (8) is not displayed or represented by any other letter except “K”, such characteristic (7) is considered incorrect, and data of characteristic (7) are not displayed
ZDA (Time And Date) \$--ZDA,hhmmss.ss(1),xx(2),xx(3),xxxx(4),xx(5),xx(6)*hh	
d-x1	Time (1)
d-x11	Time, UTC
d-x12	Time, local – local time in terms of time zone displayed in characteristics (5) and (6). Characteristic (5) shows time difference between UTC and local time zone; characteristic can be within time interval –13 to +13 Characteristic (6) shows time difference between UTC and local time zone; characteristic can be within time interval 0 to +59
d-x2	Date (day and month) (2), (3)
d-x3	Year (4)
ZFO (UTC & Time From Origin Point) \$--ZFO,hhmmss.ss(1),hhmmss.ss(2),c—c(3)*hh	
d-x1	Time, UTC (1)
d-x2	Elapsed time (2)
ZTG (UTC And Time To Destination Point) \$--ZTG,hhmmss.ss(1),hhmmss.ss(2),c—c(3)*hh	
d-x1	Time, UTC (1)
d-x2	Time remaining (2)
VDR (Set And Drift) \$--VDR,x.x(1),T(2),x.x(3),M(4),x.x(5),N(6)*hh	
d-x1	Degrees true (1)
	If characteristic (2) is not displayed or represented by any other letter except “T”, such characteristic (1) is considered incorrect, and data of characteristic (1) are not displayed
d-x2	Degrees Magnetic (3)
	If characteristic (4) is not displayed or represented by any other letter except “M”, such characteristic (3) is considered incorrect, and data of characteristic (3) are not displayed
d-x3	Current speed, knots (5)
	If characteristic (6) is not displayed or represented by any other letter except “N”, such characteristic (5) is considered incorrect, and data of characteristic (5) are not displayed

Code	Description
	WCV (Waypoint Closure Velocity) \$--WCV,x.x(1),N(2),c—c(3),a(4)*hh
d-x1	Velocity component, knots (1)
	If characteristic (2) is not displayed or represented by any other letter except “N”, such characteristic (1) is considered incorrect, and data of characteristic (1) are not displayed
	Characteristic (4) shows whether the sentence is correct. The sentence is considered correct, only if this characteristic is shown by the letters “A”, “D”, “E”, “M”, “S”. If characteristic (4) is not displayed or represented by any other letter, the whole sentence is considered incorrect, and data of this sentence are not displayed
¹⁾ Hereinafter the digit in parentheses, e.g. (4), matches the number of sentence parameter	