Yacht Devices

User Manual

NMEA 2000 Wi-Fi Gateway YDWG-02

also covers models

YDWG-02R, YDWG-02N

Firmware version

1.08

2017

Package Contents

Device	1 pc.
This Manual	1 pc.
Paperclip for reset	1 pc.
NMEA 2000 Drop Cable	not supplied

Note: Device can be connected to the network backbone directly, without a NMEA 2000 drop cable.

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Introduction

The NMEA 2000 Wi-Fi Gateway (hereinafter Gateway or Device) allows you to see data from a NMEA 2000 marine digital network on a PC or smartphone. With it, you get marine network data including vessel course, speed, position, wind speed and direction, water depth, AIS messages from vessels and aircrafts and other navigation data in popular software applications.

The Web Gauges page of administrative web site allow real time viewing of vessel data using a web browser on PC, laptop, tablet or smartphone and can replace instrument displays. No internet connection or app installation is required.

The Device creates its own Wi-Fi network (with range of about 30 meters in open spaces) or it can be connected to an existing Wi-Fi network. In the second case, coverage depends on the coverage of the base network; laptops and PCs can be connected to Wi-Fi routers (and the Gateway services) by Ethernet; and you can configure remote access to the Gateway over the Internet.

To configure the Gateway, you need any Wi-Fi enabled device (laptop or smartphone) with any web browser. The Device's settings can be reset to factory values using the hidden reset button (a paper clip is required, supplied with the Device).

The Gateway supports TCP and UDP network protocols (both can be enabled at the same time). For UDP protocol, the number of clients (physical devices or software applications) is unlimited.

A pair of Wi-Fi Gateways can act as a NMEA 2000 wireless extender and allows joining of two or more physical networks. To pair the gateways, you need to set up both using UDP protocol and set the same port number.

The Device has a bi-directional converter between NMEA 2000 and NMEA 0183 protocols. NMEA 0183 protocol has been widely supported in marine applications since the last millennium. So the Device is compatible with virtually all marine software, except applications especially designed for use only with specific hardware. A powerful system of data filters allows configuring data output for feature-limited mobile applications.

The Gateway also supports RAW protocol, which is not supported in any popular applications at this moment, but it does allow transferring of any NMEA 2000 messages (including proprietary messages) to an application and in the reverse direction. This protocol is open and is also supported by our USB Gateway. We hope that it will be popular among software developers, because it is very simple and free.

We hope that you'll like this tiny and low power Device. Thank you for purchasing our product and happy voyages!

Warranty and Technical Support

1. The Device warranty is valid for two years from the date of purchase. If a Device was purchased in a retail store, the sales receipt may be requested when applying for a warranty claim.
2. The Device warranty is terminated in case of violation of the instructions in this Manual, case integrity breach, or repair or modification of the Device without the manufacturer's written permission.
3. If a warranty request is accepted, the defective Device must be sent to the manufacturer.
4. The warranty liabilities include repair and/or replacement of the goods and do not include the cost of equipment installation and configuration, or shipping of the defective Device to the manufacturer.
5. Responsibility of the manufacturer in case of any damage as a consequence of the Device's operation or installation is limited to the Device cost.
6. The manufacturer is not responsible for any errors and inaccuracies in guides and instructions of other companies.
7. The Device requires no maintenance. The Device's case is non-dismountable.
8. In the event of a failure, please refer to Appendix A before contacting technical support.
9. The manufacturer accepts applications under warranty and provides technical support only via e-mail or from authorized dealers.
10. The contact details of the manufacturer and a list of the authorized dealers are published on the website: http://www.yachtd.com/.

I. Product Specification

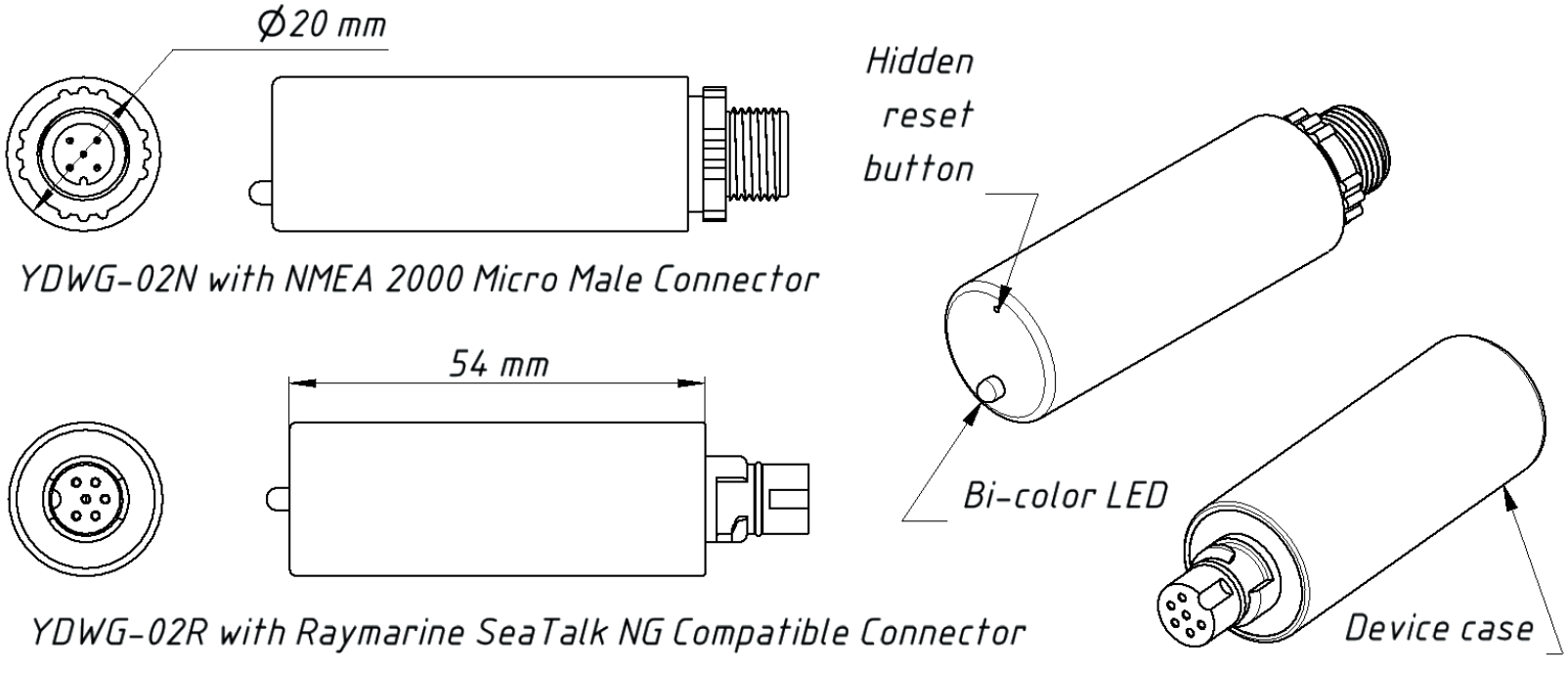

Figure 1. Drawing of YDWG-02N and YDWG-02R models of Gateway

Our devices are supplied with different types of NMEA 2000 connectors. Models containing R in the suffix of model name are equipped with NMEA 2000 connectors and are compatible with Raymarine SeaTalk NG. Models containing N in the suffix are equipped with NMEA 2000 Micro Male connectors. See connector drawings in Appendix B.

Device parameter	Value	Unit
Supply voltage (from NMEA 2000 network)	7..17	V
Current consumption	43	mA
Protection against reverse polarity	Yes	—
Load equivalency number	1	LEN
Wi-Fi module 2.4 GHz	802.11b/g/n	—
Wi-Fi internal antenna range (open space)	30 / 100	m / feet
Wi-Fi connections in Access Point mode (max.)	3	—
TCP connections from applications (max.)	9	—
UDP clients (applications or devices)	Unlimited	—
Device case length	54	mm
Weight	18	gr
Operating temperature range	-20..55	°C

The Wi-Fi antenna is located inside under the LED.

II. Installation of Device and Connection to NMEA 2000 Network

The Device requires no maintenance. When deciding where to install the Device, choose a dry mounting location. Avoid places where the Device could be flooded with water, as this can damage it.

Note that conductive materials (metals) weaken the Wi-Fi signal or may even completely block it. Do not place the Device behind a metal bulkhead. Metals reflect radio signals, and you should avoid (if possible) placing the Device in front of metal bulkheads also. Plastic or wood (and many other non-conductive materials) did not significantly affect the signal.

The Device is well-suited for fiberglass and plastic sailing yachts as well as motor boats up to 65 feet (20 m) in length. With good signal strength over a 30m area in open space, the Gateway provides good coverage inside and outside the boat.

On metal vessels or large vessels, an external Wi-Fi router may be required. In this case, coverage depends on the coverage of the base network, which can contain multiple Wi-Fi routers connected by Ethernet (for example). PCs and laptops can be connected to routers (and to the Gateway services) by Ethernet.

The Device is directly connected to the NMEA 2000 network backbone without a drop cable. Before connecting the Device, turn off the bus power supply. Refer to the manufacturer's documentation if you have any questions regarding the use of connectors:

- SeaTalk NG Reference Manual (81300-1) for Raymarine networks
- Technical Reference for Garmin NMEA 2000 Products (190-00891-00) for Garmin networks

After connecting the Device, close the lock on the connection to ensure it is water resistant and firmly secured.

When powered on, the Device produces a single green flash to indicate that power is supplied. After that, the Gateway will produce a series of four flashes every five seconds (see details in chapter VI). A new Device usually flashes GREEN-GREEN-RED-GREEN after the installation, meaning that it is connected properly.

You can also check the NMEA 2000 connection and firmware version from a chart plotter. Please, see chapter IX for details.

III. Wi-Fi Settings

The Device can work in Access Point mode (factory defaults) and in Client mode, when the Device is connected to an existing Wi-Fi network. To configure the Gateway, you need any Wi-Fi enabled device (laptop or smartphone) with a web browser.

The internal web server of the Gateway has limited possibilities and simultaneous access from multiple devices is not recommended. Updating settings of NMEA servers can cause termination of the current TCP data connections.

1. *Access Point mode*

In the Access Point mode, the Device creates its own Wi-Fi network with the name "YDWG" (SSID) and password 12345678. To open the administration web site, connect to this network and type http://192.168.4.1 in a web browser. Use the login "admin" and password "admin" (without quotes) to log into the administration web site.

The administration web site has a navigation menu on the left; in the mobile version, the menu is accessible by clicking on the icon in the top left corner.

On the "Wi-Fi Access Point" page, you can change the Wi-Fi network name (SSID), password, change the authentication type and make the network hidden. Hidden networks are not visible in the list of Wi-Fi networks, and you can connect to such networks only by entering its name. To enter the name, click on the button with a name like "Other network.." in the list of Wi-Fi networks.

We strongly recommend changing the default Wi-Fi password. A hijacker can take control of autopilot and other important ship systems. In the air drone era, this can happen even far from shore.

Up to three Wi-Fi connections are supported in Access Point mode. You can switch the Device to Client mode to avoid this limitation.

2. *Client mode*

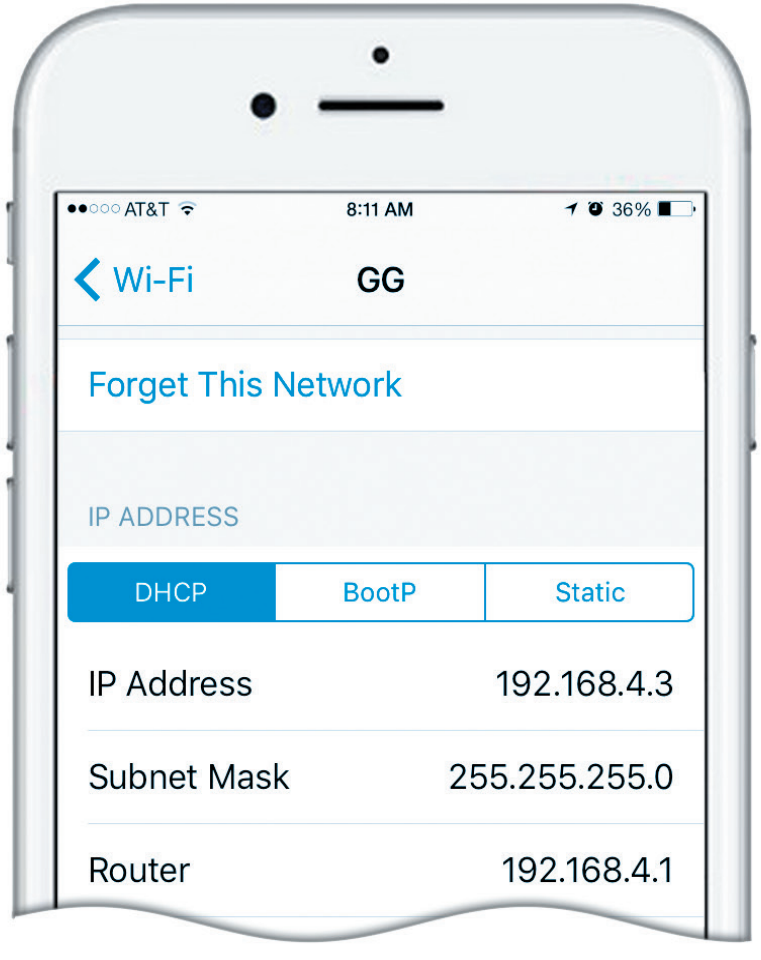

Figure 1. Wi-Fi details on IPhone 6

In this mode, the Gateway connects to an existing Wi-Fi network. To switch to this mode from Access Point mode, or tune the settings, open the “Wi-Fi Client” page on the administration web site.

The Gateway must have a fixed IP address. This can be done in the Wi-Fi router settings; you can assign a fixed IP address by the MAC address of the Gateway printed on the “Wi-Fi Client” page. In this case, you can leave the default “Use DHCP” setting in the IP address configuration. Note that the Gateway has two different MAC addresses, one for the internal Access Point and one for connecting to other networks. You should use the MAC address from the “Wi-Fi Client” page.

Or you can choose “Static IP” address and enter an IP, subnet mask and network router address. In most cases, you can open the settings of the Wi-Fi network on a smartphone or PC, and copy the mask address and router address and select a free IP address from this subnet. For example, if the router has the address 192.168.4.1 (see Figure 1 on the previous page) and a smartphone has the address 192.168.4.3, you can try 192.168.4.100. This is far enough from the address assigned to smartphone.

In case of difficulty, contact your router administrator or refer to the router documentation.

The “Save” button saves settings to EEPROM, and they will be applied at the next connection to the Wi-Fi network. The “Save & Apply” button saves settings and tries immediately to apply them if the Gateway is in Client mode already.

Choose the network from the list or enter the name of a hidden network in the “Other...” edit box and click “Connect”.

If the Gateway was in Access Point mode before, it will shutdown the “YDWG” network after successful connection. Your client device (smartphone, laptop) will continue searching for a non-existing network, and you may need to change the Wi-Fi network manually and enter the new IP address of administration web site in the browser.

For example, you connect the Gateway to the network “Yacht” and specify 192.168.1.100 as the address in the static IP address field. You should connect your smartphone or laptop to the “Yacht” network and type http://192.168.1.100 in the web browser to open administration web site.

3. *What to do if the Device is not accessible*

There many possible reasons why you may not be able connect to the Gateway after changing settings. Check the following:

- was the IP address configured before switching to Client mode?
- what is the Gateway state according the LED signals? (see VI.)
- is your smartphone or laptop connected to the same Wi-Fi network as the Gateway?
- what IP address was assigned to the Gateway? (in Wi-Fi router settings)

If you cannot diagnose what is wrong, you can reset the Device’s settings (see VII.) and the Device will be returned to Access Point mode. You can connect to “YDWG” network again and try to change the settings one more time.

4. *Other important settings*

We also strongly recommend changing the default password for access to the administration web site. It can be done on the “Administration” page.

Access to port 80 (default port of web server) can be limited in some network configurations, and you may change the port on the “Home” page to another, 8000 for example. In this case, you will need to type http://192.168.4.1:8000 in the address bar of browser instead of http://192.168.4.1 to get access to the administration web site.

IV. Configuration of Application Protocols

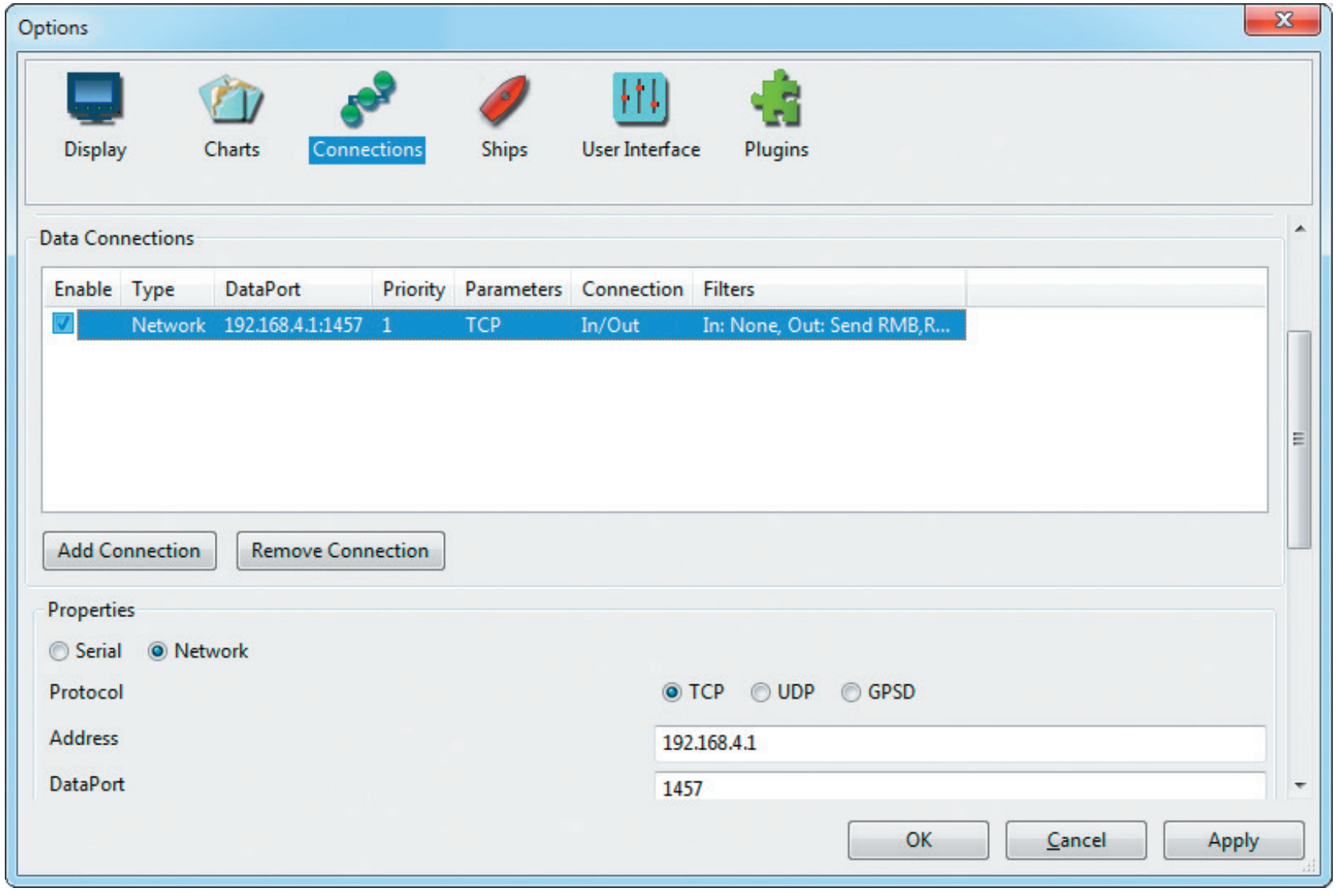

Figure 1. Settings of OpenCPN application

Most marine applications support both TCP and UDP network protocols. TCP is a connection-oriented protocol. This means that the receiver must confirm reception of data before it gets the next packet of data, otherwise the sender repeats the transmission after a timeout. So, the second TCP connection doubles the network

traffic and CPU load, despite the fact that both clients receive the same data.

UDP is a connectionless protocol; any number of clients can listen to data broadcasted from a specified port without any additional load on the server and without increasing the actual network traffic. We recommend using UDP protocol where possible, because the resources of the Device's CPU are limited.

The Gateway supports RAW and NMEA 0183 data protocols. The RAW protocol is not supported in any popular marine application yet. But this protocol is very simple, open and also supported by our USB Gateway YDNU-02. We hope that this protocol becomes popular among software developers.

NMEA 0183 is supported in virtually all marine applications. The Gateway contains a bi-directional converter between NMEA 0183 and NMEA 2000 and has a flexible system of message filters (see V).

On the "NMEA Server" page on the administration web site you can set up to three server ports (see Figure 2 on the next page). If TCP network protocol is selected, up to three connections (from three different applications on one device, or from three devices with one marine application running on each) are allowed at the same time. So three servers allow nine connections in total.

In the case of using UDP protocol, the number of devices or applications used the data port is not limited. We recommend using UDP protocol when possible.

Server port can be configured as bi-direction, read-only (Transmit Only) or write-only (Receive Only). We recommend configuring data ports as read-only if possible, to prevent network flooding from incorrectly configured applications.

Server 3 also supports “Debug” data protocol, designed to diagnose issues with software applications. This protocol is described in chapter VIII.

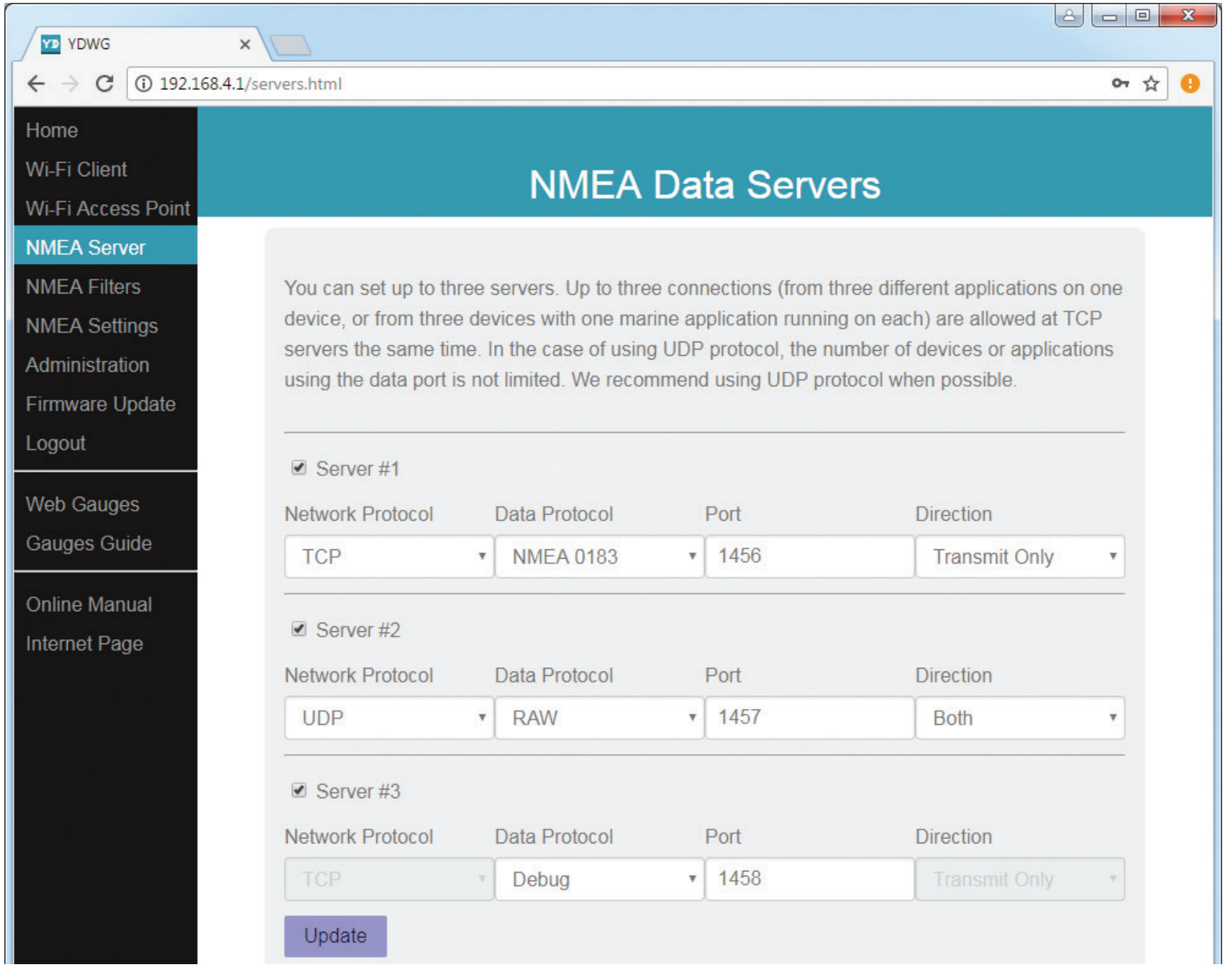

Figure 2. Gateway server settings

With the factory settings, Gateway has the 1st server enabled and pre-configured use TCP port 1456 and the NMEA 0183 data protocol. To connect your application to the Gateway with factory settings:

- connect your laptop or mobile device to YDWG network;
- set the IP address 192.168.4.1 in the application settings;
- specify the TCP protocol and port 1456 in the application settings.

To use the gateway with a Navionics Boating App, no settings are required in the app, but some changes are required in the Gateway configuration:

- configure one of the Gateway servers to use UDP port 2000 and NMEA 0183 data protocol;
- connect your smartphone or tablet to the Gateway's Wi-Fi network.

Some versions of Nobeltec MaxSea and TimeZero (PC and iPad versions) ignore sentences with -- talker ID (gateways' factory setting) and you need to change it to something else, for example, to YD or GP (see X.2).

The settings on the "NMEA Settings" page are designed to control an autopilot by NMEA 0183 protocol and tune NMEA 0183 output settings, see chapter X. for details.

V. NMEA 0183 and NMEA 2000 Message Filters

The Device has 14 filter lists which allow limiting the set of messages passed from the NMEA 2000 network to a PC or mobile application (transmit filters) and messages passed from the application to the NMEA 2000 network (receive filters).

Each NMEA server has four filter lists: two for incoming and outgoing NMEA 0183 messages, two for incoming and outgoing NMEA 2000 messages (used for RAW protocol). Which filter is used depends on the server data protocol settings defined on the “NMEA Servers” page. There are 12 filter lists in total.

The Device also has two “Global” filter lists, which define what NMEA 2000 messages can be passed from the network to internal NMEA servers and what NMEA 2000 messages can be sent by internal NMEA servers to the NMEA 2000 network.

Each filter list has a switchable type: WHITE or BLACK. A message is passed thru the WHITE filter if it contains a record matched with a message. And the reverse for BLACK. In the factory settings, all filter lists are empty and are of BLACK type, so all messages are passed through the filters.

1. *Syntax of NMEA 0183 filters*

NMEA 0183 filters contain 3-char NMEA 0183 sentence formatters separated by a space character. According to the standard, a NMEA 0183 sentence starts with a $ or ! symbol, followed by a two-character talker ID and a 3-char sentence formatter. These elements are followed by data fields (after the comma).

The sentence is finished by a check sum after the * (asterisk) symbol.

Gateway with factory settings using -- talker ID, it can be changed on the “NMEA Settings” page (see X.2). The Device uses 3-char sentence formatters only for filtering. The following sentences matches to GLL and VDM records (sentence formatters):

```
$GPGLL,4146.5894,N,07029.6952,W,173412.02,A*02
!AIVDM,1,1,,B,ENk`smq71h@@@@@@@@@@@@@@@@@@=MeR6<7rpP00003v
f400,4*5F
```

Example of correct NMEA 0183 filter text:

```
GLL VDM DPT
```

2. Syntax of NMEA 2000 (RAW protocol) filters

You should be familiar with the NMEA 2000 Standard (can be purchased from National Marine Electronics Association, www.nmea.org) to operate with NMEA 2000 filters.

These filters actually contain pairs of 29-bit message identifiers and a mask. The identifier is compared by processing the NMEA 2000 message identifier and the second value (mask) defines the comparison concerning which bits are significant. The identifier contains a PGN (Parameter Group Number, described in NMEA 2000 Standard) and a source device address. You can use decimal and hexadecimal numbers (which start with a 0x prefix).

To simplify defining filters, it is also allowed to set filters using PGN only. The filter string contains records separated by comma. Records contain an identifier and mask separated by space, or a PGN number.

Example of correct filter:

```
0x1FD0700 0x1FFFFFF, 130310, 1 255, 130311
```

This filter matches with messages with PGN 130311 (0x1FD07) sent by the device with address 0, PGN 130310 (sent by any device), messages sent by a device with address 1 ("1 255" is another form of the record "0x0000001 0x00000FF"), and PGN 130311 (sent by any device).

3. *Configure filters*

We recommend using Gateway filters only when filtering is not available in software applications (unfortunately, this is not rare in mobile applications). Read chapter VIII to learn how to tune filter settings.

To configure a filter, open the "NMEA Filters" page on the administration web site and select it with "Server", "Data Protocol" and "Filter" combo boxes. Switch the filter type to required, enter a filter string and click "Update" (to discard changes just switch to another filter). On update, the Device parses the string and returns the effective settings back. Incorrect strings are ignored by the Device.

Changes take effect immediately, and if you have diagnostics data opened in another browser window (see VIII), you can monitor the effect of changes in real time.

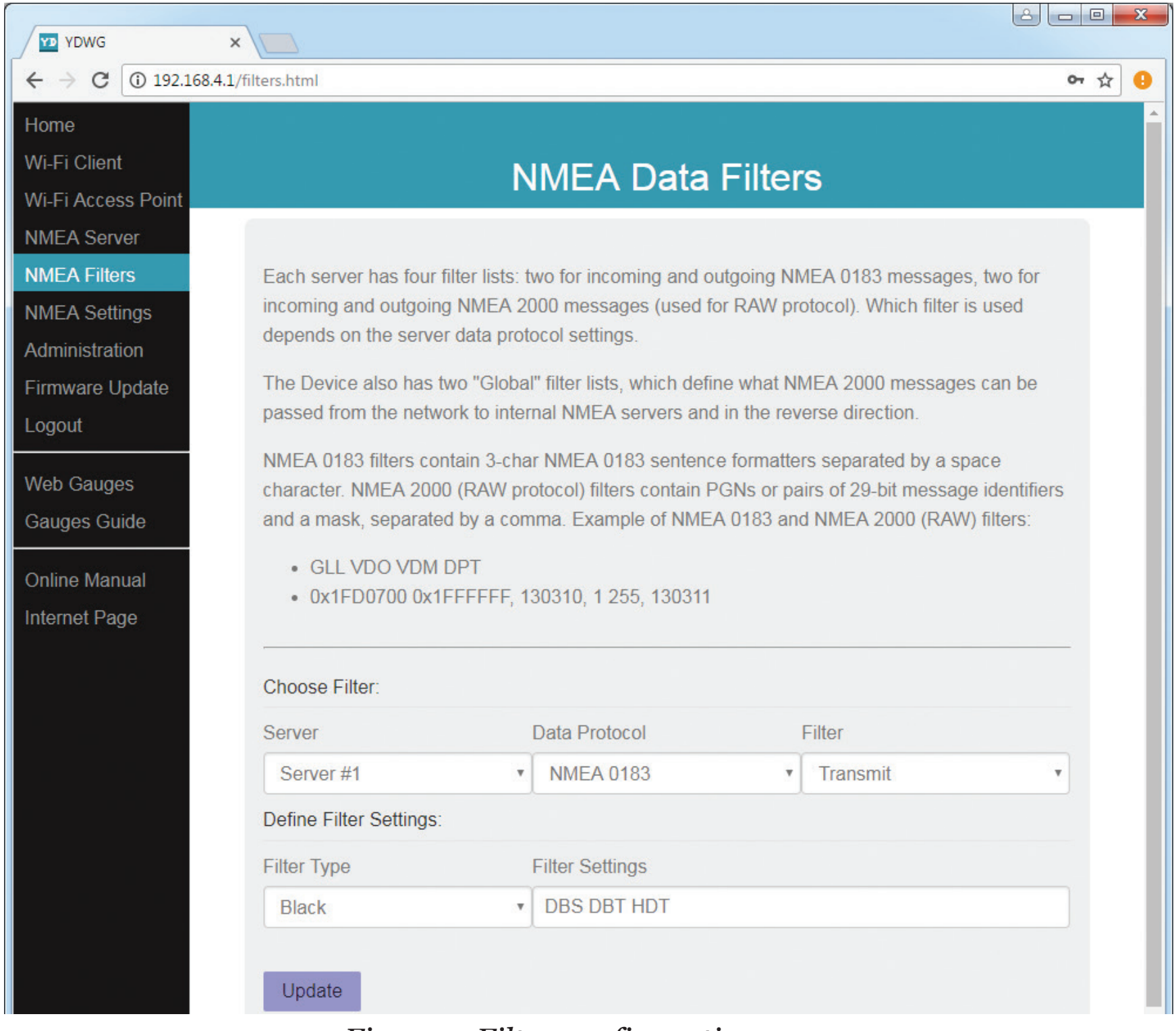

Figure 1. Filter configuration page

VI. LED Signals

The Device is equipped with a bi-color LED that indicates the Device's state. At power on, the Device produce a single green flash to indicate that power is supplied.

#	Meaning	GREEN	RED
1	Wi-Fi Configuration	Gateway is configured to use its own Wi-Fi network named "YDWG" (SSID), Access Point mode.	The Gateway is configured to use the boat's existing Wi-Fi network, Client mode.
2	Wi-Fi State	The state of Wi-Fi link is normal.	Wi-Fi link is not established yet or some error happen (cannot connect to existing Wi-Fi network, wrong password, etc.).
3	TCP Connections	Some clients are connected to Gateway services by TCP protocol. When the administration web site is browsed, the connection exists only a short period when page is downloading from the server.	No TCP connections are open (but applications can receive data by UDP protocol at the same time).
4	NMEA 2000 State	Data was received or sent to the NMEA 2000 network.	No data was received or sent to the NMEA 2000 network

During normal operation, the Gateway produces a series of four flashes every 5 seconds.

With the factory settings, the Gateway should flash GREEN-GREEN-RED-GREEN, and when you open the administration web site in the web browser (http://192.168.4.1), the Device will blink all green while pages are loading.

LED signals during device reset using the hidden reset button are described in chapter VII.

LED flashes during firmware update procedure are described in chapter IX.

VII. Reset of Settings and Hardware Reset

Insert the paper clip (at a right angle to the device face) in the small hole in the end plate of the Gateway. The LED of the Gateway will constantly shine red when the hidden button under the hole is pressed.

Wait 2-3 seconds and the LED will change from red to green. Release the button to reset the Device's settings. Otherwise, the LED will become red 2-3 seconds later. Keep the button pressed ten seconds more, and the LED becomes green. Release the button to complete a hardware reset of Device. Alternatively, wait two seconds, and the LED color returns to red.

Note that nothing happens if you release the button when the LED signal is red. The settings reset occurs if you release the button during the first green light period, and the hardware reset occurs on the second period.

During settings reset, the Device changes all settings to factory values (returns to Access Point Mode, network SSID to "YDWG"), and the Device will produce fast green flashes for 2-3 seconds, then reboot.

During hardware reset, the Gateway returns to the firmware version programmed at the factory (the Device always keeps a copy of this version in EEPROM) and to the factory settings. LED signals during firmware updates are described in chapter IX.

Hardware reset is normally not required. It can be used for firmware rollback.

VIII. Recording of Diagnostics Data

Diagnostics designed to troubleshoot issues with software applications. A log contains all sent and received NMEA 2000 messages and all data sent and received from and to the NMEA server #1 port (see IV). The NMEA server #3 can be configured to send log data in a real time to a web browser or terminal application.

1. Configure problem application to use port of server #1.
2. To get the diagnostics log, configure server #3 port to the “Debug” data protocol (it is TCP network protocol).
3. If the Gateway has the address 10.1.1.1 and server #3 port has a number 1500, type http://10.1.1.1:1500 in browser address bar (experienced users can also use terminal applications to get data from this port).

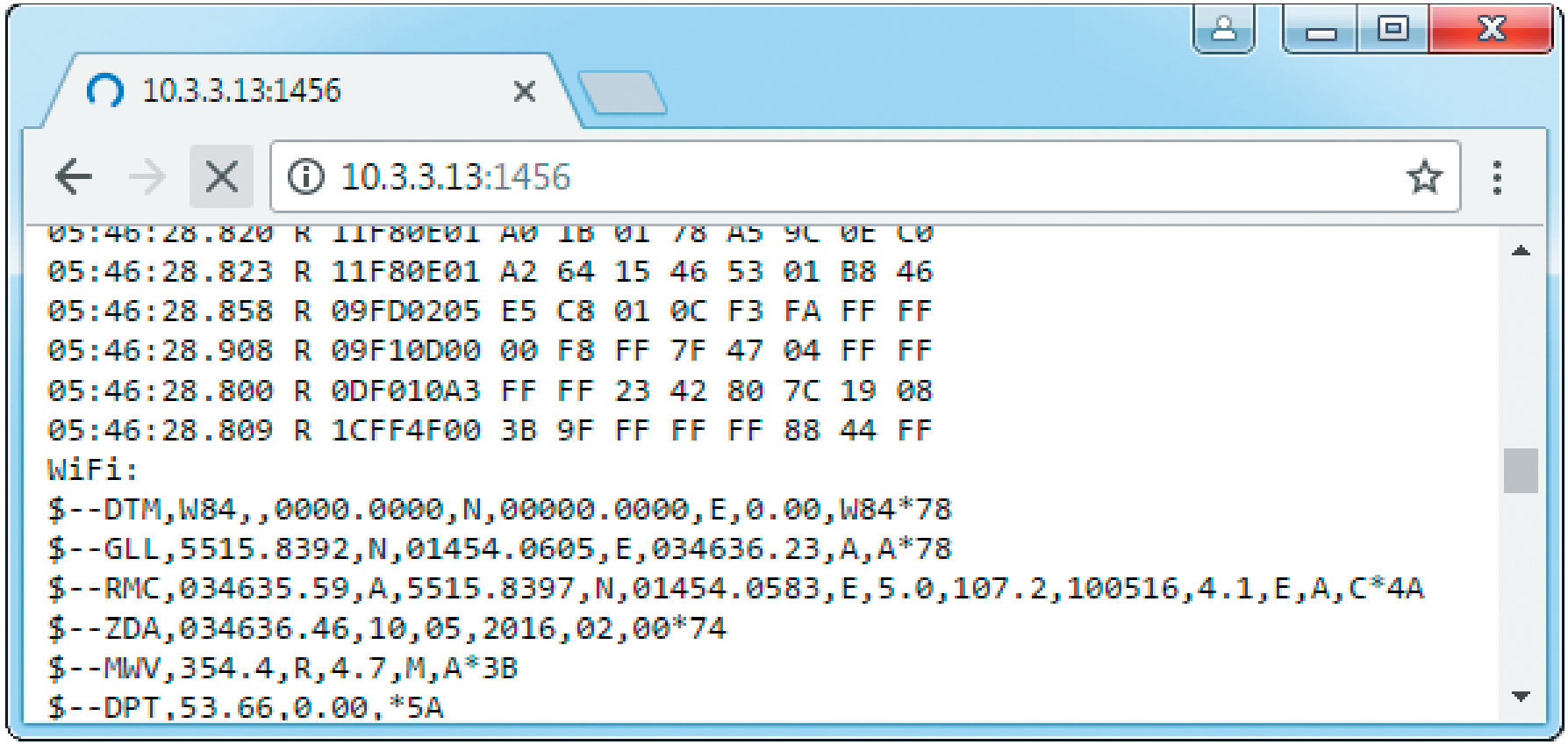

Figure 1. Chrome browser with log

Press the “Stop” button in the browser (or the Esc button in some browsers) when enough data is downloaded and saves the log to disk. Some mobile browsers do not allow saving of files and we recommend using a laptop or PC to record diagnostics data. Some web browsers may try to download the web page again while saving. In this case, you can use the clipboard (Copy All and Paste commands of operating system) and text editor to save the data to a file.

IX. Firmware Updates

You can check the current firmware version at login or on the home page of administration web site (see III) or in the Device information in the list of NMEA 2000 (SeaTalk NG, SimNet, Furuno CAN) devices or in the common list of external devices on the chart plotter (see the third line in Figure 1).

Usually access to this list is located in the “Diagnostics”, “External Interfaces” or “External devices” menu of the chart plotter.

We recommend updating the firmware from a laptop or PC. You can download the latest firmware version from our web site: http://www.yachtd.com/downloads/

You should open the downloaded .ZIP archive with an update and copy the WUPDATE.BIN file to the disk. The README.TXT file inside the archive can contain important information regarding the update.

1. Log in to the administration web site.
2. Open the “Firmware Update” page.
3. Click the “Choose File” button and locate the WUPDATE.BIN file on the disk.
4. Click the “Update the firmware” button.

The Firmware upload takes 20 – 40 seconds. After this period you’ll get a message that the update is started. You will see chaotic flashes of the LED for 40 – 60 seconds, and the Gateway will be rebooted when the update procedure is finished.

The firmware update cannot damage the Device and all settings will remain intact (unless otherwise stated in the README.TXT file provided with

the update) For example, if the update procedure is interrupted due to power failure, it will be re-started at the next power on.

You can roll back all firmware updates and return to the factory firmware with hardware reset (see chapter VII).

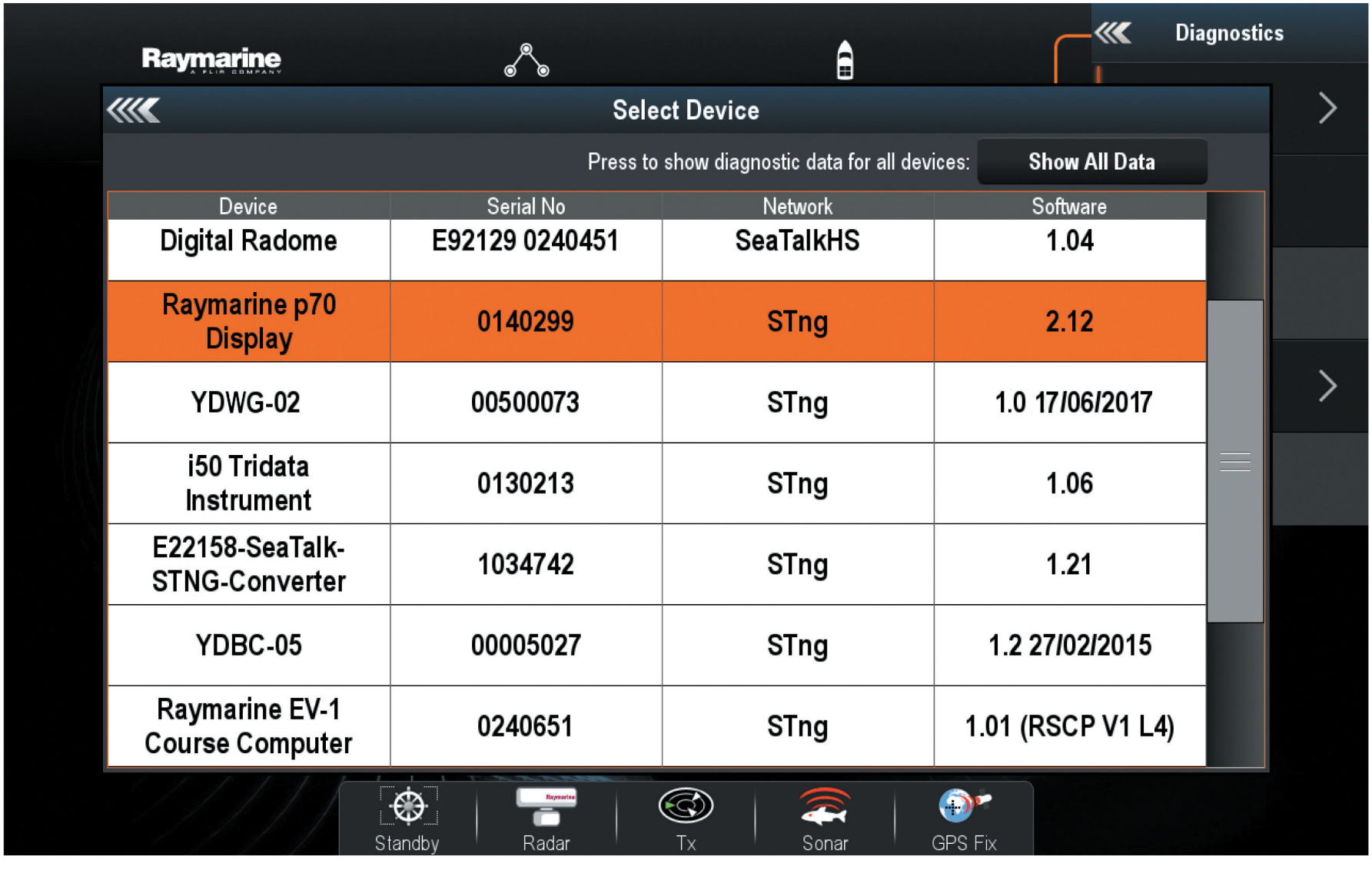

Figure 1. Raymarine c125 MFD devices list with the Device (YDWG-02)

X. NMEA Settings and Autopilot Control

This chapter describes how to control NMEA 2000 (SeaTalk NG) autopilot from the application using NMEA 0183 protocol and the settings available on the "NMEA Settings" page of the administration web site.

1. True wind calculation

The wind sensor always measures apparent wind; true wind angle is calculated using SOG or STW data and true wind direction requires COG or heading. A chart plotter can join all these data and send calculated values to NMEA 2000, but usually TWD, TWA and TWS are not available.

Historically, STW/HDG are used to calculate true wind. However, this is not correct in places with strong current, and the «true» value of true wind can be obtained using the SOG/HDG pair. Therefore, our gateways offers four options: SOG/HDG (if you love truth), SOG/COG (if you have GPS only), STW/HDG (if tradition is most important), or you can disable calculations. In the last case the gateway reports true wind data only if they are calculated by another device available on NMEA 2000 network.

The default setting «Any» means that the gateway will detect what data are available on the network and will calculate true wind data using the best possible option.

2. Talker ID

You can configure the talker ID (two next characters after $ or ! sign) for NMEA 0183 output sentences. The default setting for the talker ID is «--» and gateway sentences looks like:

```
$--WPL,5441.1350,N,02014.8640,E,005*67
$--RTE,1,1,c,My Funyy Route,001,002,003,004,005*0D
```

Some versions of Nobeltec MaxSea and TimeZero (PC and iPad versions) ignore sentences with this talker ID and you need to change it to something else, for example, to YD or GP.

3. Autopilot control

Modern autopilots have the following modes:

- **Standby.** In this mode, autopilot is not engaged to the vessel control.
- **Auto.** The autopilot has a fixed course to steer.
- **Wind.** The autopilot steers the boat at a specified angle to the wind.
- **Waypoint.** The autopilot steers the boat to the specified waypoint.
- **Route or Track.** The autopilot steer the boat by a specified route.

The difference in the last two modes is that autopilot not only maintains the right direction to the waypoint, but also tries to follow the line from the previous to the next waypoint.

Note that Gateway server port must be configured to work in both directions ("Transmit Only" in factory settings) to allow control of autopilot from the application. When NMEA 2000 autopilot is controlled from a NMEA 0183 application, it must receive:

- position of the destination waypoint (from RMB sentence);
- course from the position to the destination waypoint (APB and/or RMB);

- cross track error, means the distance and direction from the current position to the route (APB and/or RMB and/or XTE).

Depending on the implementation, the NMEA 2000 autopilot can also use the following data (and not only):

- vessel heading (HDG sentence), but in most systems the heading sensor is connected directly to the autopilot;
- rate of turn (ROT sentence);
- position, course and speed over ground (RMC sentence).

To control the autopilot, Gateway should receive APB and RMB sentences from the application. Gateway also needs to have magnetic variation data, which can be obtained from HDG or RMC sentences or from the NMEA 2000 messages (must be turned on in the Gateway settings).

If your NMEA 2000 network has GPS data, it can use data already available on NMEA 2000 and sending of the ROT, HDG and RMC sentences from the application may not be required. It is better to send minimal data from a PC to the NMEA 2000 network if possible.

Depending on the autopilot sensitivity settings, autopilot can control your vessel smoothly or aggressively. The application only provides the situation (where is the waypoint and how far we are from the route), but the course to steer and the rudder angle are defined by the autopilot logic.

Switching of waypoints is the work of the application. If the arrival radius is set to 1 NM, application can switch to the next waypoint when the current point is still a mile away. If your route is circular or approximately so, the application can

unexpectedly switch from the first point to the last. You should be familiar with your application settings and test how the system works on the open water.

The autopilot can warn you or ask for your confirmation when the application changing the waypoint. It depends on autopilot settings. When the application terminates the navigation, it usually stops sending APB and RMB sentences. Autopilot usually switches to Auto mode and signals about that.

Raymarine autopilots use proprietary messages to control. The Gateway was tested with the two systems, but we also expect that it will work well with all other Raymarine SeaTalk NG autopilots:

- Raymarine C90W chartplotter, Raymarine SPX SmartPilot SPX30 and Raymarine ST70 Pilot Head;
- Raymarine c125 chartplotter (LightHouse 17), Raymarine EV-1 Course Computer and Raymarine ACU200 Actuator Unit.

To control Raymarine autopilot:

- Gateway server port must be configured to use the NMEA 0183 data protocol and works in both directions (“Transmit Only” in factory settings);
- its support must be turned on in the settings (first setting at the “NMEA Settings” page), because it is turned off by default;
- autopilot must be initially set to the Auto mode to be controlled from the application;
- the application must provide APB, RMB and RMC sentences;

- the application should provide an HDG or RMC sentences or using of NMEA 2000 variation must be on in the settings (3rd setting at the “NMEA Settings” page).

When the route or waypoint is activating in the application, autopilot switches to the Track mode from Auto. If automatic confirmations are off (default settings, 2nd setting at the “NMEA Settings” page), the chart plotter and pilot head will ask for the confirmation when waypoint is changing. When the application terminates the navigation, autopilot returns to the Auto mode.

It is impossible to switch from Track mode to Auto when the application controls the autopilot, because it will return it to the Track mode after a 5-second delay. To take control in an emergency, switch the autopilot to Standby mode.

XI. Web Gauges of Administrative Web Site

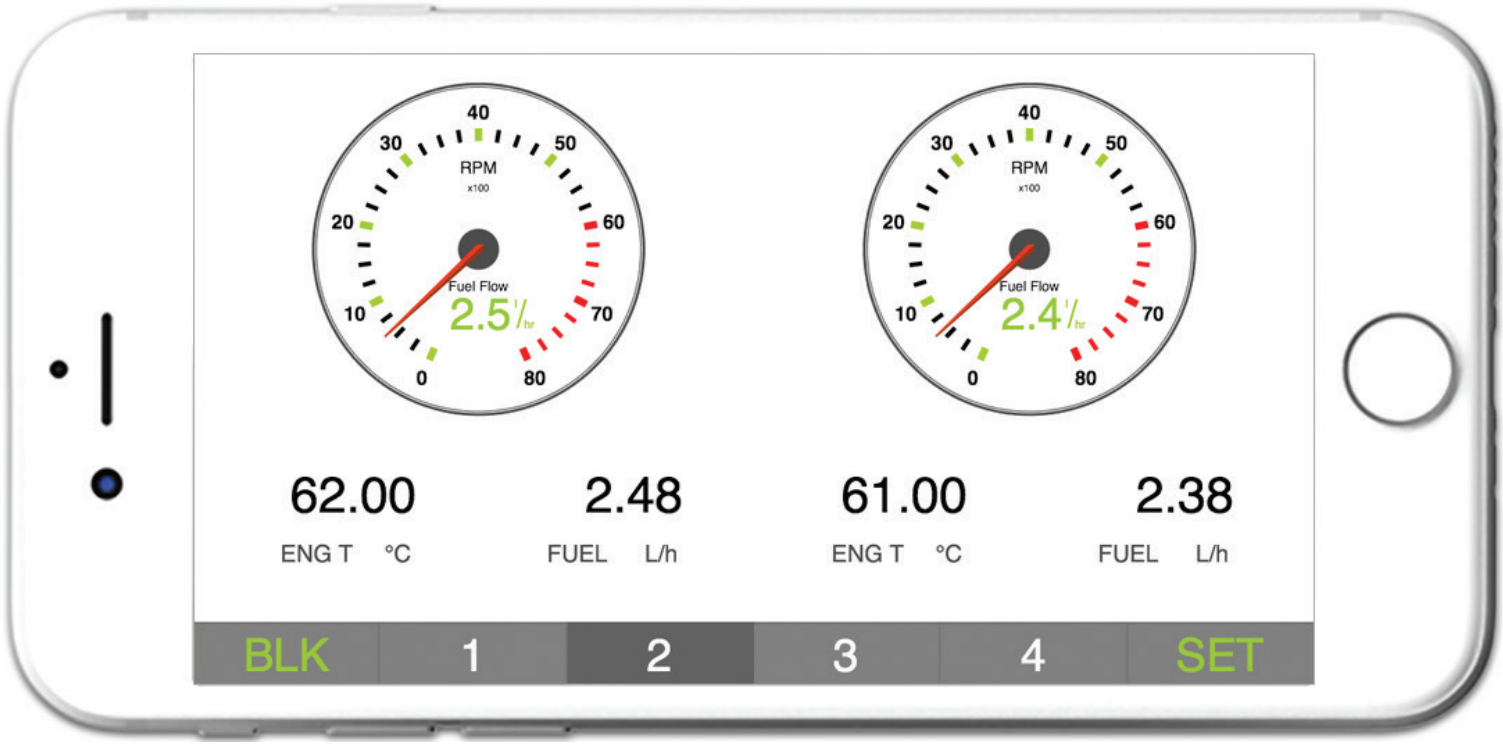

Figure 1. Built-in web gauges (Apple IPhone 7)

The Web Gauges page (WG) allow real time viewing of vessel data using a web browser on PC, laptop, tablet or smartphone and can replace instrument displays. You can open the WG using the link on the logon page of the gateway's administrative web site (no authorization is required) or, if you are logged in, using the «Web Gauges» menu item. No internet connection or app installation is required.

WG offers four customizable data pages. On mobile devices you can slide pages, or you can use the numeric buttons on the menu (at the bottom of the screen) to choose the active page. Data pages are pre-configured. The first page contains circular gauges for course/speed and AWA/AWS (apparent wind angle and speed),

and text data bars with STW, heading, TWS and TWA data. The second page (see Figure 1) is configured to view twin engines' data and contains circular tachometers and text data bars with engine temperature and fuel rate data. The third page contains data bars with position, time, log, sea and air temperature, barometric pressure and depth surface graph with current depth value. The fourth page is not configured and contains no gauges or data bars. You can change any page's layout and its sets of data bars.

On an IPhone, IPad and Android devices, the address bar and/or menu bar of a web browser can reduce the visible area and overlap WG menu in horizontal or vertical screen orientation. In this case, add WG to the Home Screen (see browser menu) and open it using the WG icon on the Home Screen. The page will then open in full screen mode without browser menus or address bars.

The actual WG guide is available on administrative web site (the next link after Web Gauges link at the logon page or in the menu of administrative web site) and online at: http://www.yachtd.com/products/web_gauges.html

APPENDIX A. Troubleshooting

Situation	Possible cause and correction
LED does not signal when NMEA 2000 is turned on	**1. No power supply on the bus.** Check if the bus power is supplied (NMEA 2000 network requires a separate power connection and can not be powered by a plotter or another Device connected to the network). **2. Loose connection in the power supply circuit.** Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another connector.
Device does not signal with 5-second interval	Reset Gateway settings and/or perform a hardware reset (see VII). Apply to technical support.
Software application does not work as expected	**1. Check NMEA filters configuration** (see V). **2. Record diagnostics data** (see VIII) and send it with a software screenshot to technical support.
Cannot connect Wi-Fi device to Gateway	**1. Exceeded the number of allowed connections (3) in Access Point mode.** Reboot Gateway to drop all Wi-Fi connections. **2. High load of Gateway.** Switch applications from TCP to UDP protocol

Table continued

Cannot open TCP server port of Gateway in application	**1. Exceeded the number of TCP connections (3) to server.** Configure application to use another server port or UDP. **2. IP address of Gateway changed.** Static IP address is not configured or DHCP server of Wi-Fi router is not configured. Be sure that you can open the administration web site with browser, reset Gateway settings in case of failure.
Cannot login to Wi-Fi network or administration web site	**Wrong password or authorization settings.** Reset Gateway settings (see VII).

APPENDIX B. Device Connectors

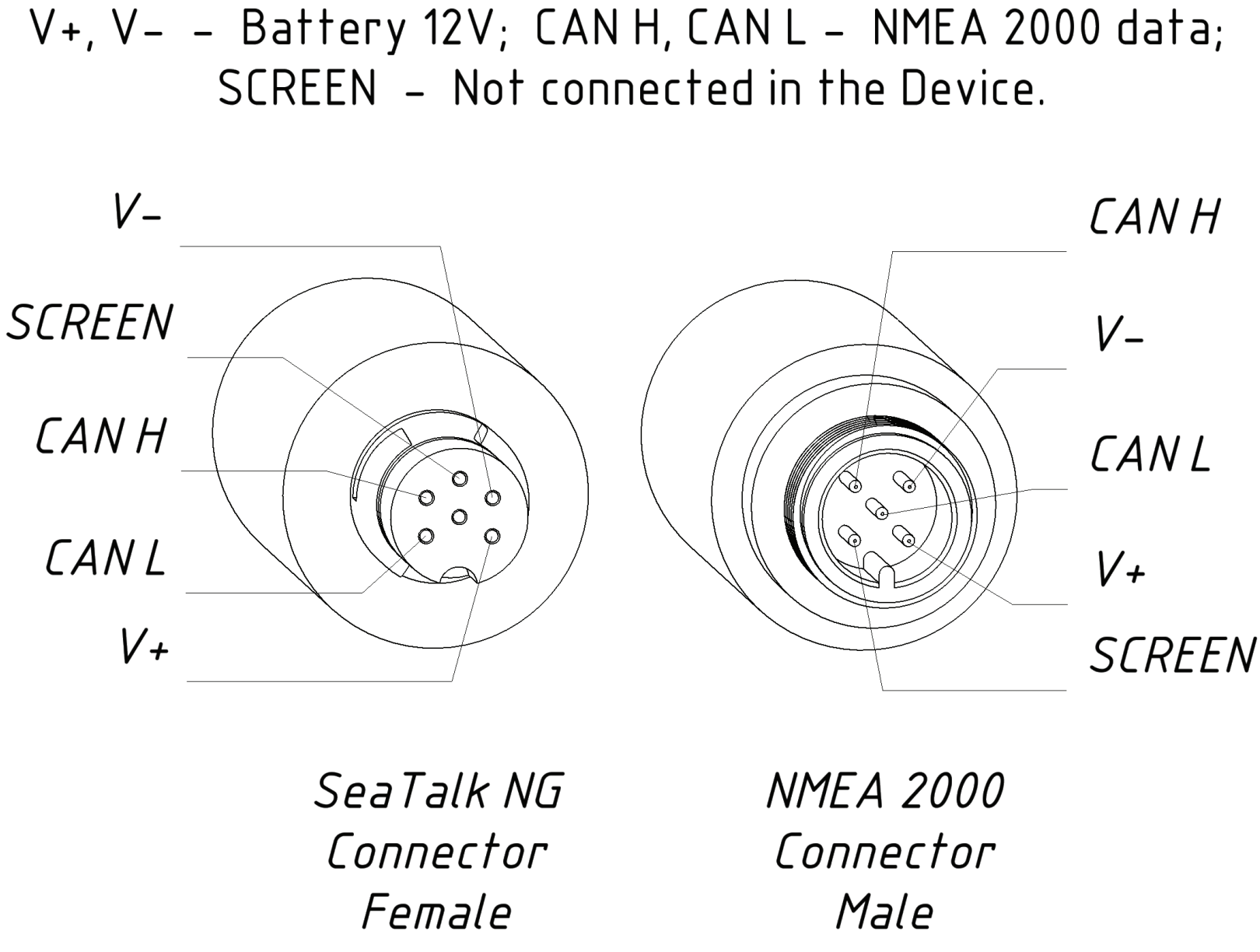

Figure 1. NMEA 2000 connectors of the YDWG-02R and YDWG-02N

APPENDIX C. NMEA 2000 Messages Supported by Device

The Gateway can pass any message from NMEA 2000 to a PC application and in the opposite direction. “No” in the table below means that the Device will not process these messages during service communication with other devices on the network. Note that service communications are not affected by the filter settings of the Device (see chapter V).

Appendix D contains the list of messages processed during conversion from NMEA 2000 to NMEA 0183 and from NMEA 0183 to NMEA 2000.

Table 1. Messages supported by Device

Message	**Receive**	**Transmit**
ISO Acknowledgment, PGN 59392 (0xE800)	Yes	Yes
ISO Address Claim, PGN 60928 (0xEE00)	Yes	Yes
ISO Request, PGN 59904 (0xEA00)	Yes	No
GNSS Position Data, PGN 129029 (0x1F805)	Yes	No
Local Time Offset, PGN 129033 (0x1F809)	Yes	No
PGN List Group Function, PGN 126464 (0x1EE00)	No	Yes
Product Information, PGN 126996 (0x1F014)	Yes	Yes
System Time, PGN 126992 (0x1F010)	Yes	No

APPENDIX D. Conversions Between NMEA 2000 and NMEA 0183

Table 1. Conversions from NMEA 2000 to NMEA 0183

NMEA 2000 PGN	NMEA 0183 Sentence	Comment
65311 Magnetic Variation (Raymarine Proprietary)	—	See note (4)
126992 System Time	ZDA, GLL	See also PGN 129033
127237 Heading/Track Control	APB	Use PGN 129284, 129283 if possible
127245 Rudder	RSA	Two rudders supported
127250 Vessel Heading	HDG, HDM, HDT	See note (4)
127251 Rate of Turn	ROT	
127258 Magnetic Variation	—	See note (4)
127488 Engine Parameters, Rapid Update	RPM	Two engines are supported
127489 Engine Parameters, Dynamic	XDR	Engine temperature and fuel rate only
128259 Speed, Water referenced	VHW	Also may be used in RMC, VTG
128267 Water Depth	DBT, DBS, DPT	

Table 1 continued

NMEA 2000 PGN	**NMEA 0183 Sentence**	**Comment**
128275 Distance Log	VLW	
129025 Position, Rapid Update	GLL	Also use PGN 126992 or 129029
129026 COG & SOG, Rapid Update	VTG	Also used in RMC
129029 GNSS Position Data	GGA, GLL, RMC, ZDA	See also PGN 129033
129033 Local Time Offset	—	Time offset is used in ZDA
129044 Datum	DTM	
129283 Cross Track Error	XTE	
129284 Navigation Data	RMB	Use 129283, 129029 if possible
129285 Navigation - Route/WP information	—	Waypoint names from this message are used in RMB and APB sentences
129291 Set & Drift, Rapid Update	VDR	

Table 1 continued

NMEA 2000 PGN	**NMEA 0183 Sentence**	**Comment**
129539 GNSS DOPs	GSA	PGN 129540 is also required
129540 GNSS Sats in View	GSV	
130066 Route and WP Service — Route/WP-List Attributes	RTE	Use waypoints from 130067
130067 Route and WP Service — Route — WP Name & Position	WPL	
130074 Route and WP Service — WP List — WP Name & Position	WPL	
130306 Wind Data	MWD, MWV	See note (3). Also used in MDA.
130310 Environmental Parameters	XDR, MTW, MDA	See note (1), (5)
130311 Environmental Parameters	XDR, MTW, MDA	See notes (1), (2), (5)
130312 Temperature	XDR, MTW, MDA	See notes (1), (2), (5)
130313 Humidity	XDR, MDA	See notes (1), (2), (5)
130314 Actual Pressure	XDR, MDA	See notes (1), (2), (5)

Table 1 continued

NMEA 2000 PGN	**NMEA 0183 Sentence**	**Comment**
130316 Temperature, Extended Range	XDR, MTW, MDA	See notes (1), (2), (5)
129038 AIS Class A Position Report	VDM, VDO	AIS VHF messages 1, 2 and 3
129039 AIS Class B Position Report	VDM, VDO	AIS VHF message 18
129040 AIS Class B Extended Position Report	VDM, VDO	AIS VHF message 19
129041 AIS Aids to Navigation (AtoN) Report	VDM, VDO	AIS VHF message 21
129793 AIS UTC and Date Report	VDM, VDO	AIS VHF messages 4 and 11
129794 AIS Class A Static and Voyage Related Data	VDM, VDO	AIS VHF message 5
129798 AIS SAR Aircraft Position Report	VDM, VDO	AIS VHF message 9
129809 AIS Class B "CS" Static Data Report,Part A	VDM, VDO	AIS VHF message 24
129810 AIS Class B "CS" Static Data Report, Part B	VDM, VDO	AIS VHF message 24

Note (1): Air and water temperature, inside and outside humidity, barometric pressure are supported.

Note (2): Only messages with data instance 0 are converted.

Note (3): Device with factory settings perform conversion from true to apparent wind and vice versa. MWV sentence is sending twice (one for relative wind and one for true). See X.1 for details.

Note (4): Magnetic variation is used in RMC, HDT, HDG, VDR, VHW, VTG. Priority of variation PGNs: 127250, 127258, 65311.

Note (5): MDA is sent only when air or water temperature, or barometric pressure or outside humidity are available. Also contains wind speed and direction.

Table 2. Conversions from NMEA 0183 to NMEA 2000

NMEA 0183 Sentence	**NMEA 2000 PGN**	**Comment**
APB	129283 Cross Track Error	Also used in PGN 129284
DPT	128267 Water Depth	
DTM	129044 Datum	
GLL	129025 Position, Rapid Update	See note (6)
HDG	127250 Vessel Heading	
HDM, HDT	127250 Vessel Heading	Use variation and deviation from HDG
MWV	130306 Wind Data	Theoretical wind sent as ground referenced to True North; calculated using COG/ SOG
RMB	129283 Cross Track Error 129284 Navigation Data 129285 Navigation — Route/ WP information	Use data from APB; PGN 129284 sent twice with true and magnetic bearings

Table 2 continued

NMEA 0183 Sentence	**NMEA 2000 PGN**	**Comment**
RMC	126992 System Time 127258 Magnetic Variation 129025 Position, Rapid Update 129026 COG & SOG, Rapid Update	See note (6)
RSA	127245 Rudder	
RTE	130066 Route and WP Service — Route/WP-List Attributes 130067 Route and WP Service — Route — WP Name & Position	Use data from WPL
ROT	127251 Rate of Turn	
VHW	128259 Speed, Water referenced	
VDR	129291 Set & Drift, Rapid Update	
VTG	129026 COG & SOG, Rapid Update	
WPL	130074 Route and WP Service — WP List — WP Name & Position	Only waypoints not included to the route (the RTE should be received during 3 seconds after WPL).
ZDA	126992 System Time 129033 Local Time Offset	

Table 2 continued

NMEA 0183 Sentence	**NMEA 2000 PGN**	**Comment**
VDO, VDM	129038 AIS Class A Position Report 129039 AIS Class B Position Report 129040 AIS Class B Extended Position Report 129041 AIS Aids to Navigation (AtoN) Report 129793 AIS UTC and Date Report 129794 AIS Class A Static and Voyage Related Data 129798 AIS SAR Aircraft Position Report 129809 AIS Class B "CS" Static Data Report, Part A 129810 AIS Class B "CS" Static Data Report, Part B	AIS VHF messages 1, 2 and 3 AIS VHF message 18 AIS VHF message 19 AIS VHF message 21 AIS VHF messages 4 and 11 AIS VHF message 5 AIS VHF message 9 AIS VHF message 24 AIS VHF message 24

Note (6): The Device provides 50 milliseconds intervals between outgoing NMEA 2000 messages that are generated by more than one NMEA 0183 sentence. For example, a message with PGN 129025 is generated only once if RMC and GLL are received within a 50 millisecond interval, and twice if the time between GLL and RMC is more than 50 milliseconds.

Note (7): Sentences with no significant data (or data marked as invalid) may not be translated to NMEA 2000 messages. NMEA 0183 sentences with invalid check sum are ignored.

APPENDIX E. Format of Messages in RAW Mode

In RAW mode, network messages are converted to plain text format. We recommend that software developers support this format in applications because it is the easiest option. In the terminal window, NMEA 2000 messages look like a log in a chart plotter.

Messages sent from Device to PC have the following form:

```
hh:mm:ss.ddd D msgid b0 b1 b2 b3 b4 b5 b6 b7<CR><LF>
```

where:

- **hh:mm:sss.ddd** — time of message transmission or reception, ddd are milliseconds;
- **D** — direction of the message ('R' — from NMEA 2000 to application, 'T' — from application to NMEA 2000);
- **msgid** — 29-bit message identifier in hexadecimal format (contains NMEA 2000 PGN and other fields);
- **bo..b7** — message data bytes (from 1 to 8) in hexadecimal format;
- **<CR><LF>** — end of line symbols (carriage return and line feed, decimal 13 and 10).

Example:

```
17:33:21.107 R 19F51323 01 2F 30 70 00 2F 30 70
17:33:21.108 R 19F51323 02 00
17:33:21.141 R 09F80115 A0 7D E6 18 C0 05 FB D5
17:33:21.179 R 09FD0205 64 1E 01 C8 F1 FA FF FF
17:33:21.189 R 1DEFFF00 A0 0B E5 98 F1 08 02 02
17:33:21.190 R 1DEFFF00 A1 00 DF 83 00 00
17:33:21.219 R 15FD0734 FF 02 2B 75 A9 1A FF FF
```

Time of message is UTC time if the Device has received the time from the NMEA 2000 network, otherwise it is the time from Device start.

The format of messages sent from application to Device is the same, but without time and direction field. Outgoing messages must end with <CR><LF>. If the message from application is accepted, passes filters and is transmitted to NMEA 2000, it will be sent back to the application with 'T' direction.

For example, the application sends the following sentence to the Device:

```
19F51323 01 02<CR><LF>
```

When this message is sent to the NMEA 2000 network, the Application receives an answer like:

```
17:33:21.108 T 19F51323 01 02<CR><LF>
```

The Application will get no answer if the message filtered or the message syntax is invalid.

The format of NMEA 2000 messages is available in Appendix B of NMEA 2000 Standard, which can be purchased on the site www.nmea.org.