Yacht Devices

User Manual

NMEA 2000 Ethernet Gateway YDEN-03

also covers models

YDEN-03R, YDEN-03N

Firmware version

1.00

2025

Package Contents

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

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

Web: http://www.yachtd.com/

Contents

Introduction

The NMEA 2000 Ethernet Gateway (referred to as the Gateway or Device) connects navigation PCs and laptops to NMEA 2000 networks via Ethernet, Garmin Marine Network, Raymarine SeaTalk HS, RayNet, Furuno NavNet, or NMEA OneNet. It also supports bridging between multiple NMEA 2000 networks. The Gateway is equipped with a standard RJ45 Ethernet connector, though a proprietary adapter may be required to integrate it with your vessel's network. It can also be connected directly to a PC using a standard Ethernet cable.

The Device provides NMEA 0183 and NMEA 2000 data streams over TCP and/or UDP and includes a bi-directional converter between the two standards. This allows users to view navigation data — including AIS — and control NMEA-compatible equipment such as autopilots through most marine software, including OpenCPN and Expedition (supporting both NMEA 0183 and NMEA 2000 protocols). The Gateway features three configurable TCP/UDP data servers, allowing for customized settings for different applications.

An integrated web server makes configuration and firmware updates simple via any web browser. The built-in Web Gauges page enables control of Raymarine SeaTalk NG autopilots, digital switching equipment, and real-time monitoring of vessel data from any web-enabled device (PC, laptop, tablet, or smartphone), eliminating the need for dedicated instrument displays. No internet connection or additional applications are required.

The Device records vessel data to internal memory, which can be downloaded as GPS tracks, spreadsheets, or XML files through the web interface. Data can also be automatically uploaded to Yacht Devices' free Cloud Service, allowing online position sharing, track retrieval, and remote vessel monitoring from anywhere.

We hope you enjoy this compact, energy-efficient device. Thank you for choosing our product — we wish you safe and pleasant voyages!

Warranty and Technical Support

1. The Device warranty is valid for two years from the purchase date. 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 becomes void if the instructions in this manual are violated, if the Device casing is opened or damaged, or if the Device is repaired or modified 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

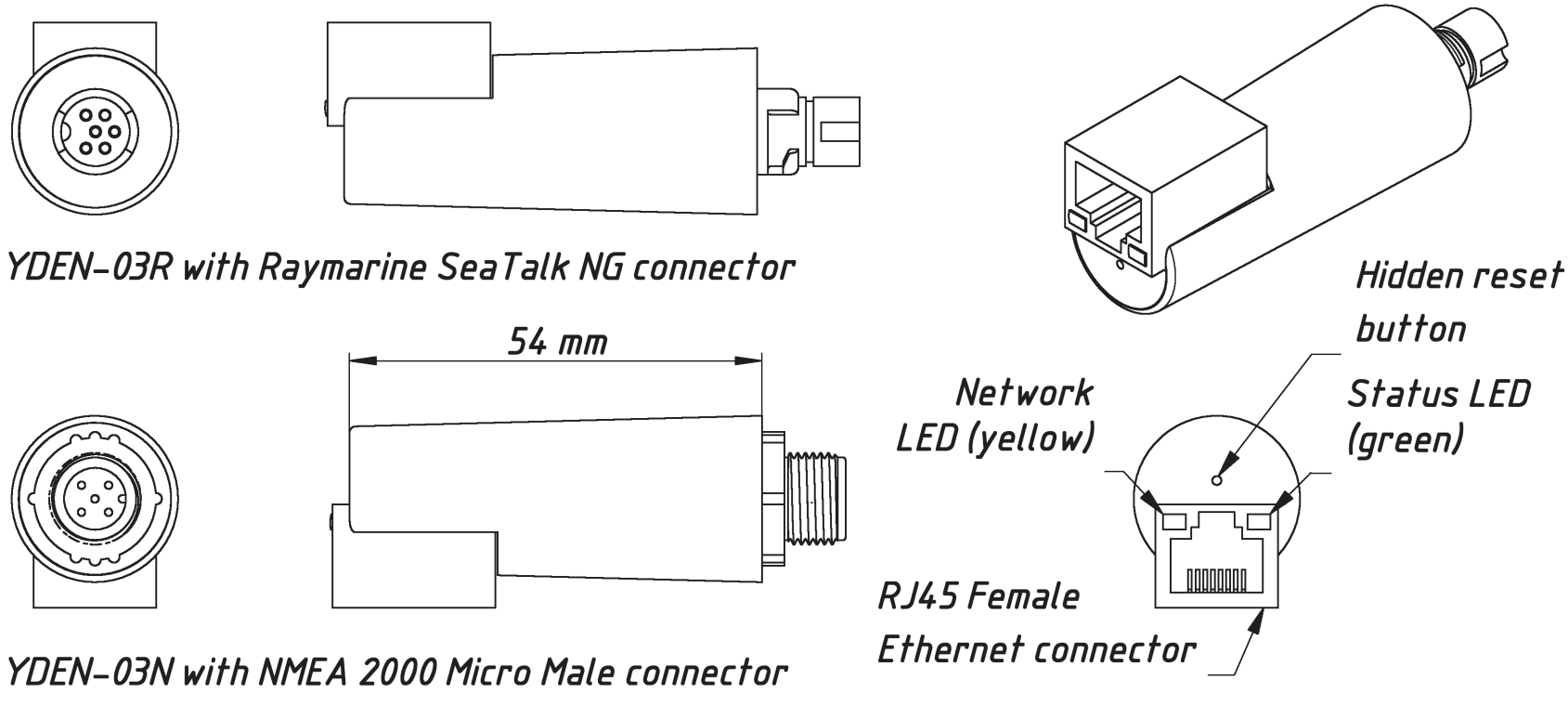


Figure 1. Drawing of YDEN-03R and YDEN-03N

Our devices are supplied with different types of NMEA 2000 connectors. Models with an «R» index feature NMEA 2000 connectors and are compatible with Raymarine SeaTalk NG. Models with an «N» index are equipped with NMEA 2000 Micro Male connectors.

To connect the Device to a Simrad SimNet network (with yellow connectors), you can use an adapter cable (SimNet Female to NMEA 2000 Micro Female, Navico part number 24006199).

Device parameter	Value	Unit
Operating voltage (from an NMEA 2000 network)	7..17	V
Reverse polarity protection	Yes	—
Current consumption (average)	75	mA
Load Equivalency Number	2	LEN
Ethernet physical layer	10/100 Base-T/TX	—
Ethernet interface maximum speed	100	Mb/s
Ethernet galvanic isolation from NMEA 2000	1500	V_{RMS}
Internet protocol version	IPv4	—
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

CE Yacht Devices Ltd declares that this product is compliant with the essential requirements of EMC directive 2014/30/EU and radio and TTE directive 1999/5/EC.

Dispose of this product in compliance with the WEEE Directive or local regulations. Do not dispose of it with household or industrial waste.

II. Device Installation and Connection

The Device requires no maintenance. When selecting an installation location, choose a dry area. Avoid placing the Device where it could be submerged, exposed to rain, or subjected to water spray. Note that during configuration, you may need to observe LED signals or press the Device's hidden button.

The Device's interfaces can be connected in any order. Hot-plugging Ethernet cables (while the Device is powered) is supported. However, since the Device is powered through the NMEA 2000 interface, we recommend connecting this first.

1. NMEA 2000 Connection

The connection method depends on the type of NMEA 2000 connector. While the YDEN-03N can be connected directly to an NMEA 2000 backbone or with a drop cable (up to 6 meters long), the YDEN-03R can only be connected directly to a SeaTalk NG backbone without a spur cable. If you require a longer connection for a SeaTalk NG network, you can use the YDEN-03N with an NMEA 2000 drop cable and a SeaTalk NG-to-NMEA 2000 adapter cable (A06035, A06075 or A06078).

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.

Make sure that the Device connector and the T-piece/drop cable connectors are in good condition. Align connectors key and notches and push the Device into

connector. Do not twist the Device or its pins might be damaged. Close the NMEA 2000 connector lock to ensure its water resistance and reliability.

After powering on the NMEA 2000 network, the status LED on the Ethernet connector (green, shown in Figure 1 of Section I) will begin flashing. This indicates that the Gateway is powered and operating normally (see Section VI for details).

2. Ethernet Connection

The Device can be connected directly to a PC or operate over various networks including Ethernet (10, 100, or 1000 Mb/s), Garmin Marine Network, Raymarine SeaTalk HS, RayNet, Furuno NavNet, or NMEA OneNet. However, note that the Device can't convert radar or sonar imaging data to NMEA 2000, as the NMEA2000 protocol does not support such data types.

PoE (Power over Ethernet) technology is not supported.

Do not connect the Device to networks with PoE!

For direct PC connection, you'll need a standard RJ45 Male-to-Male Cat 5e/6 cable (not supplied with the Device). The cable can be up to 100 meters long and must have at least 4 connected wires (though most cables have all 8 wires connected).

The same cable type can be used for connection to standard Ethernet hubs/routers or Garmin Marine Networks. Note that vessel Ethernet networks (typically used for connecting chart plotters to radars or fishfinders) may use proprietary connectors. Manufacturers provide adapter cables with standard RJ45 connectors, such as:

- Raymarine RayNet: Cables A62360, A80151, A80159;
- Raymarine SeaTalk HS: Cables E55049, E55050, E55051

When connected to an Ethernet network or PC, the Device's yellow network LED will flash to indicate network activity (including service packets) — this occurs periodically even when not in active use. A steady LED indicates either an unconnected/damaged cable or powered-off network equipment. No yellow LED signal means either: the NMEA 2000 network is off (the Device's power source), or a hardware failure requiring Gateway replacement.

III. Connection Settings

Before proceeding, ensure the Device is properly connected to either an Ethernet network or a PC, and verify that the network status LED is blinking irregularly (refer to Section II.2 for details).

1. Ethernet and Internet Protocol (IP) basics

Every Ethernet device possesses a unique 6-byte physical address (MAC address). For application layer communication (including web browsers and TCP/UDP protocols), a 4-byte IP address is required instead. All IP addresses within a subnet must be unique. Devices can obtain their IP address in two ways: either through a static IP configuration (manually assigned and stored in the device settings) or dynamically via DHCP server allocation during startup.

In addition to an IP address, each network interface requires a subnet mask and Gateway address to function properly. For example:

- IP address 192.168.4.3:
- Subnet mask: 255.255.255.0
- Network gateway: 192.168.4.1

These settings inform the device that all hosts with IP addresses in the 192.168.4.xxx range are directly accessible through this interface. If this is the device's only network interface, any traffic destined for other subnets (such as 10.1.1.1) will be routed through the specified gateway. Note that packets will be dropped if the gateway lacks routing rules for the destination subnet (e.g., 10.x.x.x networks).

For domain name resolution (like www.yachtd.com), applications use either:

1. DNS servers (for internet connections);
2. mDNS or Bonjour services (for local network discovery via multicast)

Modern operating systems including Linux, macOS, and Windows 10/11 all support both mDNS and Bonjour protocols.

2. Gateway connection

To access the Gateway, open a web browser and enter one of these addresses:

- http://yden.local
- http://192.168.4.1

This should open the Gateway's web interface. Use «admin» as a password. If you forgot your password, you can reset the Device to restore the default credentials (see Section V for instructions).

If the connection is unsuccessful, disconnect the network cable for 30 seconds, then reconnect it.

3. Operating Modes

The Gateway supports multiple network operating modes:

- **DHCP Client (dynamic IP address).** In this mode, the Gateway automatically obtains its IP address and network configuration from your router. You can typically view the assigned address through your router's web interface by checking the list of connected devices.
- **DHCP Server.** When acting as a DHCP server, the Gateway assigns IP addresses to client devices configured for automatic IP acquisition. The address pool is limited to four sequential addresses (for four clients), beginning

with the next available address after the Gateway's own IP (factory default: 192.168.4.1). Other network devices must use static IP addresses in this configuration.

- **Static IP Address.** In static IP mode, the Gateway uses a fixed IP address while other devices may use either static IP addresses or obtain them from local DHCP server on the network.
- **DHCP Magic (Factory Default Mode)** This hybrid mode first attempts to obtain a dynamic IP address (DHCP Client mode) and automatically switches to DHCP Server mode if unsuccessful. The transition typically completes within few seconds, with the active mode indicated by the status LED. Note that this selection isn't persistent — the process repeats after each reboot.

The «DHCP Magic» mode should work well in case of direct connection with PC (in rare cases, PCs are configured for a static IP address and an address conflict is possible). But if you have a network router with a DCHP server, it can assign random address to the Gateway in «DHCP Magic» mode (if your router has a web interface, you can log on and check the list of connected devices).

For direct PC connection, DHCP Magic generally works well: set up the PC's Ethernet interface to get an IPv4 address automatically (from a DHCP server), and the Device will act as a DHCP server,— it will set up IPv4 for target PC's Ethernet interface and will become available at default address (192.168.4.1).

When the Device is connected to LAN segment with an active DHCP server (e.g. running on LAN's main router), Device will get an IPv4 settings from that DHCP server.

Typically, DHCP server allocates IPv4 addresses (from specified address range) randomly, so Device's IPv4 address may change after power cycle.

To circumvent this, you can either access Device by its local domain name (default: http://yden.local) or set up LAN router's DHCP Server to always give the Device the same IPv4 address (via «static DHCP» aka «DHCP tethering» feature) or even set up the Device in static IP mode.

The Gateway's current Ethernet mode is indicated by its green status LED every 8 seconds (see Section VI for detailed information).

4. Emergency Mode

If you have issues with connection to the web interface, you can enable Emergency mode. This mode can be activated when turning on the Device using a hidden button, and is reset to the previous mode upon reboot.

To initiate Emergency mode, first turn off the NMEA 2000 power supply. Using the provided paperclip, press and hold the hidden reset button (refer to Section V). While continuing to hold the button, restore power to the Device. Release the button once status LED (green) lights up; it will remains constantly lit — this indicates the Gateway has successfully entered emergency mode with the default IP address 192.168.4.1.

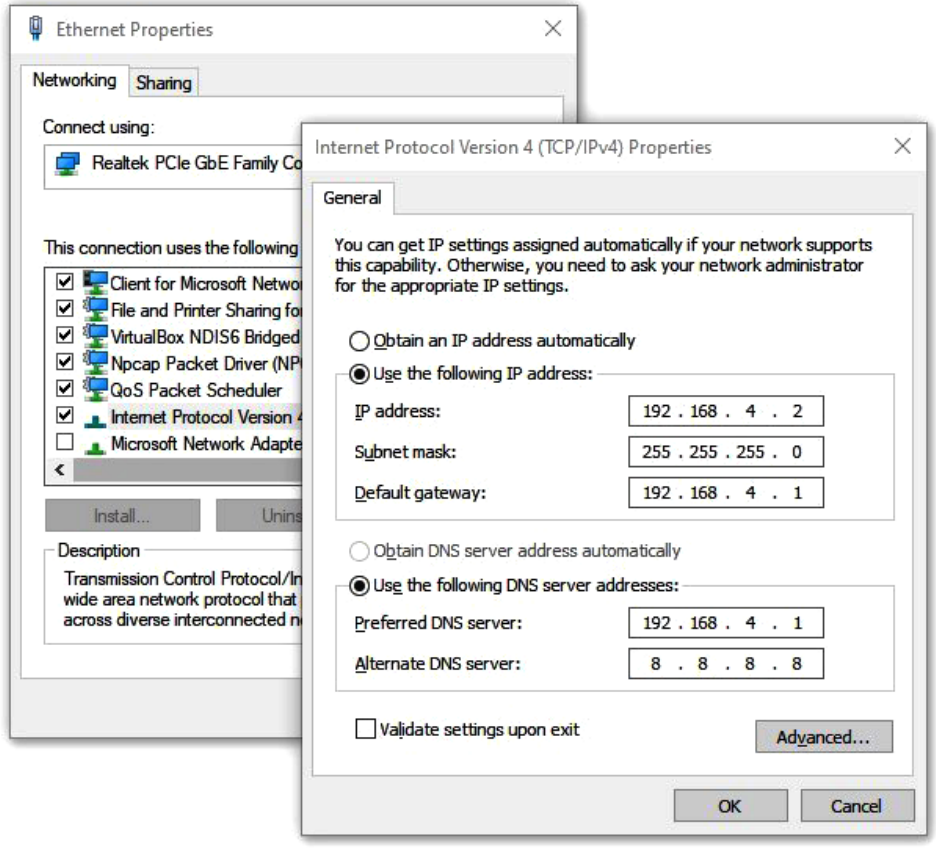


Figure 2. Internet protocol settings in Microsoft Windows

To configure your PC for direct connection, access the network connection properties and select «Internet Protocol Version 4 (TCP/IPv4)» (Windows users — refer to Figure 2). Set the IP address to 192.168.4.2 with subnet mask 255.255.255.0 and default gateway 192.168.4.1; other parameters can remain unchanged. For optimal results and to prevent network conflicts, connect your PC directly to the Gateway using an Ethernet cable.

If you're unable to access the Gateway's web interface:

- verify your web browser's proxy settings are disabled;
- try using an alternative web browser;
- consult the troubleshooting section in the next chapter for additional solutions.

5. Ethernet Connection Troubleshooting Guide

Follow these steps to diagnose and resolve network connection issues:

a. Verify Network Activity. Ensure the Gateway's yellow network LED is blinking irregularly every few seconds. If not, refer to Section II for further instructions.
b. Check Network Mode. Confirm the Gateway's current mode by observing the green status LED patterns (details in Section VI).
c. Reset the Gateway. Perform a settings reset (or a firmware reset if using beta firmware). This will restore the Gateway to DHCP Magic mode (Section III.3).
d. Test Direct Connection. Connect your PC directly to the gateway (bypassing any hubs or routers) and attempt to access the web interface (Section III.2).
e. Enable Emergency Mode. Switch the Gateway to emergency mode and reconfirm your PC's network settings and browser configuration (Section III.4).
f. Seek Further Assistance. If issues persist:

- Photograph your setup and PC network settings.
- Record a short video of the LED activity.
- Contact technical support or consult a local network specialist.

6. Recommended Ethernet settings

For optimal network performance, we recommend adjusting the Gateway's default settings based on your specific LAN setup:

- When connecting directly to a laptop or using a passive network hub (with no DHCP Server running in your LAN), configure the Gateway to «DHCP Server» mode instead of the default «DHCP Magic» mode.

- If your network already has a DHCP server (typically through a router), set the Gateway to «DHCP Client» or «Static IP Address» mode.

- For stationary onboard PCs (as opposed to portable laptops), we suggest assigning a static IP address that differs by at least 10 from the Gateway's address (e.g., x.x.x.11 if the Gateway uses x.x.x.1).

Important note: If you assign an IP address different from the one printed on the Device label, either:

- Apply a new sticker with the updated address on the Gateway, or
- Record the modified address in this manual for future reference.

This configuration ensures stable network operation while maintaining proper address management.

We strongly advise reviewing and customizing all default settings after installation. Unsecured network configurations could potentially allow unauthorized users to gain control of critical vessel systems, including the autopilot. If your network has external connectivity, you must ensure that web interface is not accessible from external networks, and all data servers are properly secured against outside access. Implement appropriate firewall rules and access controls to prevent unauthorized remote access to your network infrastructure.

IV. Gateway Settings

To configure the Gateway, access its web interface using any standard web browser (see Section III.2).

1. Password Setup. Navigate to the Home tab in the left-side menu (tap the menu icon in the top-left corner on mobile devices) to change the web interface password. For security purposes, we recommend recording the new password in this manual.

2. Network Configuration. Proceed to the Ethernet Settings page (Section III.6) to verify or modify your network mode. Important DNS considerations:

   - In DHCP Server mode, the specified DNS server address is automatically provided to client devices.

   - The Gateway uses this DNS setting for Cloud Service access (Section IX) in all modes except DHCP Client mode (where it obtains DNS information from the network's DHCP server).

   The same page allows you to view or modify:

   - The Device's MAC address (physical hardware identifier — typically requires no changes).

   - The local domain name (default: yden.local).

Note: Access by local domain name requires Bonjour/mDNS services, which are natively supported on Linux, macOS, and Windows 10/11 systems. If these services aren't active on your PC, you'll need to access the Gateway using its IP address instead.

1. Application Protocol Configuration

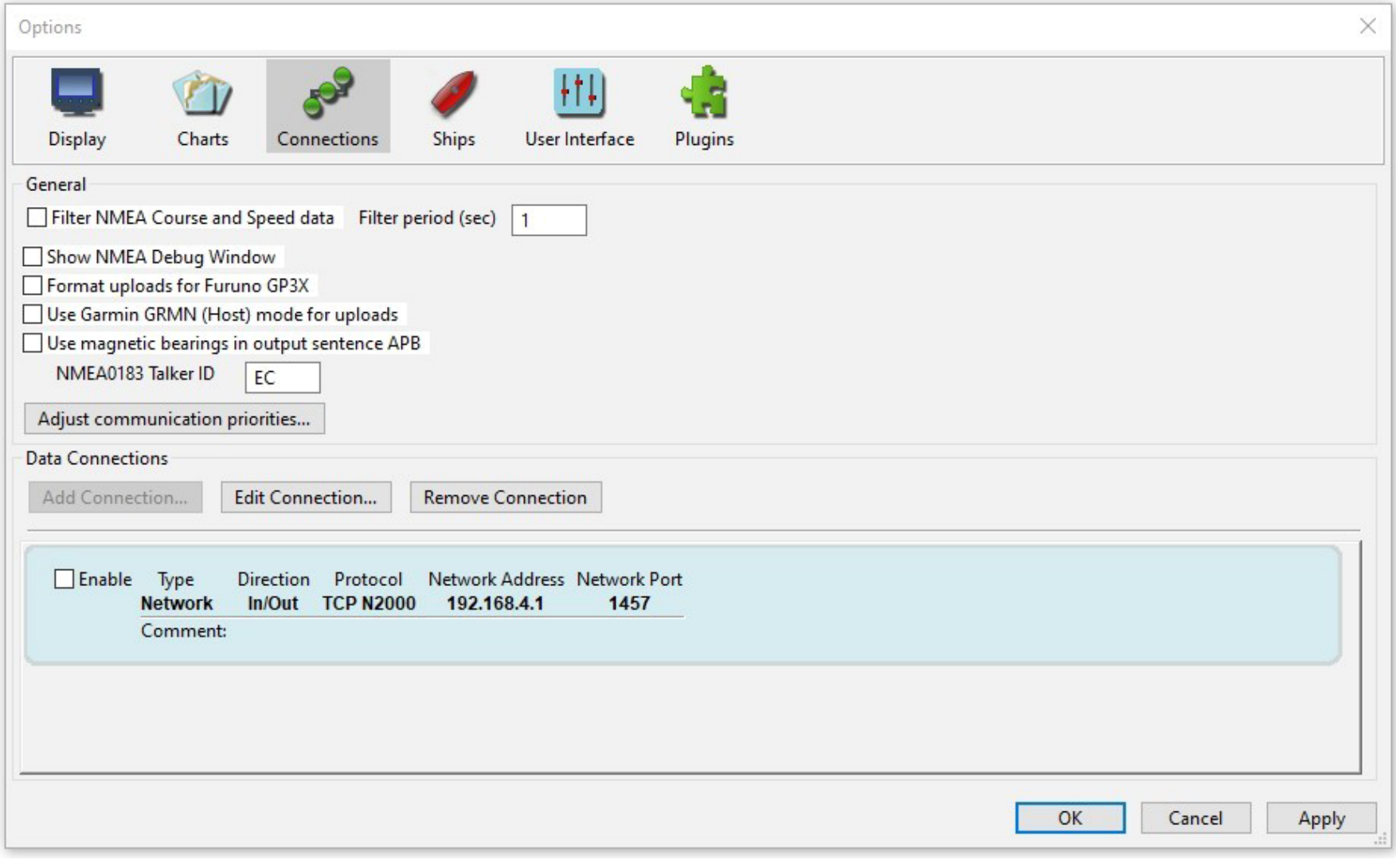


Figure 3. OpenCPN connection settings

Marine applications typically support both TCP and UDP network protocols, each with distinct characteristics:

TCP is a stateful protocol requiring receiver acknowledgment for each data packet. If acknowledgment fails, the sender retransmits the data. This means each

additional TCP connection doubles network traffic and CPU load, even when clients receive identical data.

UDP, being stateless, allows multiple clients to listen to data broadcasts from a single port without increasing server load or network traffic. We recommend using UDP whenever possible.

The Gateway supports both NMEA 2000 (RAW) and NMEA 0183 marine data protocols, featuring a built-in bi-directional converter between them (detailed in Appendix C) along with a configurable message filtering system (see Section IV.3). The NMEA 2000 (RAW) protocol implementation is compatible, for example, with OpenCPN, Expedition, SignalK Server and also with our CAN Log Viewer applications (Section VII.2) and represents an open, simplified standard that maintains interoperability with our complete range of gateways and routers — complete technical specifications for this protocol can be found in Appendix D.

This unified architecture provides seamless protocol conversion while offering customizable data handling capabilities across all supported marine electronics platforms.

The «Data Servers» page allows you to configure of up to three server ports (see Figure 4). If the TCP network protocol is selected, up to three connections are allowed at the same time, either from three separate applications running on a single device, or from three individual devices each running one marine application. This configuration enables a total of nine simultaneous TCP connections across all three servers.

When utilizing the UDP protocol, there are no restrictions on the number of devices or applications that can access the data simultaneously.

Data direction can be configured on each Data Server individually. The default

mode is «From NMEA 2000» — to only receive data from NMEA 2000, but you can set «To NMEA 2000» — to send data to NMEA 2000, or to «Bidirectional» — to both send and receive. We recommend configuring data ports as read-only whenever possible, to prevent network flooding caused by incorrectly configured applications.

Server #1 is used by Web Gauges (see Section VIII) in addition to connected clients; this means that Web Gauges are not operable if this server is configured as RAW protocol or turned off.

Server #3 also supports the «Debug» data protocol. The «Debug» protocol, described in Section VII, is intended for diagnosing hardware or software issues.

The Gateway is supplied preconfigured with Server #1 enabled and set up to use TCP on port 1456, NMEA 0183 data protocol, transmit-only data direction for immediate out-of-the-box functionality. To connect your application to the Gateway with factory settings:

- set the IP address 192.168.4.1 in the application connection settings;
- specify the TCP protocol and port 1456 in the application connection settings.

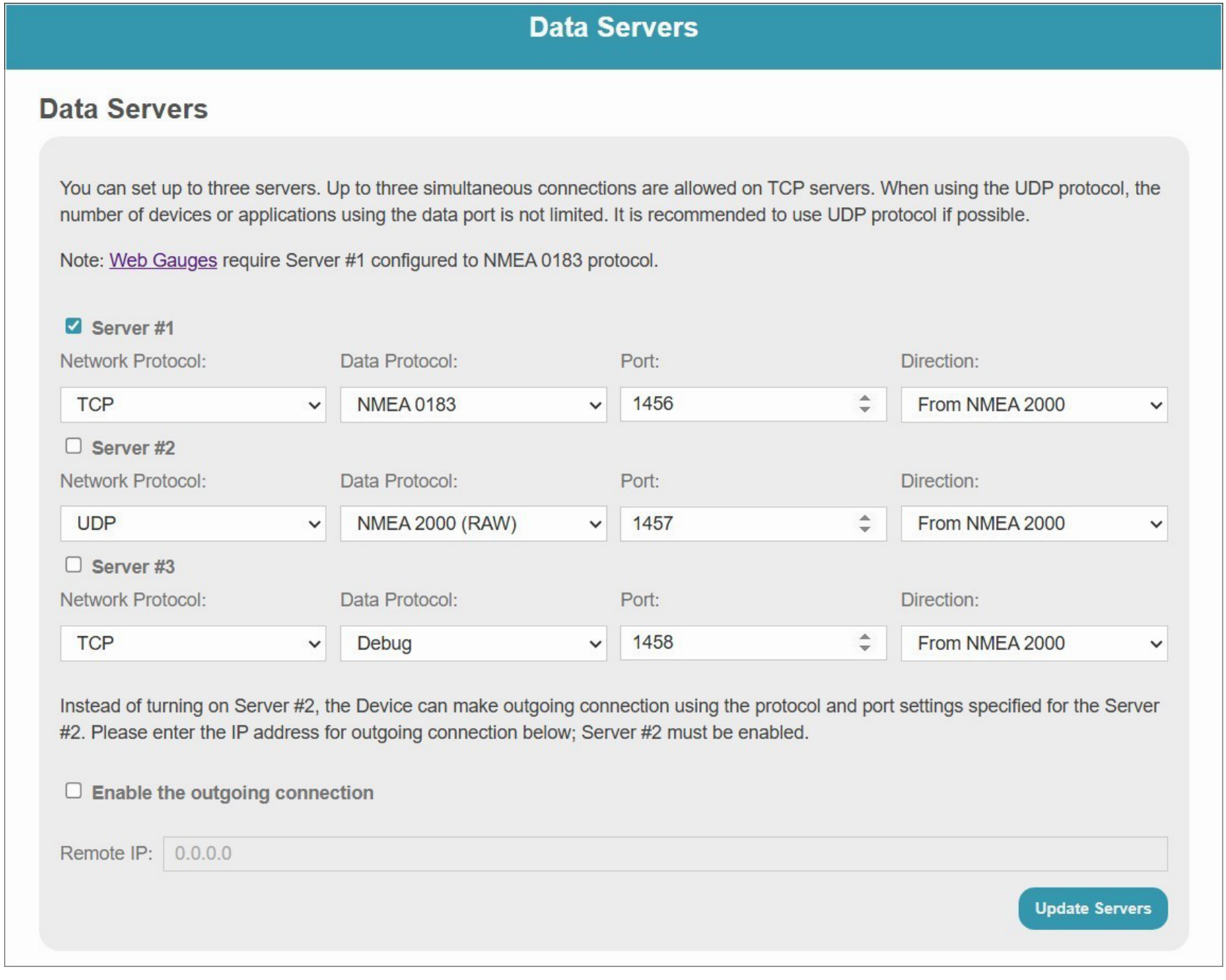


Figure 4. Gateway's Data Servers settings

2. NMEA Settings and Autopilot Control

On the «NMEA Settings» page you can configure control of NMEA 2000 (SeaTalk NG) autopilots, and tune conversion between NMEA 0183 and NMEA 2000 protocols.

2.1. True wind calculation

The wind sensor always measures apparent wind. True wind angle is derived from SOG or STW data, while true wind direction additionally requires COG or heading. A chart plotter can combine these data sources and transmit calculated values to NMEA 2000; however, TWD, TWA, and TWS are typically not available.

Traditionally, STW/HDG are used to calculate true wind. This method is inaccurate in areas with strong currents, where a more accurate true wind value can be obtained using the SOG/HDG pair. The Gateway therefore provides four configuration options:

- SOG/HDG (for maximum accuracy);
- SOG/COG (for GPS-only installations);
- STW/HDG (for compatibility with traditional practice);
- or Disabled (in which case the Gateway will report true wind data only if they are provided by another device on the NMEA 2000 network).

The default setting, Any, instructs the Gateway to automatically detect available data on the network and compute true wind values using the best available option. Please note that true wind is calculated only during conversion from NMEA 2000 to NMEA 0183.

2.2. 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 «YD» and gateway sentences looks like:

```
$YDWPL,5441.1350,N,02014.8640,E,005*7A
$YDRTE,1,1,c,My Funyy Route,001,002,003,004,005*10
```

2.3. Autopilot control

The Device allows to steer NMEA 2000 autopilots (in GoTo and TRACK modes) under control of navigational software (for example, OpenCPN). Most of the software solutions still use the NMEA 0183 protocol for communication. When NMEA 2000 autopilot is controlled by a NMEA 0183 solution, the Device must receive:

- position of the origin and destination waypoints (via RMB sentence);
- course to steer from the position to the destination waypoint (via APB and/or RMB);
- cross track error, the distance and direction from the current position to the active route's leg (via APB and/or RMB and/or XTE).

So, the bare minimum data that should be provided to the Device is an RMB sentence — with all data fields filled with correct data. Note that RMB, APB and XTE sentences should be sent with at least 2 seconds interval (1 second update interval recommended).

When the track changes to the next leg, RMB waypoint IDs should change in correct sequence — i.e. «Destination waypoint ID» of the previous leg should become «Origin waypoint ID» of the current leg. Destination waypoint IDs should be the same in APB and RMB sentences.

Please, note also that navigation system switches route legs based on set arrival radius. Make sure to set up correct arrival radius (smaller than minimal distance between any of the track's waypoints) and test how the system works on the open water (e.g. try circular route or box pattern).

The autopilot may not activate GOTO/Track mode when receiving standard NMEA 2000 messages, as the autopilots we are familiar with, require additional proprietary control messages to switch operating modes. In this case, we recommend the following sequence of actions:

- activate Track or GoTo mode on a NMEA 0183 navigational solution;
- engage Autopilot in TRACK mode (using the Pilot Head or Autopilot GUI on a chartplotter).

Device also has an extra support for Raymarine SeaTalk NG autopilots (SmartPilot SPX and Evolution series) and offers a limited mode switching features.

If «Control of Raymarine autopilots from NMEA 0183» setting is enabled, Device can switch Autopilot mode from AUTO to TRACK whenever correct APB, RMB, XTE sentences are detected, and switch back to AUTO mode when APB, RMB, XTE sentences are not detected within 5 seconds, or their data are invalid, or waypoint IDs on the leg change are not in a correct sequence order. Note that it will not be possible to switch Autopilot mode back to AUTO while navigational solution still controls it — Autopilot will fall back to TRACK mode after 5 second delay.

To take control in an emergency, switch Autopilot to STANDBY mode using Pilot Head.

Raymarine autopilots are designed to warn you each time the destination waypoint changes, and you need to confirm the next waypoint on each next leg. If the setting «Send automatic confirmation when changing waypoint» is enabled (refer to Figure 5), Device will confirm the next waypoint automatically. Use with caution!

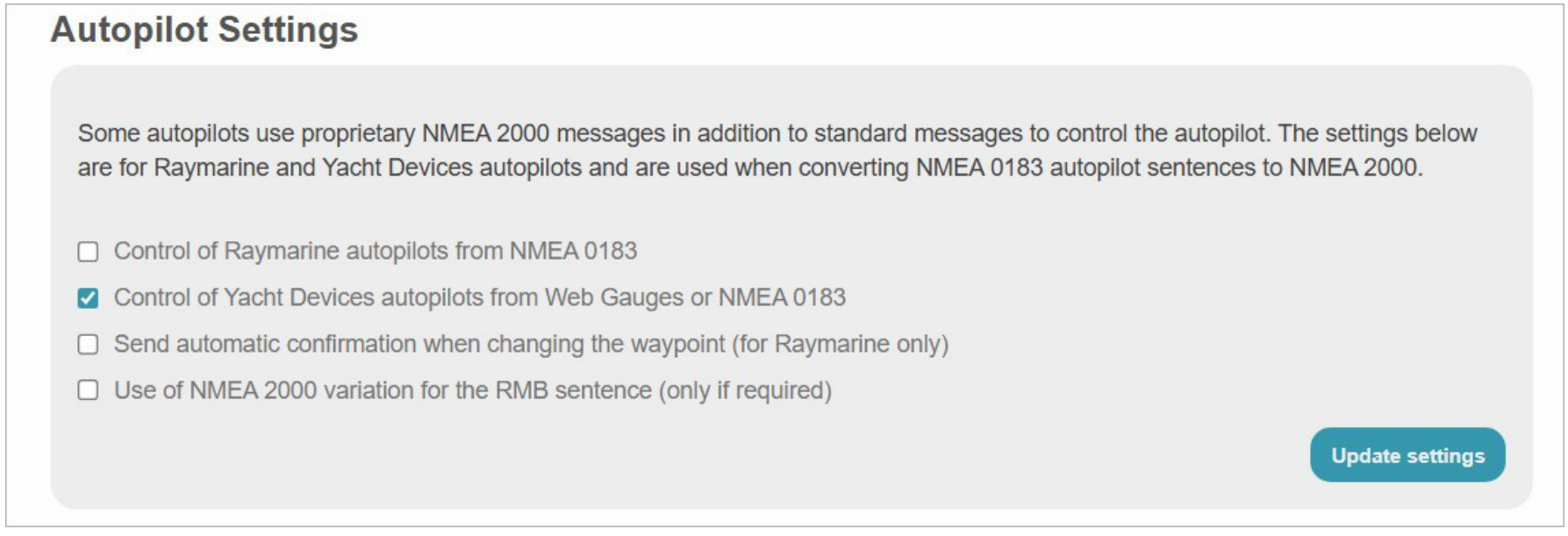


Figure 5. Autopilot Control Settings

Yacht Devices and Raymarine Seatalk NG autopilots can be controlled from Web Gauges (including mode switching). For that, you need to enable the corresponding option in the «Autopilot Settings» section, and also configure the Web Gauges page (see Section VIII).

2.4. XDR Settings

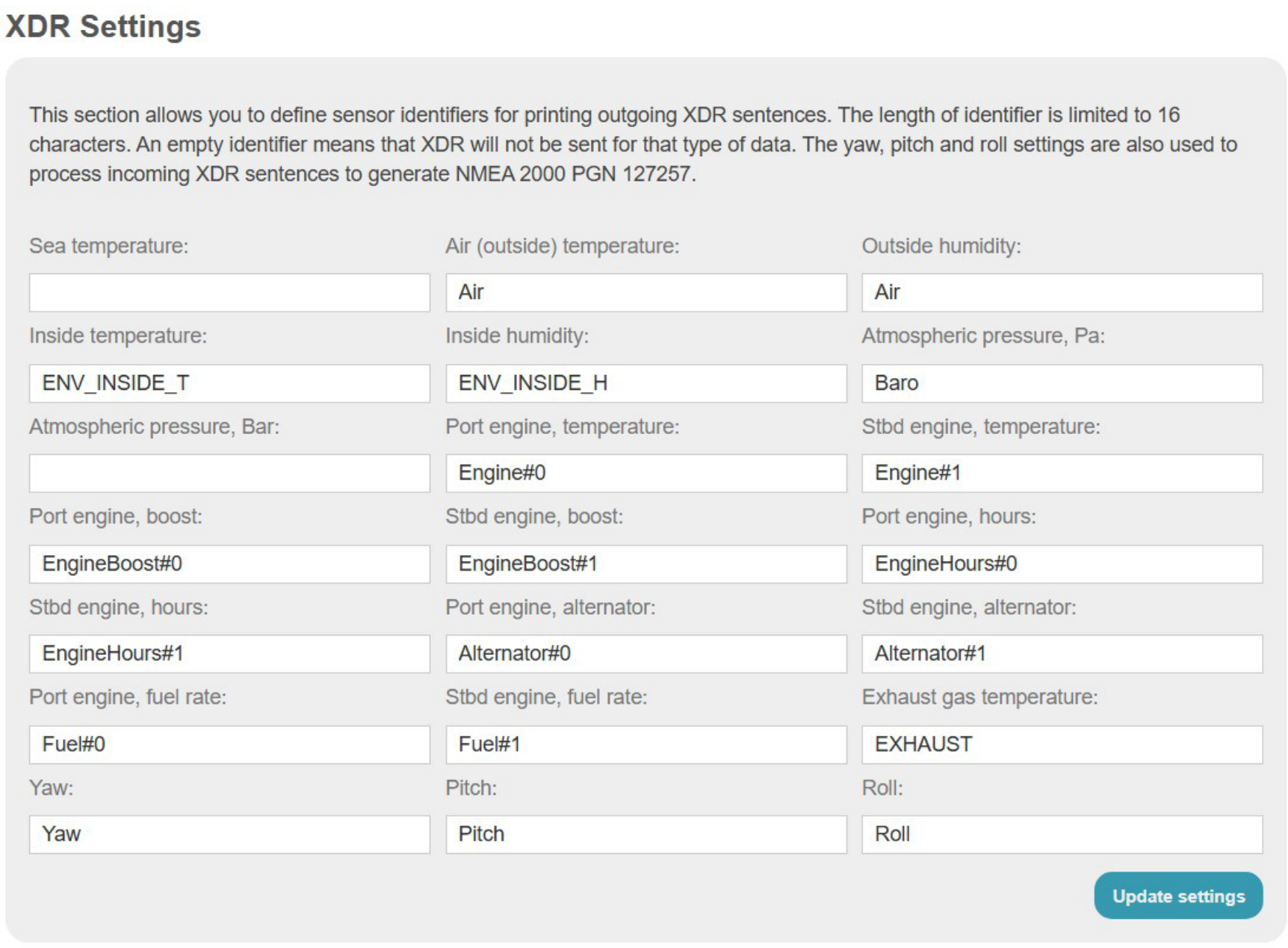


Figure 6. XDR settings

In this section you can set identifiers (transducer IDs) for incoming and outgoing XDR sentences.

The XDR sentence is used to transfer data from sensors, tanks, engines, etc.

This sentence contains the sensor's text identifier (name), which was not defined by NMEA Standard until end of 2018. This led to the invention of names by every company on the market. For example, B&G uses «AIRTEMP» to send air temperature data, OpenCPN software uses «TempAir», Maretron uses «ENV_OUTSIDE_T», and the NMEA 0183 Standard 4.11 defines «Air».

With these settings you can define names used in XDR to provide compatibility with software or hardware. The length of the name is limited to 16 characters.

An empty name disables the conversion.

Note that Yaw, Roll and Pitch conversion works in both directions..

For more details about XDR refer to our FAQ: https://www.yachtd.com/faq/.

3. NMEA 0183 and NMEA 2000 Message Filters

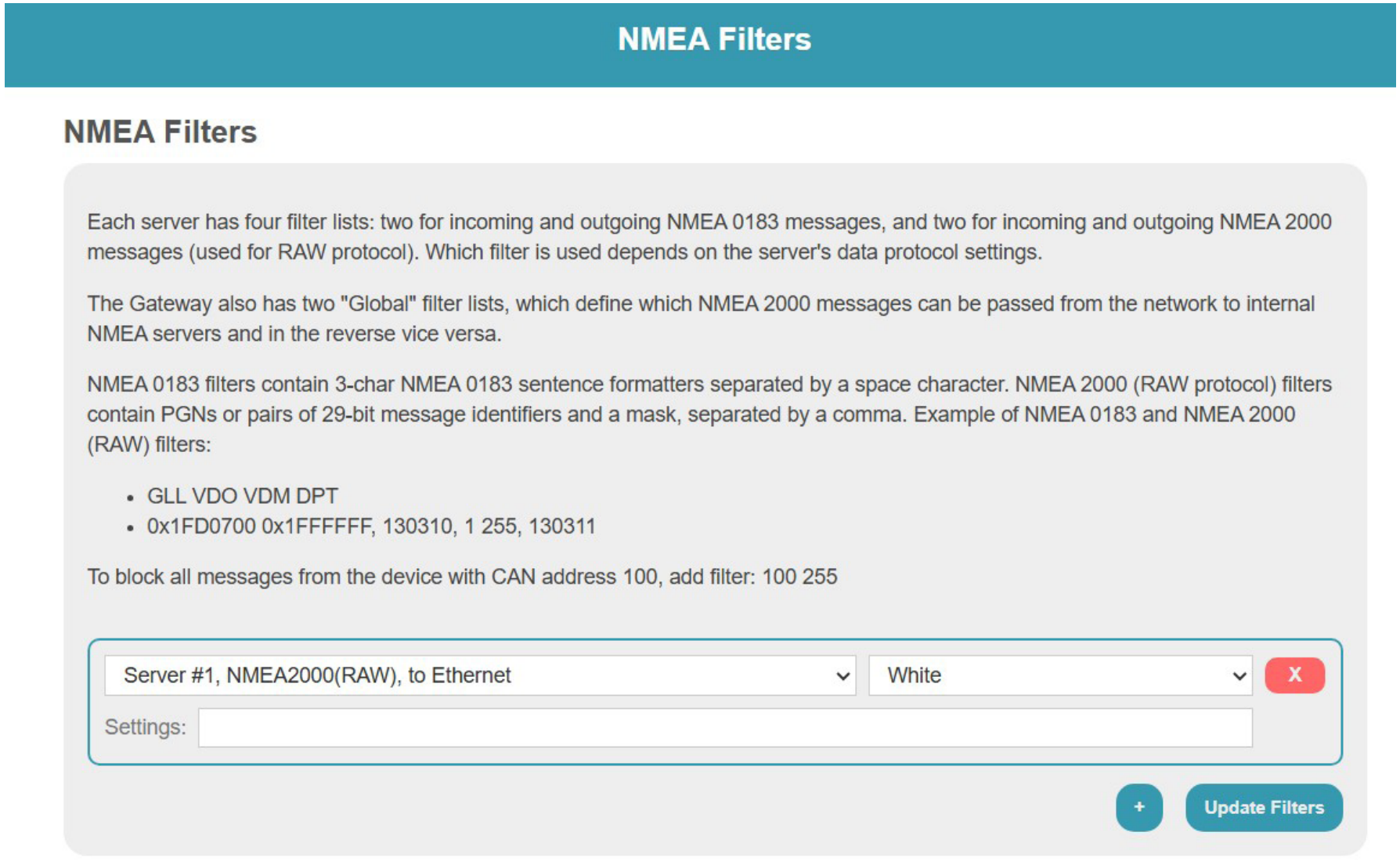


Figure 7. NMEA Filters page

On the NMEA Filters page, you can create a filter for a certain data stream. This means that you can block specific messages or messages from a specific device in NMEA2000 (or vice versa, allow only the necessary messages). In most cases, these settings are not required and this section can be skipped.

To configure a filter, open the NMEA Filters page (Figure 7) in the web interface and select the desired filter using the drop-down menu. Set the required filter type (White or Black):

- In WHITE mode, only messages explicitly listed are passed.
- In BLACK mode, all messages are passed except those explicitly listed.

Then enter a filter string (identifiers of messages that are subject to the filter) — refer to Sections IV.3.1 and IV.3.2. Note that messages for the filter must match the selected protocol type.

Click Update to save the filter. To discard changes, simply switch to another filter or refresh the browser page.

By default (factory settings), all filter lists are empty and set to BLACK mode, meaning all messages are passed without restriction.

Once updated, the Device parses the string and applies the relevant settings. Invalid strings are ignored. Changes take effect immediately and, if you have diagnostic data open in another browser window (see Section VII), you can observe the results in real time.

3.1. Syntax of NMEA 0183 filters

NMEA 0183 filters consist of a list of 3-character sentence formatters separated by spaces.

According to the standard, each NMEA 0183 sentence starts with a $ or ! symbol, followed by a two-character talker ID and a 3-character sentence formatter. These elements are then followed by data fields (separated with commas).

Each sentence ends with a checksum, separated by the * (asterisk) symbol. By default, the Gateway uses the talker ID YD, which can be changed on the NMEA Settings page (see IV.2.2). The Device applies filtering only to the 3-character sentence formatter.

An example of GLL and VDM sentences:

```
$GPGLL,4146.5894,N,07029.6952,W,173412.02,A*15
!AIVDM,1,1,,B,ENk`smq71h@@@@@@@@@@@@@@@@@@=MeR6<7rpP00003v
f400,4*5F
```

For example, to block processing of GLL and VDM sentences received on Server #1, set filter type «Server #1, NMEA 0183, to NMEA 2000», type BLACK and enter filter settings string:

```
GLL VDM DPT
```

3.2. Syntax of NMEA 2000 (RAW protocol) filters

NMEA 2000 data filters allows to select:

- individual NMEA 2000 PGNs;
- device addresses;
- any arbitrarily CAN frame IDs, including Priority bits, PGN and device Source Address.

You can enter up to 20 filter records. Each record should be separated by comma. Full record format is a pair of 29-bit CAN frame identifier (CAN_FRAME_ID) followed by space character and a bitmask, that denotes which of the 29 bits should be checked and which should be ignored. You can use hexadecimal (starts with 0x prefix) or decimal numbers.

Formal match comparison expression for filters is:

```
if (( CAN_FRAME_ID AND mask ) == filter ) then MATCH else NO_MATCH
```

Simple record format is also allowed, with only PGN number and no mask.

Example of a valid filter string:

```
0x1FD07C8 0x1FFFFFF, 130310, 1 255
```

This filter records match:

- PGN 130311 (0x1FD07) sent by a device from address 0xC8 (decimal 200);
- PGN 130310 sent by any device — simple record format example, observe no mask used;
    a. all PGNs sent by a device from address 1 («1 255» record is a decimal equivalent for hex «0x0000001 0x00000FF»), observe 0xFF bitmask covers only LSB byte of 29-bit CAN ID, which is a Device Address.

V. Settings Reset and Firmware Reset

When powering on, the hidden button (shown on Figure 1) switches the Gateway to Emergency mode (see Section III.4). After this phase, the settings can be reset in any mode.

To proceed, insert a paper clip into the small hole on the Gateway's end plate (near Ethernet connector). The Gateway's green status LED will stay lit constantly when the hidden button beneath the hole is pressed.

After 2–3 seconds, the LED will begin flashing rapidly. Release the button at this point to reset the Device's settings. If you do not release it, the LED will return to a constant light after another 2–3 seconds. If you continue holding the button for an additional ten seconds, the LED will flash again. Releasing the button during this second flashing period will complete a firmware reset of the Gateway. Alternatively, waiting two more seconds will cause the LED to remain lit constantly again.

Note that releasing the button while the LED is constantly lit will have no effect. A settings reset only occurs if the button is released during the first flashing period, while a firmware reset occurs if released during the second flashing period.

During a settings reset, the Device reverts all configurations to factory defaults (switching back to «DHCP Magic» mode, restoring the default admin password, etc.) and then reboots.

A firmware reset restores the Gateway to its initial factory firmware (a copy of which is always stored in EEPROM) and factory settings. LED signals during firmware updates are detailed in Section X. A firmware reset is typically unnecessary but can be used to roll back the firmware.

Data stored on the internal memory (see Section IX) is not erased during a settings reset but can be cleared with a firmware reset or via the button on the «Logging» page.

VI. LED Signals

The Gateway features two indicator LEDs (green and yellow), as illustrated on Figure 1.

The yellow Network LED shows Ethernet activity, including service messages, and will blink intermittently at least once every few seconds during normal operation. A solid yellow light indicates physical connection issues (such as an unplugged network cable) — refer to Section II.2 for troubleshooting details.

The green Status LED reflects the Device's operational state. Upon powering on, the Gateway immediately confirms successful initialization with two quick flashes. The following section details all status light signalling patterns.

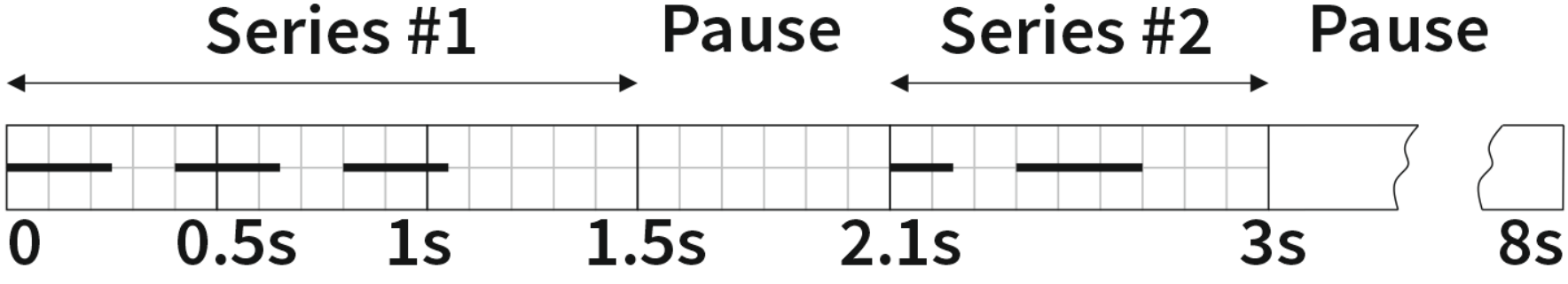
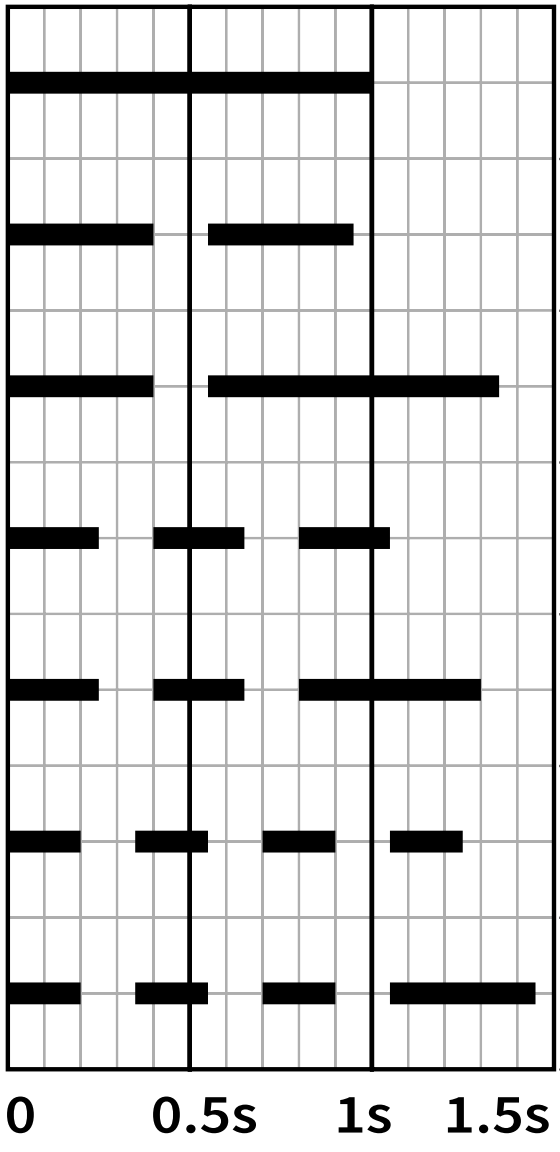


Figure 8. Example of flashing sequence

During normal operation, the status LED emits two distinct flash sequences every 8 seconds (refer to Figure 8).

Table 2. LED indication patterns



Mode	Notes
DHCP Magic	This signal is usually sent once after power-on, as the mode changes to DHCP client or DHCP server within the next 8 seconds.
Static IP	No problems detected, Gateway using the fixed IP address assigned by user (192.168.4.1 by default).
Static IP	IP address conflict is detected; some other device has the same IP address as the Gateway.
DHCP Client	The device obtained a dynamic IP address from the DHCP server or router; also sent when switches from DHCP Magic mode.
DHCP Client	Device is configured to DHCP Client mode, but cannot receive an address from the DHCP server or network router.
DHCP Server	This signal means that the Gateway issued the address to one or multiple client devices on the network.
DHCP Server	No addresses issued to other devices (they can be configured for static IP); also used when mode was switched from DHCP Magic.

1. First Flash Sequence (Network Status)

The first series takes 1.5 seconds and consists from one to four flashes and indicates the Ethernet mode (see Section III.3), see Table 2.

2. Second Flash Sequence (System Status)

- Follows the first flash sequence after ≥0.6 second pause.
- First flash:
  - 0.15 s: Normal NMEA 2000 activity (data transmitted/received within last 8 sec);
  - 0.3 s: Potential NMEA 2000 connection issue (no data flow).
- Second flash:
  - 0.15 s: Normal TCP connection status;
  - 0.3 s: TCP connection limit exceeded (new connections being dropped).

Example Sequence (Figure 8):

- First 3 flashes: Device is in DHCP Client mode and has successfully obtained an IP address from the LAN's DHCP Server.
- Second sequence:
  - 0.15 s flash: Normal NMEA 2000 connection;
  - 0.3 s flash: TCP connection limit exceeded.
- Followed by ≥5 second pause.

VII. Diagnostic Data Recording

The diagnostics feature is designed to troubleshoot issues with software applications or web gauges. You can record diagnostics data using either a web browser (for both NMEA 0183 and NMEA 2000 data) or the free CAN Log Viewer software (for NMEA 2000 data only).

1. Data recording using Web Browser

Server #3 can be configured to stream diagnostic data directly to a web browser or terminal application. The generated log includes all transmitted and received NMEA 2000 messages and complete data exchanges through Server #1 port (both incoming and outgoing traffic).

To create log:

- Set up the problem application to connect to Server #1.
- Configure Server #3 to use the «Debug» protocol (see Section IV.1).
- For example, if the Gateway has an IP address 192.168.4.13 and Server #3 port is 1458, enter http://192.168.4.13:1458 in browser address bar. Experienced users can also use TCP terminal applications like PUTTY.

To save log:

- Stop the data stream by clicking the browser's «Stop» or «Esc» button.
- Save the page as a text.

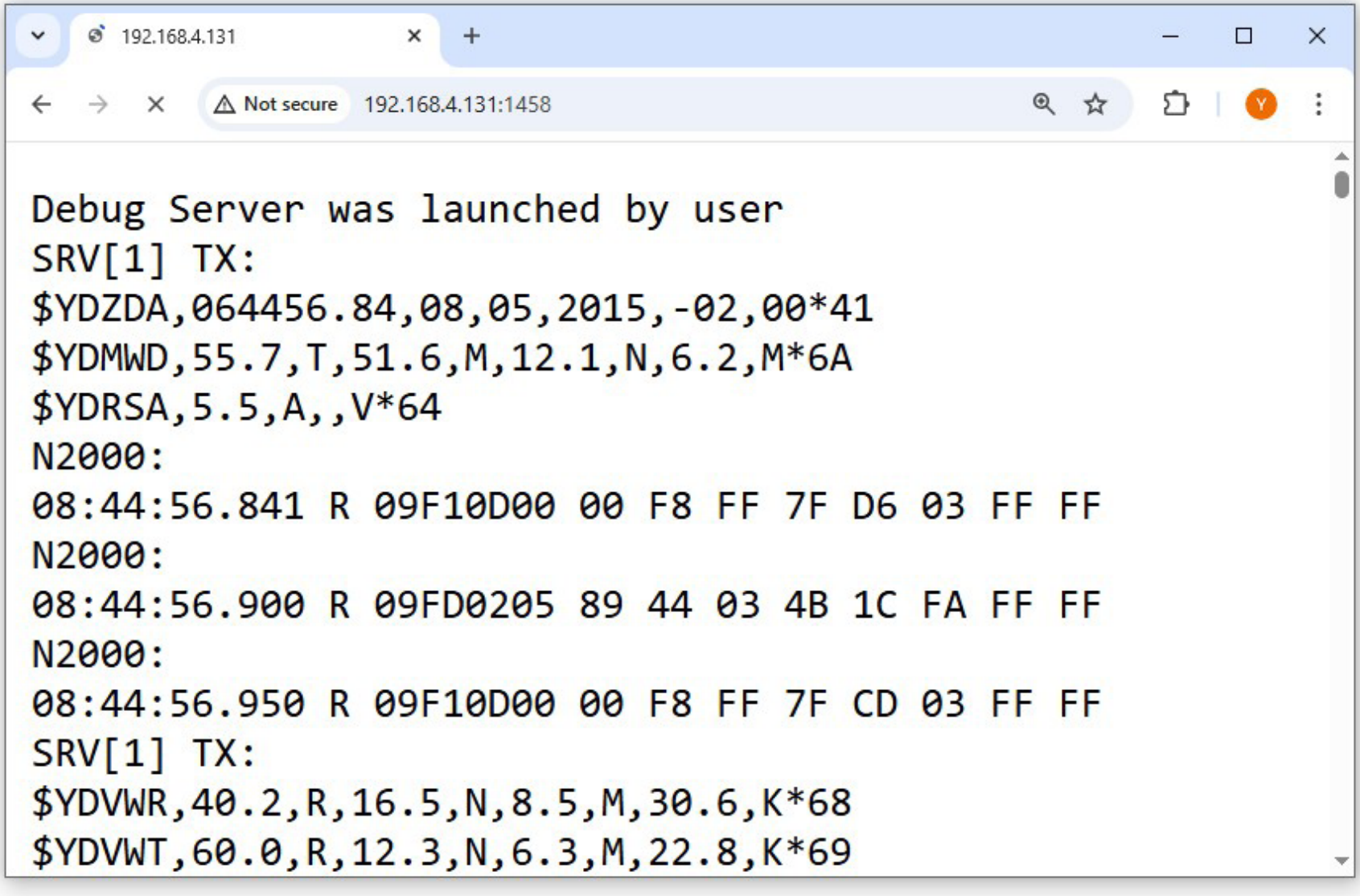


Figure 9. Chrome browser with log

Some mobile browsers do not allow file saving and we recommend using a laptop or PC to record diagnostics data. Also, certain 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.

2. Data recording with CAN Log Viewer

The CAN Log Viewer is a free cross-platform application available for Microsoft Windows, Linux, and macOS. This powerful tool enables users to monitor live NMEA 2000 data in both binary and decoded formats through the Gateway; discover, list, and configure NMEA 2000 devices on the network; record NMEA 2000 data streams to files for later analysis. Recorded files can be replayed in CAN Log Viewer itself. Also, it can be replayed into NMEA 2000 network by Yacht Devices Voyage Recorder to reproduce the situation on a test bench, facilitating detailed analysis and troubleshooting.

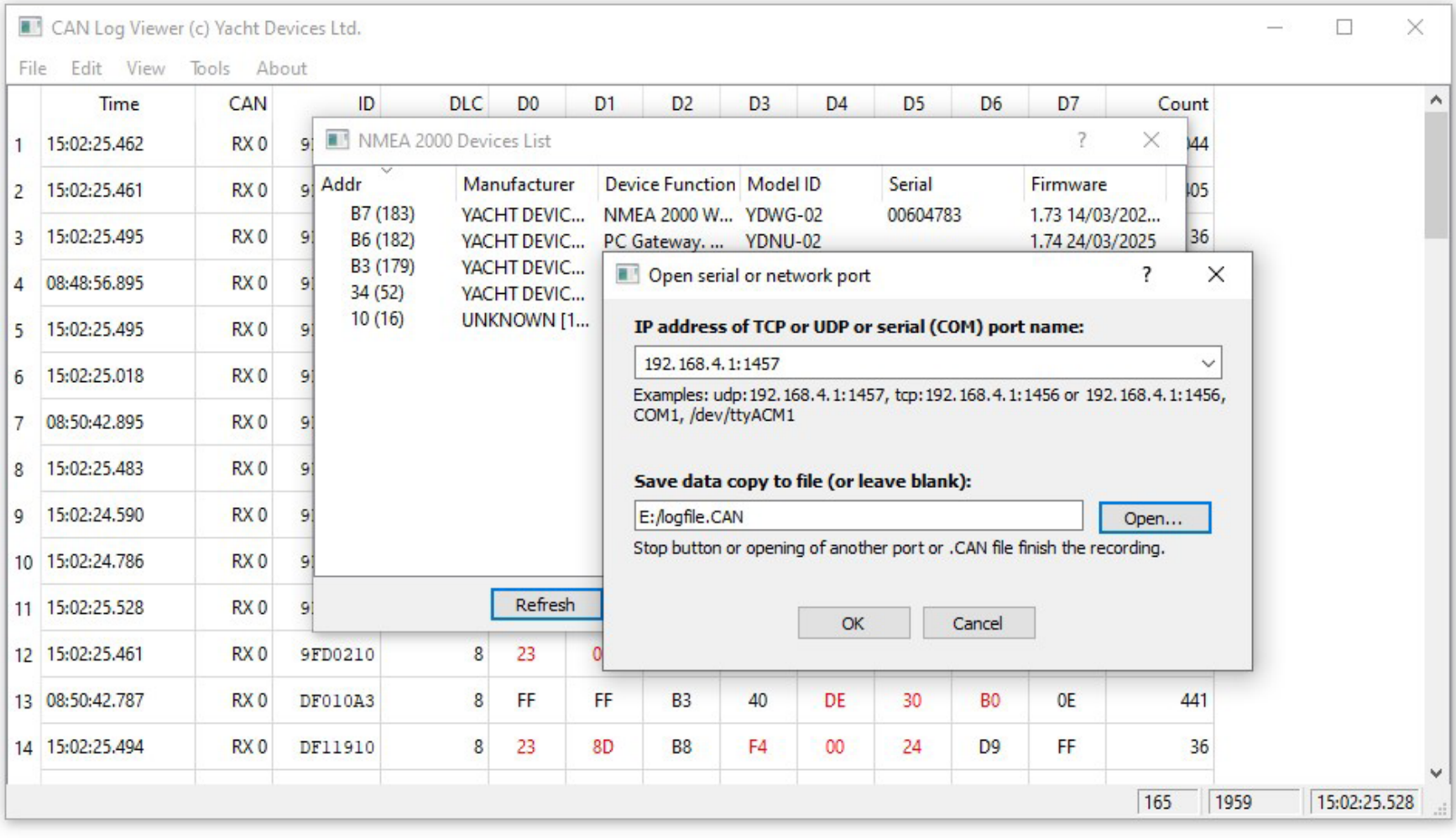


Figure 10. CAN Log Viewer software

To record the log file with CAN Log Viewer:

- Set up one of the Gateway's data servers with RAW data protocol, set «Bidirectional» mode.
- In CAN Log Viewer, navigate to File → «Open port...».
- In the dialog window, specify:
  - target data server network protocol (TCP or UDP);
  - Gateway IP address;
  - target Data Server network port.
- Click «Open...» to select where the log file will be saved (refer to Figure 10).
- Click «Ok». Binary NMEA 2000 data stream should appear in the main window.
- Click «View» → «NMEA2000 Devices» → «Refresh» to query NMEA 2000 devices information and populate the device list.
- When finished, go to «File» → «Stop» to end data capture.
- Reopen the File menu and select «Close All» to save the log file and close the connection.

VIII. Web Gauges

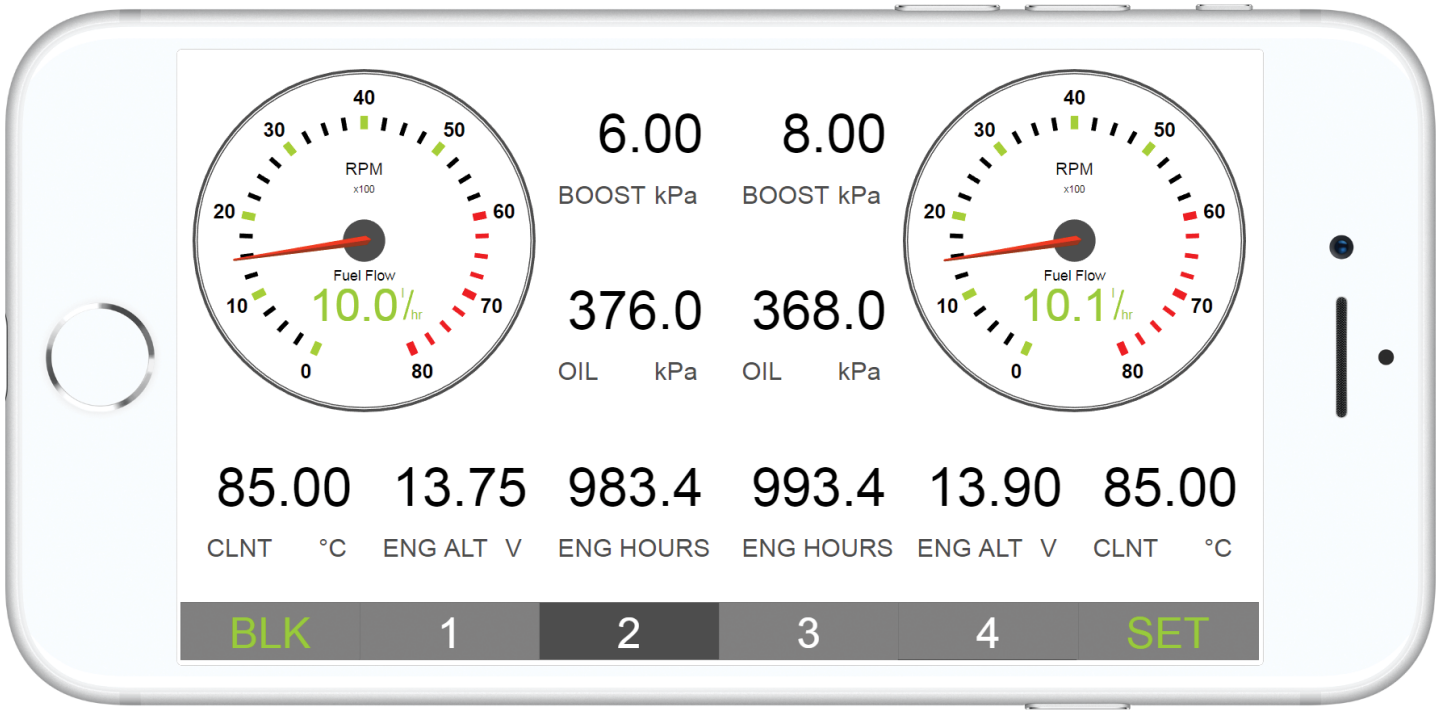


Figure 11. Built-in web gauges (Apple iPhone)

The Web Gauges (WG) page enables real-time vessel data monitoring through a web browser on any PC, laptop, tablet, or smartphone, serving as a replacement for traditional instrument displays. You can access WG either via the link on the Gateway's web interface login page (no authorization required) or through the «Web Gauges» menu item after logging in. No internet connection or additional app installation is necessary.

WG features five fully customizable data pages. On mobile devices, you can swipe between pages or select them using the numbered menu buttons at the bottom of the screen. Each page comes preconfigured with specific displays:

- The first page shows circular gauges for course/speed and apparent wind angle/speed (AWA/AWS), along with text data bars displaying speed through water (STW), heading, true wind speed (TWS), and true wind angle (TWA).
- The second page (Figure 11) is configured for twin engine monitoring, featuring circular tachometers and text data bars for engine temperature and fuel rate.
- The third page displays position data, time, log, sea/air temperatures, barometric pressure, and a depth surface graph with current depth reading.
- The fourth page remains unconfigured by default with no gauges or data bars.
- The fifth page comes preconfigured for autopilot control (Figure 12).

All page layouts and data bar configurations can be modified to suit your preferences.

On iPhones and iPads devices, the web browser's address bar and menu bar may reduce the visible area and overlap with the WG menu in either screen orientation. To resolve this, add WG to your home screen (via the browser menu) and launch it using the WG icon. This will open the page in full-screen mode without browser interface elements. Unfortunately, the current version of Android now does not allow you to open pages in the browser in full screen (for security reasons).

The complete WG guide is available both in the web interface (accessible through the link next to the Web Gauges option on the login page or in the web interface menu) and online at: https://www.yachtd.com/products/web_gauges.html.

Most autopilots require manufacturer-specific messages to activate TRACK mode and may need proprietary commands during navigation, which typically limits their compatibility to the same manufacturer's MFD and control head. However, starting with firmware version 1.70, the Gateway supports direct control of Yacht Devices' YDAP-04 and Raymarine SeaTalk NG autopilots through Web Gauges (see Figure 11).

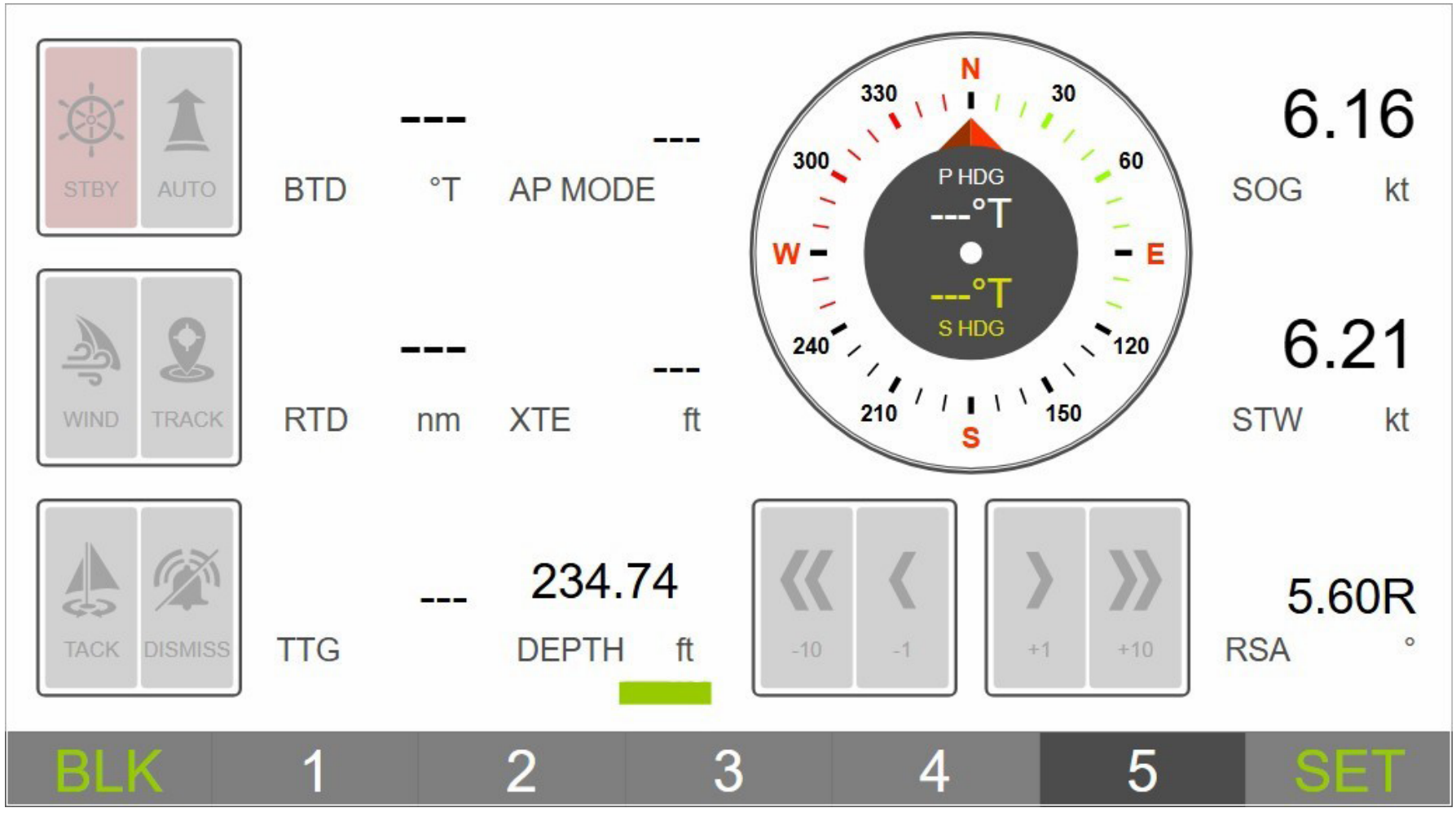


Figure 12. Web Gauges Autopilot control page

To enable Raymarine SeaTalk NG autopilot support in Web Gauges:

1. Server #1 should be configured for bidirectional exchange and NMEA 0183 protocol.

2. On NMEA Settings page you need to enable «Control of Yacht Devices autopilots from NMEA 0183 and Web Gauges». For SeaTalk NG autopilots «Control of Raymarine autopilots from NMEA 0183» also should be enabled.

3. On Web Gauges Autopilot Control page, the «CONTROL/BANK» setting should be set for all buttons as:

- «5» for Yacht Devices autopilots;
- «Third Party» for Raymarine autopilots.

4. For Raymarine SeaTalk NG autopilots, in Web-gauges OVERALL SETTINGS set «Third Party Autopilot» as «Raymarine SeaTalk NG».

For more details refer to Application Note on Web Gauges page:

https://www.yachtd.com/products/web_gauges.html

IX. Data Logging and Cloud Services

The Gateway can be set up to store your vessel's data in its internal memory. You can download the recorded data directly from the web interface (no internet connection needed) in multiple formats: GPX for tracks, CSV for spreadsheet analysis, or XML for structured data. When internet-connected, the Gateway can automatically upload data to Cloud Services. This enables you to conveniently access your navigation tracks from anywhere and share your real-time position with others. For detailed information about Cloud Services, visit: https://cloud.yachtd.com/ .

1. Logging setup

Open the «Logging» page in the web interface. This page contains three sections: «Logging», «Download», and «Upload». In the «Logging» section, you can set the recording interval between 15 seconds and 1 hour or disable logging, and choose the data set.

By default, the system logs data every 5 minutes using the «Basic» data set, which includes: GPS position, date/time, COG, SOG, AWA, AWS, TWA, TWS, TWD, heading, STW, and depth. All other available data sets contain these «Basic» parameters plus additional data — you can view the complete contents of each set on the «Logging» page. Switching the data set does not affect previously recorded data.

The «Do not save points closer than 5 meters apart» option optimizes storage by excluding redundant data points when the vessel is stationary. Disable this feature if you're using Cloud Services for real-time monitoring of marina conditions or onboard systems, as it may affect data resolution.

The system automatically overwrites the oldest data when memory becomes full. For privacy and security, always use the «Clear all data» button before transferring ownership of the Gateway. Be aware that while a firmware reset will erase all recorded data, a standard settings reset will not (see Section V).

2. Data download

To download recorded data from the Gateway, just open Logging page, scroll to Download section, choose desired period and click Download. In appeared Export section, choose the preferred file format (CSV, GPX or binary), configure format-specific options and click Export.

Most chart plotters allow import of GPX tracks, and data recording is very useful as a backup if you have forgotten to start track recording on MFD.

Note that export may not work properly on iPads and iPhones with an iOS version prior to v13, no issues exist with other devices or operating systems.

3. Upload to Cloud Services

The Cloud Service offers free, unlimited storage for your sailing tracks with no restrictions on data age or size. This provides an excellent backup solution while also enabling you to share your position and tracks with registered users or publicly via a private link. To use this service, your Ethernet network must maintain periodic internet connectivity. Also, you should ensure that your NMEA2000 network contains valid GPS position and date/time, as this data is used as a waypoint ID.

To begin using the service:

1. register at https://cloud.yachtd.com/;

2. generate a «Boat Key» using your Gateway's serial number;
3. enter this key in the «Upload» section of the «Logging» page.

Once configured, the Gateway automatically uploads data to Cloud Services every 15 minutes if it has more than 1 non-uploaded point and an internet connection is available.

Turn on the setting «Do not save points closer than 5 meters apart» in the «Logging» section if you do not wish to consume traffic while the boat is in a marina. A single point using the «Basic Set» takes 32 bytes, and a point from other sets takes 64 bytes to transfer. The upload session requires transferring about 400 bytes in addition to the size of data. This efficient data structure makes Cloud Services economical to use, even with satellite connections.

You can check the time and status of recent uploads either in the «Uploads» section of the «Logging» page or directly in Cloud Services. If you are using a static IP address or DHCP Server mode, ensure proper configuration of your network gateway and DNS server addresses in the «Ethernet Settings» page (see Section IV).

For troubleshooting purposes, utilize Logging section and «Debug» protocol (refer to Section VII) to verify whether data points have been successfully recorded in the Gateway's memory. In the debug output, look for entries beginning with «YD CLOUD» — these should appear at 15-minute intervals if non-uploaded data exists. Below is an example of the debug output (which may be mixed with NMEA data from other ports):

```
$MXPGN,01F200,2800,00300B1C007FFFFF*6D
YD CLOUD: Connecting (DNS: 192.168.4.102, 192.168.4.98)...
YD CLOUD: Connecting to 45.33.127.28 server...
N2000:
06:28:22.142 R 1DEFFF02 45 00 00 00 00 00 00 00
```

The rows above mean that an Internet connection exists (the address of the cloud server was successfully resolved to its IP address). The next lines show the first lines of server's response and connection result:

```
06:17:24.150 R 19FA0402 D5 F0
YD CLOUD: Response: HTTP/1.1 201 Created Content-Type: text/
html; charset=UTF-8 Server: Microsoft-IIS/7.5 X-Powered-By:
PHP/5.6.38 X-Powered-By: ASP.NET Date: Mon, 07...

YD CLOUD: 2019-10-07 19:40:11 Data uploaded (last point GMT
2016-10-27 08:16:45)
N2000:
06:17:24.151 R 19FA0302 FF DA 78 00 A1 00 71 00
```

If you have connectivity problems, please supply our technical support with a diagnostics recording which contains the «YD CLOUD» strings. If your recording has no such strings, check that you have recorded data using the «Logging» Section.

To turn off data uploading, remove the boat's key from the Device's settings.

X. Firmware Updates

Your current firmware version can be checked in the Device's web interface or in NMEA 2000 Device List on your MFD.

You can download the latest firmware version from our web site: http://www.yachtd.com/downloads/.

Download YDEN03.ZIP archive and unzip it. Read README.TXT file first – it may contain important information regarding the update. Copy YDEN03.BIN to the disk.

1. Open Device's web interface.
2. Open the «Firmware Update» page.
3. Click the «Choose File» button and locate the YDEN03.BIN file on the disk.
4. Click the «Update» button.

The firmware upload process takes up to 2 minutes. Once completed, you will receive a message confirming the update has started, and the Gateway will reboot. Two quick 0.5-second flashes of the green status LED will indicate the reboot is complete. After 5–7 seconds, four 0.5-second flashes will confirm the firmware update was successful. Following this, the Gateway resumes normal operation and begins signaling as described in Section VI.

The firmware update process is safe and will not damage the Gateway. All settings will remain unchanged unless specified otherwise in the README.TXT file included with the update. Even if the update is interrupted — for example, due to a power failure — it will automatically restart the next time the Gateway is powered on. If needed, you can revert all firmware updates and restore the original factory firmware by performing a firmware reset (see Section V).

APPENDIX A. Troubleshooting

Table 1

Situation	Possible cause and correction
No LED indication when NMEA2000 is powered on	**1. No power supply on the bus.** Verify that power is being supplied to the bus. (An NMEA 2000 network requires a dedicated power connection and cannot be powered by a plotter or any other device connected to the network.) **2. Loose connection in the power supply circuit.** Clean the Device connector with an electrical contact cleaner spray, then try plugging the Device into another connector.
Network LED (yellow) is constantly lit	Network cable is unplugged, damaged, or all Ethernet devices are turned off, see Section II.2.
Network LED (yellow) flashing, but the Gateway is not accessible from the PC	The Ethernet interface is physically connected, but the problem lies in the settings. Refer to Section III.5 for Ethernet settings troubleshooting.
I forgot the password to administrative web site	Perform settings reset, see Section V.

Table 1 continued

Situation	**Possible cause and correction**
Software application does not work as expected	**1. Check NMEA filters configuration** (see Section IV.3). **2. Record diagnostics data** (see Section VII) and send it with a software screenshot to technical support.
TCP server port of the Gateway cannot be opened in the application	**1.** The number of TCP connections to the server has exceeded the limit (3). This can be checked using the status LED signals. Configure the application to use a different server port or UDP. **2.** The IP address of the Gateway has changed. In DHCP Client or DHCP Magic mode, the address can be changed after rebooting. See Section III.6.
The Device has no waypoints to upload to the Cloud	Check that you have valid GPS position and date/time data in your NMEA 2000 network.
The Device can't connect to the Cloud	**1.** Check Internet connection. **2.** Check that you specified valid Device's serial number in Cloud Boat details. **3.** Check that you specified valid Boat key in Device's settings.

APPENDIX B. Supported NMEA 2000 Messages

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 Section V).

Appendix C 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 C. 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
127233 Man Overboard Notification (MOB)	MOB	
127237 Heading/Track Control	APB, HSC, HTD	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	
127257 Attitude	XDR	Configure sensor IDs. See Section IV.2.4
127258 Magnetic Variation	—	See note (4)
127488 Engine Parameters, Rapid Update	RPM, XDR, DIN, PGN	See note (6)

Table 1 continued

127489 Engine Parameters, Dynamic	XDR, DIN	See note (6)
127493 Transmission Parameters, Dynamic	DIN, PGN	See note (6)
127501 Binary Status Report	DIN	See note (6)
127505 Fluid Level	DIN, PGN	See note (6)
127508 Battery Status	DIN, PGN	See note (6)
128259 Speed, Water referenced	VHW	Also, may be used in RMC, VTG
128267 Water Depth	DBT, DBS, DPT	
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	

Table 1 continued

129284 Navigation Data	RMB, HSC, BWR, BOD	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	
129539 GNSS DOPs	GSA	PGN 129540 is also required
129540 GNSS Sats in View	GSV, GRS	PGN 129539, 129029 required
129547 GNSS Pseudorange Error Statistics	GST	
129808 DSC Call Information	DCS, DSE	
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, VWR, VWT	See note (3). Also used in MDA

Table 1 continued

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)
130316 Temperature, Extended Range	XDR, MTW, MDA	See notes (1), (2), (5)
130578 Vessel Speed Components	VBW	
130816 Proprietary: History Data	BHD	
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	VDM, VDO	AIS VHF message 19
129041 AIS Aids to Navigation (AtoN) Report	VDM, VDO	AIS VHF message 21

Table 1 continued

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
129797 AIS Binary Broadcast Message	VDM, VDO	AIS VHF message 8
129798 AIS SAR Aircraft Position Report	VDM, VDO	AIS VHF message 9
129802 AIS Safety Related Broadcast Message	VDM, VDO	AIS VHF Message 14
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, dew point, inside (saloon), water and exhaust gas temperature, inside and outside humidity, barometric pressure are supported.

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

Note (3): In factory settings, Device performs conversion from true to apparent wind. The MWV sentence is sent twice (one for apparent 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, dew point or water temperature, or barometric pressure or outside humidity are available. Also contains wind speed and direction.

Note (6): DIN and PGN are sentences are non-standard; they simply encapsulate raw NMEA 2000 PGNs payload data in ASCII strings according to SeaSmart (v1.6.0) and MiniPlex (v2.0) specifications. Engine revolutions, boost pressure, coolant temperature, hours, fuel rate, alternator voltage are also transmitted in XDR sentence.

Table 2. Conversions from NMEA 0183 to NMEA 2000

NMEA 0183 Sentence	**NMEA 2000 PGN**	**Comment**
AAM	129284 Navigation Data	RMB is required
APB	129283 Cross Track Error	Also used in PGN 129284
BOD	129284 Navigation Data	RMB is required
BHR	61184 Proprietary: History Request	
BWR	129284 Navigation Data	RMB is required
DIN	59904 ISO Request 127488 Engine Parameters, Rapid Update 127489 Engine Parameters, Dynamic 127493 Transmission Parameters, Dynamic 127502 Switch Bank Control 127505 Fluid Level 127508 Battery Status	According to SeaSmart.net protocol specification v1.6.0
DBK	128267 Water Depth	When DPT sentence is not available

Table 2 continued

DBS	128267 Water Depth	When DPT sentence is not available
DBT	128267 Water Depth	When DPT sentence is not available
DPT	128267 Water Depth	
DSC	129808 DSC Call Information	
DSE	129808 DSC Call Information	DSC is required
DTM	129044 Datum	
GGA	129029 GNSS Position Data	ZDA or RMC are required
GLL	129025 Position, Rapid Update	See note (7)
GNS	129025 Position, Rapid Update	
GRS	129540 GNSS Sats in View	
GSA	129539 GNSS DOPs	
GST	129547 GNSS Pseudorange Error Statistics	
GSV	129540 GNSS Sats in View	Data from GRS and GSA is used
HDG	127250 Vessel Heading	
HDM, HDT	127250 Vessel Heading	Variation and deviation from HDG are used

Table 2 continued

MDA	130311 Environmental Parameters 130314 Actual Pressure 130306 Wind Data	Relative air humidity, air and water temperature, atmospheric pressure, wind data
MOB	127233 Man Overboard Notification (MOB)	
MTW	130311 Environmental Parameters	
MWD	130306 Wind Data	
MWV	130306 Wind Data	Theoretical wind is sent as calculated using Heading/ Speed through Water
RMB	129283 Cross Track Error 129284 Navigation Data 129285 Navigation — Route/WP information	Data from APB is used; PGN 129284 is sent twice with true and magnetic bearings
RMC	126992 System Time 127258 Magnetic Variation 129025 Position, Rapid Update 129026 COG & SOG, Rapid Update	See note (7)
ROT	127251 Rate of Turn	

Table 2 continued

RPM	127488 Engine Parameters, Rapid Update	
RSA	127245 Rudder	
RTE	130066 Route and WP Service — Route/WP-List Attributes 130067 Route and WP Service — Route — WP Name & Position	Data from WPL is used
VBW	130578 Vessel Speed Components	
VDR	129291 Set & Drift, Rapid Update	
VHW	128259 Speed, Water referenced	
VLW	128275 Distance Log	
VTG	129026 COG & SOG, Rapid Update	
VWR, VWT	130306 Wind Data	

Table 2 continued

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)
XDR	127505 Fluid Level 127508 Battery Status 130310 Environmental Parameters 130311 Environmental Parameters 130314 Actual Pressure 130316 Temperature, Extended Range	Depends on configuration in «XDR Settings» section
XTE	129283 Cross Track Error	
ZDA	126992 System Time 129033 Local Time Offset	

VDO, VDM	129038 AIS Class A Position Report	AIS VHF messages 1, 2 and 3
	129039 AIS Class B Position Report	AIS VHF message 18
	129040 AIS Class B Extended Position Report	AIS VHF message 19
	129041 AIS Aids to Navigation (AtoN) Report	AIS VHF message 21
	129793 AIS UTC and Date Report	AIS VHF messages 4 and 11
	129794 AIS Class A Static and Voyage Related Data	AIS VHF message 5
	129798 AIS SAR Aircraft Position Report	AIS VHF message 9
	129802 AIS Safety Related Broadcast Message	AIS VHF Message 14
	129809 AIS Class B «CS» Static Data Report, Part A	AIS VHF message 24
	129810 AIS Class B «CS» Static Data Report, Part B	AIS VHF message 24

Note (7): 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 milliseconds interval, and twice if the time between GLL and RMC is more than 50 milliseconds.

Note (8): Sentences with no significant data (or data marked as invalid) may not be translated to NMEA 2000 messages. NMEA 0183 sentences with invalid checksum are ignored.

APPENDIX D. Message format in RAW mode

In RAW mode, network messages are converted into plain text. We recommend that software developers use this format in applications, as this is the easiest option. In a terminal window, NMEA 2000 messages appear similar to a log on 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);
- **b0..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>. Once a message from the application is accepted, passes all filters, and is transmitted to the NMEA 2000 network, it will be returned to the application with a «T» designation to indicate its transmission 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 https://www.nmea.org/.