# Yacht Devices

## User Manual

Exhaust Gas Sensor YDGS-01

**also covers models**

YDGS-01R, YDGS-01N

**Software version**

1.00

**2018**

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# Package Contents

| | |
|---|---|
| Device | 1 pc. |
| This Manual | 1 pc. |
| Brass thermal interface bolt with M10 external thread | 1 pc. |

# Introduction

This Manual contains information on how to install, configure and operate YDSG-01 Exhaust Gas Sensor (hereinafter Device) intended for use on pleasure crafts.

The Device performs measurements within the range from 0 to +800 °C (+32 to 1472 °F). Temperature is measured by the thermocouple which is placed outside the Device case and has a flexible 90-cm (3 foot) sheath with an internal heat-resistant fiberglass insulation layer. The Device can be used to measure the temperature of extremely hot gases, solids and liquids. The thermocouple wire cannot be elongated. The Device is configured to display «Air Temperature» by default, but can be reconfigured to display «Exhaust Gas Temperature», «Heating System Temperature», «Engine Room Temperature», etc.

Up to 50 Devices may be used on a vessel simultaneously; this limitation is set by the NMEA 2000 network specification. Data from the Devices can be displayed on chartplotters, digital navigation instruments, as well as used by other digital equipment of the vessel.

Please note that not all chartplotters and instruments are capable of displaying «Exhaust Gas Temperature». Please check your chart plotter or instrument display documentation prior to Device installation.

The Device is designed for operating in an NMEA 2000 network and is compatible with a wide range of equipment supporting this protocol. Raymarine SeaTalk NG, Simrad SimNet, Furuno CAN networks are branded versions of NMEA 2000 and differ only in the type of connectors. In its devices, Garmin uses the NMEA 2000 Micro connector which is compatible with the DeviceNet Micro connector. Our Device is supplied with different types of connectors, making it possible to connect them to networks of different manufacturers without any adapters. The Device model is shown on the case.

| **Device model** | **Type of the connector, compatibility (see Appendix B)** |
|---|---|
| YDGS-01R | Raymarine SeaTalk NG Female |
| YDGS-01N | NMEA 2000 Micro Male, DeviceNet Micro Male, Garmin NMEA 2000 Male |

To connect to other types of NMEA 2000 networks, a cable adapter is required (it is not supplied with the Device and must be purchased separately).

We thank you for purchasing our Devices and wish you 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, when applying under a warranty case, the sale receipt may be requested.

2. The Device warranty is terminated in case of violating the instructions of this Manual, case integrity breach, repair or modification of the Device without manufacturer's written permission.

3. Modification of the Thermometer sensor cable is performed by the user at his own risk, the warranty does not cover the Device failure in this case.

4. If a warranty request is accepted, the defective Device must be sent to the manufacturer.

5. The warranty liabilities include repair and replacement of the goods and do not include the cost of equipment installation and configuration, as well as shipping the defective Device to the manufacturer.

6. Responsibility of the manufacturer in case of any damage as a consequence of the Device operation or installation is limited to the Device cost.

7. The manufacturer is not responsible for any errors and inaccuracies in guides and instructions of other companies.

8. The Device requires no maintenance. Device's case is non-dismountable. If the event of a failure, please refer to Appendix A before contacting the technical support.

9. The manufacturer accepts applications under the warranty and provides technical support only via e-mail or from authorized dealers.

10. Contact details of the manufacturer and a list of the authorized dealers are published on the website: http://www.yachtd.com/.

# I. Product Specification

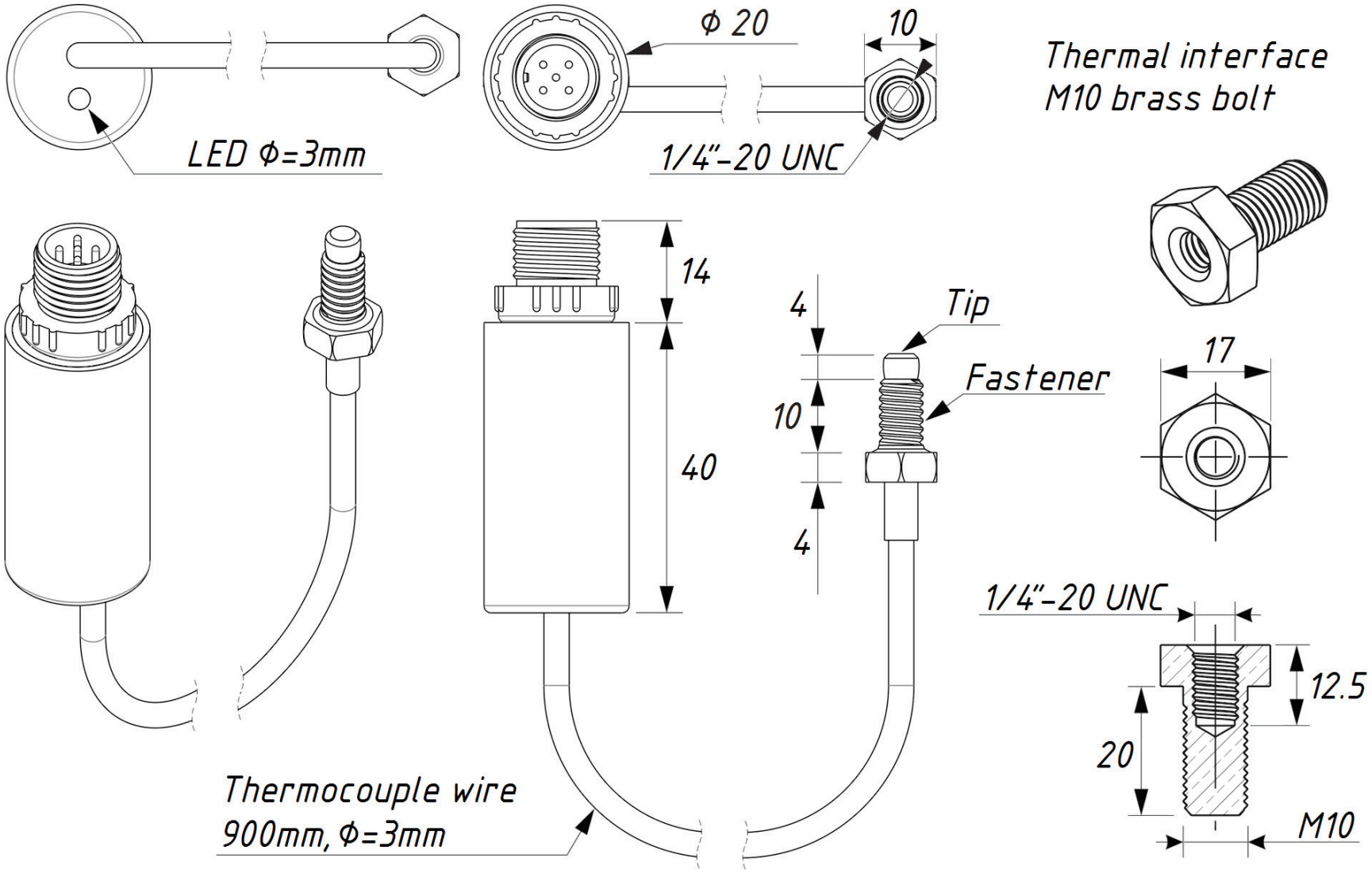


*Figure 1. Drawing of the Exhaust Gas Sensor (model YDGS-01N)*

| **Device parameter** | **Value** | **Unit** |
|---|---|---|
| Operating voltage (from an NMEA 2000 network) | 7..16 | V |
| Protection against reverse polarity | Yes | — |
| Consumption current | 34 | mA |
| Load Equivalency Number | 1 | LEN |
| Operating temperature range (except the thermocouple) | -40..80 | °C |
| NMEA 2000 data output resolution | 0.01 | °C |
| Measurement range (Note 1) | 0..+800 | °C |
| Measurement error within the range of 0..+333°C, max | ± 5.5 | °C |
| Measurement error within the rest of the range, max | ± (3 + 0.0075 × T) | °C |
| Weight | 28 | g |
| Case length | 40 | mm |
| Thermocouple wire length | 900 | mm |

*Note (1): PGN 130310, 130311 and 130312 can provide temperature value only up to +382 °C. Only PGN 130316 can provide the full range. See Section III.*

Yacht Devices Ltd declares that this product is compliant with the essential requirements of EMC directive 2014/30/EU.

Dispose of this product in accordance with the WEEE Directive. Do not mix electronic disposal with domestic or industrial refuse.

# II. Device Connection and Testing

The Device requires no maintenance; calibration of the thermocouple is performed by the manufacturer. However, you can set an offset from -10.0 to +10.0 Celsius for the sensor readings to align with readings from other ship equipment (see Section III).

When deciding where to install the Device, choose a dry mounting location. Avoid places where the Device can be flooded with water, this can damage it.

### 1. Device connection to the temperature source

The thermocouple measuring junction end (the probe) has a waterproof tip and a fastener (that looks like a bolt but is hollow) with an external 1/4” — 20 UNC thread, both made of stainless steel. Note that the thermocouple tip turns freely in the fastener. To make the connection watertight, use the brass thermal interface bolt.

The probe is not intended for permanent location in hostile environments such as sea water — in that case you should use the brass thermal interface bolt shipped with the Device. Cover the exposed surfaces with an insulation compound or heat-resistant paint.

The Device’s thermocouple cannot be elongated by the user. If the thermocouple wire is damaged, it cannot be repaired. While installing, make sure that there is no mechanical stress applied to the thermocouple sheath: it must not be pinched, twisted or bent excessively. The minimal allowed bend radius is 9 mm.

When routing the thermocouple sheath, avoid powerful sources of electromagnetic interference: motors, compressors, generators, electric pumps and transmitting antennas.

Also take into account the possible heat transfer from the measured temperature source along the thermocouple. Fix the thermocouple sheath with non-flammable heat-resistant clamps and prevent it from being in contact with flammable or heat-sensitive materials. Additional thermal insulation also can be used.

## 2. Installation recommendations for exhaust gas temperature measurement

It is recommended that you install the thermocouple sensor on the hottest part of the engine exhaust manifold. You can locate the maximal temperature using, for example, a digital pyrometer. Installation of a suitable thermal insulation layer is recommended to improve measurement accuracy.

To make the connection airtight, use the brass thermal interface bolt.

## 3. NMEA 2000 network connection

The Device is directly connected to the NMEA 2000 bus 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 connecting cables, terminators and 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 connector to ensure its water resistance and reliability.

After turning on the bus power supply, the Device LED will produce one or two short signals every second (see LED signals in Section VI).

If the Device is connected to a network having a chartplotter or any other device transmitting a PGN 0x1F814 (129044) message with chart datum configuration or PGN 0x1F11A (127258) with data on magnetic variation, the Device will produce six LED signals with a period of 0.5 seconds when such message is received for the first time after power is on. This usually happens within 15 seconds after the Device is turned on. The signal series confirms the Device is properly connected to the NMEA 2000 network and the chartplotter is able to receive data from the Device.

The Device information should be displayed in the list of NMEA 2000 devices (SeaTalk NG, SimNet, Furuno CAN) or in the common list of external devices on the chartplotter (see Figure 1). Usually, access to this list is in the «Diagnostics», «External interfaces» or «External devices» menu.

Data from the Device are available to all the equipment connected to the network and can be displayed simultaneously on several chartplotters and digital navigation instruments.

Under the factory settings, the Device shows measured temperature as «Air Temperature», but it can be reprogrammed by the user to display data in other indicators, such as «Exhaust Gas Temperature», «Heating System Temperature», «Engine Room Temperature» (see Section III).

Switch to the chartplotter screen, which provides information about the exhaust gas temperature or add this indicator to the screen using instructions supplied with your chartplotter. Data in the indicator should begin to appear no later than 5 seconds after turning the Device on. With factory settings, data are updating at 500 milliseconds interval.

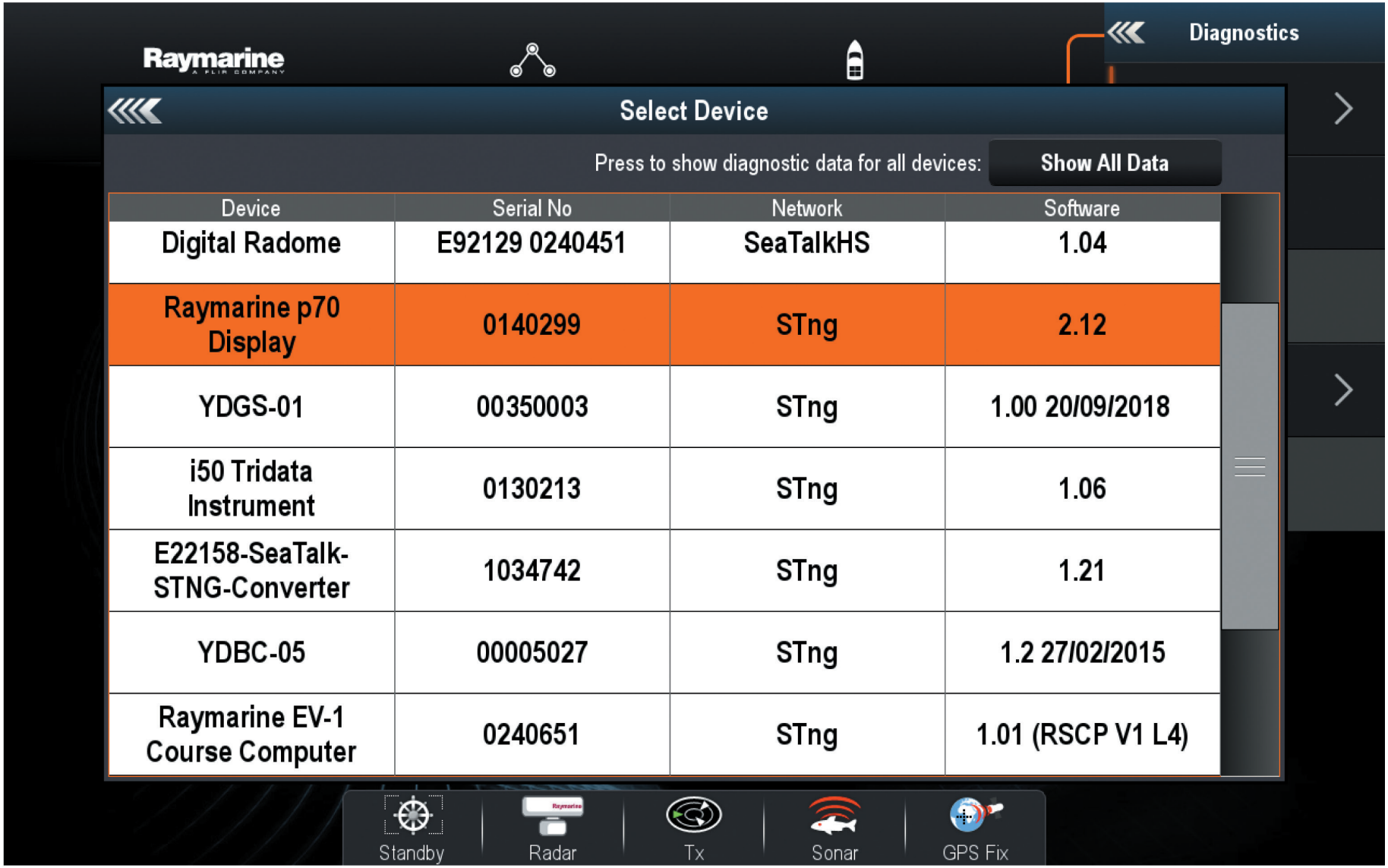


*Figure 1. Raymarine c125 MFD devices list with Exhaust Gas Sensor*

# III. Device Programming and Settings

*Programming of the Device should not be performed at sea.*

The Device can be programmed by three methods. Table 1 on the next page shows the applicability of the methods for different settings. The following methods are supported:

1. By a special sequence of datum or variation settings on a chart plotter (column [1] at Table 1). This method is tricky, but it only requires a chart plotter and it can be performed on legacy chart plotters. Tested with Garmin and Raymarine chart plotters. See Section V for details.

2. With a special installation description string which can be entered for the Device in PC software like CAN Log Viewer from our company, ActiSense NMEA Reader or Maretron N2KAnayzer. This method is very simple and may be supported in some models of chart plotters. Described in the next Section.

3. Using special PC software, including professional NMEA 2000 installer software. The Device supports «Request Message», «Command Message» and «Write Fields» functions of PGN 126208, which allows changing of the Device settings.

*Table 1. Applicability of the programming methods*

| Number | Setting or action | Method | | |
|---|---|---|---|---|
| | | [1] | [2] | [3] |
| (1) | NMEA 2000 device instance and system instance | Yes | Yes | Yes |
| (2) | NMEA 2000 data instance | Yes | Yes | Yes |
| (3) | Type of a measured data | Yes | Yes | Yes |
| (4) | Transmission interval for periodic messages | Note 1 | Yes | Yes |
| (5) | Temperature reading offset | No | Yes | Note 3 |
| (6) | Installation description | No | Yes | Yes |
| (7) | Reset all settings to factory values | Yes | Yes | Note 3 |
| (8) | NMEA 2000 message priority | No | No | Note 2 |

*Note 1: Only turning on with default transmission interval and off are allowed with this method.*

*Note 2: Setting is not stored in non-volatile memory and acts only while Device is powered.*

*Note 3: Not allowed with «Command Message» and «Write Fields» of PGN 126208, use method 2.*

NMEA 2000 device and system instances (1) should not be modified by a user, these fields are used by installers in complex NMEA 2000 networks. Message priority (8) can be dynamically managed on the network by devices and is not intended to be managed by a user.

NMEA 2000 data instance (2) may be used when multiple Devices are installed. For example, data on the exhaust gas temperature with instance 2 can be displayed as «Exhaust gas temperature of engine № 2». Chart plotters with factory settings are usually able to show only one value with data instance 0, but manufacturers may supply dealers and professional installers by internal instruments to customize chart plotter screens. Please refer to your chart plotter manual before changing this setting.

You can choose one of the 15 data types (3) for the temperature. Note, that, for example, data on the engine room temperature (value 3 in Table 2) cannot be send in the PGN 130310. Refer to your chart plotter or instrument display manual what PGNs and temperature types are supported.

Note that messages with PGN 130310, 130311 and 130312 can provide temperature values only up to +382 °C. If the measured temperature exceeds +382 °C, the «Out of range» temperature value will be sent in those PGNs. Only PGN 130316 can provide the full measurement range.

The data transmission interval (4) setting allows changing of the interval of periodical (data transmitting) messages with methods [2] or [3] and individually turning on/off message transmission with all three methods. Intervals from 50 milliseconds (value 50) to 1 hour (value 3600000) are allowed, a value of 0 turns off the transmission (but data can be received by request). «Restore default Interval» value is also supported in method [3] (see Appendix C). In case of method [1], the user can only turn on and off transmission of messages.

The Device sensor is calibrated at the factory. However you can set an offset (5) from -10.0 to +10.0 Celsius for the sensor readings to align with readings from other ship equipment.

Installation description (6) are two text fields (see the next Section), which can be filled in by installer to specify the Device's location or leave notes and contact data. Special strings starting with «YD:» in the second field are used for Device programming in method [2].

Resetting of settings (7) returns a Device to the factory state.

The next two Sections describe the details of Device programming with methods [2] and [1]. Regarding method [3], please refer to your software manual and the NMEA 2000 Standard.

*Table 2. Setting type of a measured data for the Device*

| Type setting | Description | NMEA 2000 messages, PGN | | | |
|---|---|---|---|---|---|
| | | 130310 | 130311 | 130312 | 130316 |
| 0 | Sea Temperature | Yes | Yes | Yes | Yes |
| 1 | Outside Temperature* | Yes | Yes | Yes | Yes |
| 2 | Inside Temperature | — | Yes | Yes | Yes |
| 3 | Engine Room Temperature | — | Yes | Yes | Yes |
| 4 | Main Cabin Temperature | — | Yes | Yes | Yes |
| 5 | Live Well Temperature | — | — | Yes | Yes |
| 6 | Bait Well Temperature | — | — | Yes | Yes |
| 7 | Refrigeration Temperature | — | — | Yes | Yes |
| 8 | Heating System Temperature | — | — | Yes | Yes |
| 9 | Dew Point Temperature | — | — | Yes | Yes |
| 10 | Wind Chill Temperature, Apparent | — | — | Yes | Yes |
| 11 | Wind Chill Temperature, Theoretical | — | — | Yes | Yes |
| 12 | Heat Index Temperature | — | — | Yes | Yes |
| 13 | Freezer Temperature | — | — | Yes | Yes |
| 14 | Exhaust Gas Temperature | — | — | Yes | Yes |

* — *Factory setting*

# IV. Programming with Installation Description String

Installation description strings are usually written by installers to specify the device location or to leave notes or contact information. This can be done with professional PC software (with a hardware connector to NMEA 2000 network) and it may be supported by some models of chart plotters. Please refer to your software or chart plotter documentation for details.

To program the Device, enter a special string starting with «YD:» to the installation description field 2 in the Device properties. For example, «YD:DEV 1» (without quotes) will change the NMEA 2000 device instance of the Device to 1. If the command is accepted by the Device, it will add «DONE» to the entered text and «YD:DEV 1 DONE» will be displayed in the case of our example. Note that the Device always accepts correct strings regardless of the current settings, etc.

In Figure 1 on the next page, you can see the process of programming the Device with free CAN Log Viewer software (to open this window, select the item «NMEA 2000 Devices» in the «View» menu, refresh the list of devices, select the device and click «Properties» button). You can download this program (runs on Microsoft Windows, Mac OS X and Linux) at http://www.yachtd.com/downloads/, Yacht Devices NMEA 2000 Wi-Fi Gateway or Yacht Devices NMEA 2000 USB Gateway is required to connect the PC with NMEA 2000 network.

In the software you can also modify the NMEA 2000 device instance by entering a value in the dedicated field (see «Address Claim» group on the screenshot).

After entering the command as shown in Figure 1 (click «Update» button to apply changes), the value in the «Device Instance» field will be changed to 1, and «Installation Details 2» field will be changed to «YD:DEV 1 DONE».

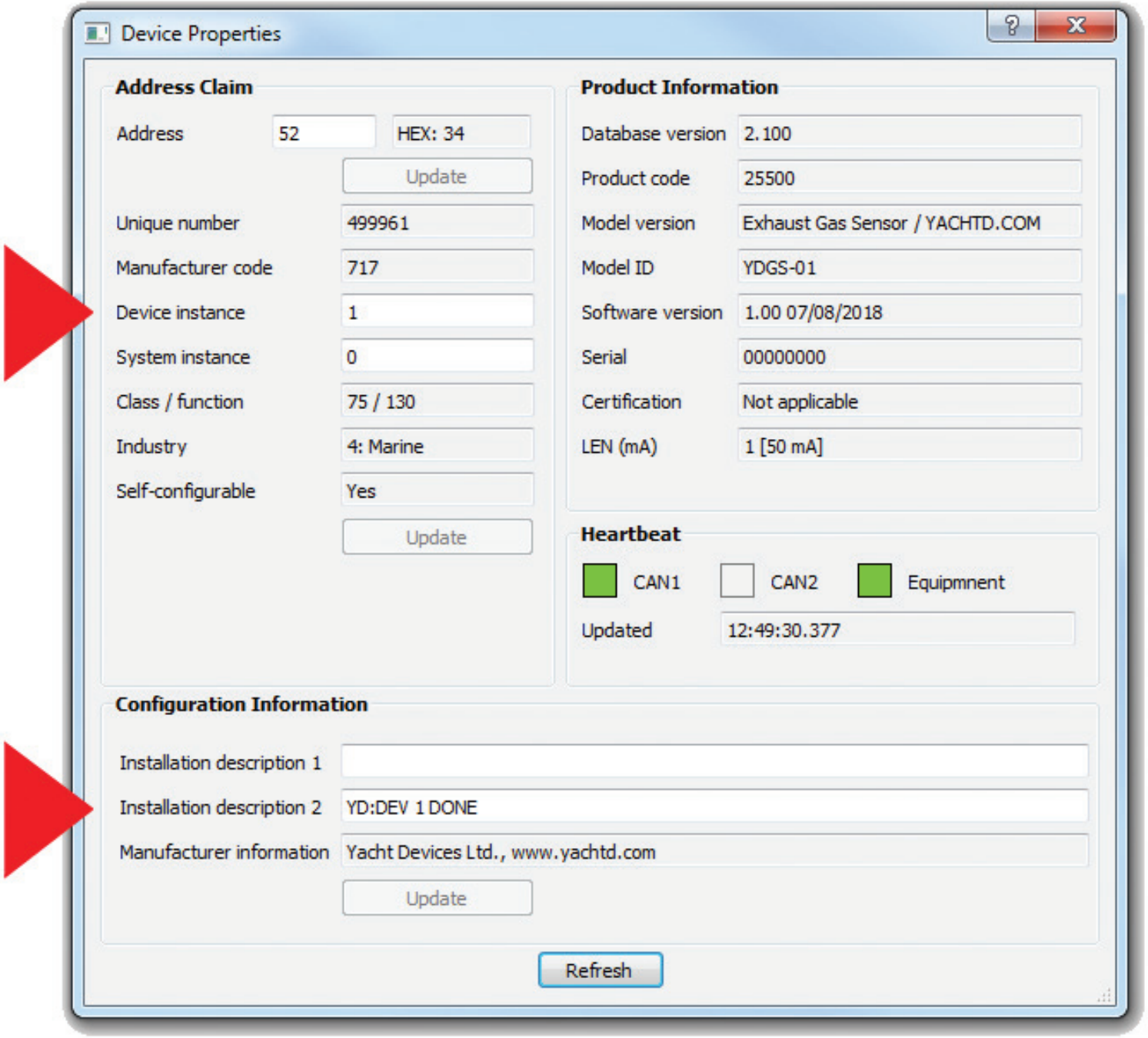


*Figure 1. Programming with CAN Log Viewer*

*Table 1. Special strings*

| **String format** | **Examples** | **Description** |
|---|---|---|
| YD:DEV <number> | YD:DEV 1 | Set NMEA 2000 device instance value (0..255). Factory setting 0. |
| YD:SYS <number> | YD:SYS 1 | Set NMEA 2000 system instance value (0..15). Factory setting 0. |
| YD:DAT <number> | YD:DAT 1 | Set NMEA 2000 data instance value (0..252). Factory setting 0. |
| YD:TYPE <number> | YD:TYPE 3 | Range 0..14, factory setting 1. Switches transmitted type of measured data (see Table 2 in the previous Section). |
| YD:TEMPERATURE <d> | YD:TEMPERATURE 3<br>YD:TEMPERATURE -1.2 | Set positive or negative offset in °C. Values from -10.0 to 10.0 are allowed. |
| YD:PGN <pgn> <interval> | YD:PGN 130310 0<br>YD:PGN 130316 500 | Set transmitted interval for specified message (130310, 130311, 130312 and 130316) in milliseconds. Values from 50 to 3600000 (1 hour) are allowed, value 0 turns transmission of specified PGN off. |
| YD: RESET | YD: RESET | Reset all settings to factory values. |

# V. Programming with Datum or Variation

To program the Device with this method, you must connect it to a network with a chart plotter. This method of programming is tricky, but is compatible with virtually all NMEA 2000 chart plotters.

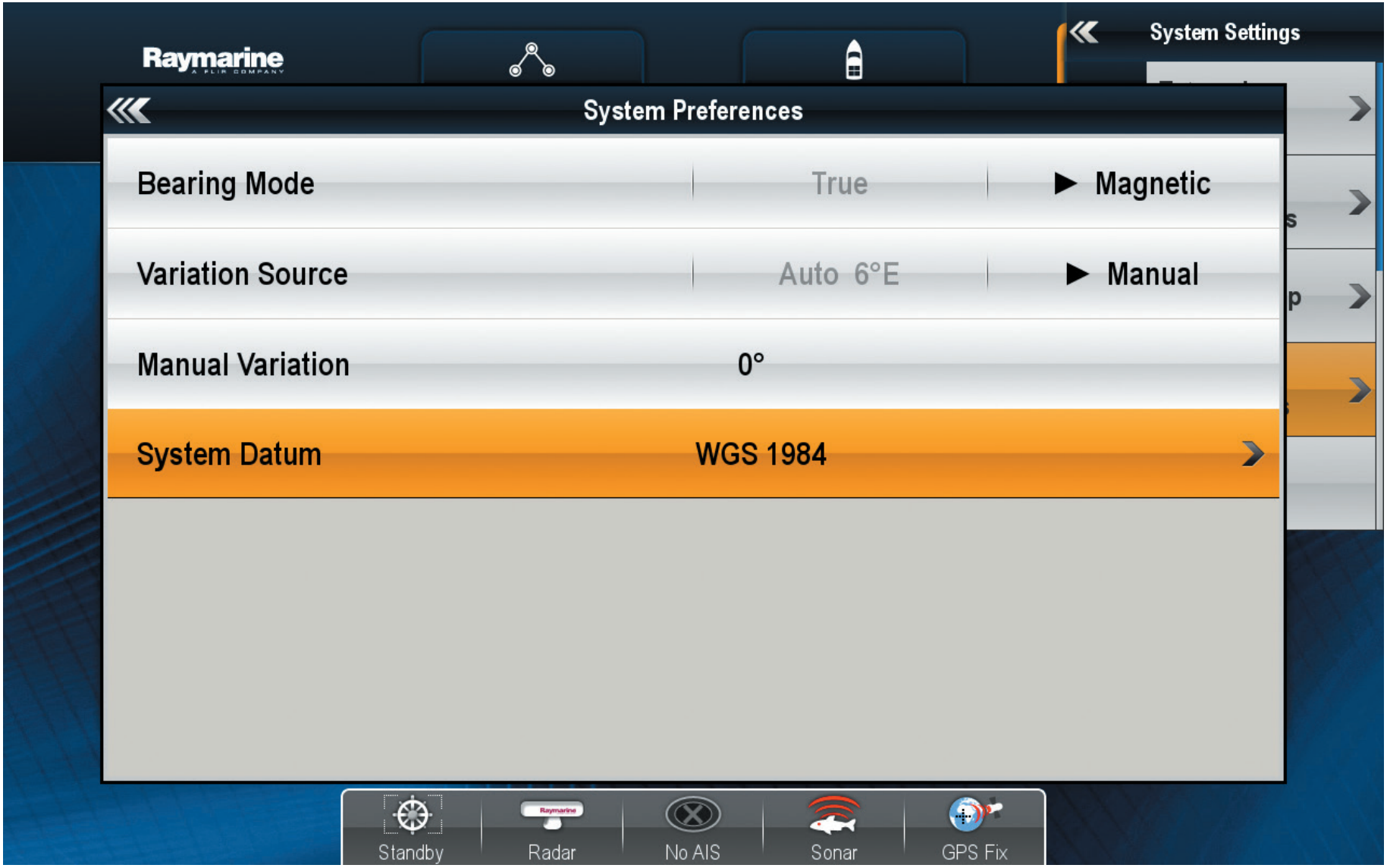


*Figure 1. Setting the chart datum and magnetic variation on Raymarine c125*

If one network includes several chart plotters, turn off all of them except the one from which you will program the Device. If multiple Devices are connected to the network, they will be programmed at the same time.

The Device confirms commands received from the chart plotter by lighting LEDs for 3 seconds once or repeatedly. If you are not able to see the Device LED when sitting behind the chart plotter, you may need an assistant.

Programming the Device is performed either by a sequential change of chart datum settings, or sequential change of the magnetic variation settings on the chart plotter. Older models of Raymarine plotters do not send notifications when changing the magnetic variation (NMEA 2000 message with PGN 127258) and only the first method is available for them. Garmin plotters do not send notifications when the chart datum is changed (NMEA 2000 message with PGN 129044) and only the second method is available for them.

To select a programming method, refer to the documentation of your chart plotter. In some cases you may need to update the plotter firmware.

**STEP 1. Putting the Device into standby mode**

The Device enters standby mode if, when it is switched on, the chart datum is set on the plotter as follows:

- to «Ireland 1965»

Or if the magnetic variation on the plotter is set to a user-defined value with the following parameter:

- 26°E

Usually the plotter sends notifications on settings every 20 seconds. When changing the setting on the plotter as mentioned above, do not forget to remember the initial configuration of the plotter. Cycle the Device power. Within a minute after the Device is turned on, it will produce a confirmation signal (LED will light up for 3 seconds). This means that the Device is put into standby mode. If the Device power is turned off along with the plotter power, the wait time for the signal will be increased by the plotter loading time.

If after some time the setting on the plotter automatically returns to the previous value, it means that there is another device in the network sending notifications. It may be an NMEA 0183 — NMEA 2000 converter, another plotter, or a computer connected to the NMEA 2000 network. Turn off the power of this device or disconnect it from the NMEA 2000 bus at the time of programming. It is recommended to disconnect any such device from the bus when the bus power is off.

### STEP 2. Putting the Device into programming mode

If the Device was put into standby mode by setting the chart datum (magnetic variation), all the subsequent steps should be carried out with the setting of chart datum (magnetic variation).

In the standby mode, without turning the Device power off, change the chart datum setting on the plotter

- to «European 1950 (Mean, European Datum)»

Or change the magnetic variation setting to:

- 29°E

The Device will produce one confirmation signal and enter programming mode.

The programming mode ends automatically 10 minutes after the Device power is turned on. Four confirmation signals are produced at the same time. After that, the Device returns to normal operation mode. The settings are not saved into nonvolatile memory and if the Device settings were changed at the time of programming, they will be kept only until the Device power is turned off.

### STEP 3. Programming the Device

When programming, you can customize the list of NMEA 2000 messages containing data sent by the Device, as well as the type of the transmitted data.

Unlike the programming method described in the previous Section, this method does not allow setting the interval for messages with periodic transmission. This method allows turning on and off message transmission only. When transmission is turned on, the interval specified in NMEA 2000 Standard for this message is applied (see Appendix C).

*Table 1. Setting NMEA 2000 messages for the Device*

| **Messages setting** | **Description** |
|---|---|
| 0 (factory setting) | Maximum compatibility mode. Transfer of the measured value with instance data instance 0 in the following messages (PGN): 130310, 130311, 130312, 130316. |
| 1 | Transfer of the measured value only in PGN 130310 message. |
| 2 | Transfer of the measured value only in PGN 130311 messages. |
| 3..15 | Transfer of the measured value only in PGNs 130312 and 130316 messages with data instance 0..12. |

We recommend using the maximum compatibility mode (value 0 in Table 1) and not changing the factory settings of messages unnecessarily. If you change the message setting to the value of 1 (see Table 1) and allow only PGN 130310 when the Device is configured to send measured data as «Engine Room Temperature» (see Table 2 in Section III), the Device will stop transmitting temperature data as engine room temperature cannot be sent in this message. When configuring messages setting with the value of 0 and data type with the value of 14 («Exhaust Gas Temperature», see Table 2 in Section III), only messages with PGNs 130312 and 130316 will be transmitted, because these data cannot be transferred in other messages.

Regardless of settings, the Device receives and transmits NMEA 2000 service messages (see Appendix C) and is displayed in the list of NMEA 2000 devices (SeaTalk NG, SimNet, Furuno CAN).

*Table 2. Device actions in response to setting changes*

| **Messages setting** | **Magnetic variation** | **Result** |
|---|---|---|
| Bermuda 1957 | 20°E | Incrementing the message setting by one. Upon reaching 16, the setting value is set to zero. |
| Bogota Observatory (Colombia) | 21°E | Incrementing the message setting by one. Upon reaching 16, the setting value is set to zero. |
| ARC 1950 (Africa) | 22°E | Incrementing the message setting by 5. Upon reaching or exceeding 16, the setting value is set to zero. |
| Campo Inchauspe (Argentina) | 23°E | Reset the message setting to zero (resetting to factory setting). Two confirmation signals. |
| Guam 1963 (Pacific Ocean) | 24°E | Incrementing the data type setting by one. Upon reaching 15, the setting value is set to zero. |
| Hjorsey 1955 (Ireland) | 25°E | Incrementing the data type setting by one. Upon reaching 15, the setting value is set to zero. |
| Ireland 1965 | 26°E | Incrementing the data type setting by 5. Upon reaching or exceeding 15, the setting is reset to zero. |
| Liberia 1964 (Africa) | 27°E | Reset the data type setting to zero. Two confirmation signals. |

Programming the Device is performed by changing the chart datum or magnetic variation setting on the plotter. The Device confirms the command by producing a single signal (unless shown otherwise in Table 2). The Device must be previously put into programming mode (STEP 2).

Please note that changing the Device settings occurs only when changing the plotter configuration. To increase the value of the message setting by 3, first change the setting to the first value from

Table 2, then to the second, and then back to the first one. After each change, wait for the Device confirming signal (lighting of LEDs for 3 seconds). Usually, when changing the setting, the plotter sends notification immediately and the Device signals just after the setting value is changed.

### STEP 4. Saving the settings in the non-volatile memory

Without turning the Device power off, change the chart datum setting on the plotter to «WGS 1984», or magnetic variation setting to 27°W. The Device will save the settings in the non-volatile memory, produce three confirming signals, and return to normal operation mode. If you do not save the settings into the non-volatile memory, they will be kept only until the power is turned off (see STEP 2). Do not forget to return the initial chart plotter settings after programming.

# VI. LED Signals

| Signal | Meaning |
|---|---|
| Short single flash after powering on | Indicating that the Device is functioning. |
| Six half-second signals, once after power on | Chart plotter presence indicator. This sentence is produced on first receiving of «Datum» (PGN 129044) or «Magnetic Variation» (PGN 127258) messages. Usually it happens within 20 seconds after chart plotter loading. |
| Repeated very short (25 milliseconds) signals | Normal operation. It is indicator of periodical messages sending (see Table 2 in Section III). Interval between flashes is 500 milliseconds by default, but can be changed by user. |
| Three second signal, once or repeatedly | Programming signals. See Section V for details. |
| Constant LED signal | Open thermocouple circuit detected. Thermocouple is broken and Device should be repaired. |
| One second signal with six second interval | Network problem. No messages was actually sent or received during the last seven seconds. |

Signals during firmware update are described in the next Section.

# VII. Firmware Updates

Firmware updates can be done with free CAN Log Viewer software running on Microsoft Windows, Mac OS X and Linux:

http://www.yachtd.com/products/can_view.html

CAN Log Viewer version should be 1.13 or later.

The program must be connected to an NMEA 2000 network with USB Gateway YDNU-02 or a Wi-Fi Gateway YDWG-02.

You should download the latest firmware version from our website:

http://www.yachtd.com/downloads/

Open the downloaded .ZIP archive with the update and copy the YDGS01.BIN file to the disk. The README.TXT file inside the archive can contain important information regarding the update.

1. Click the «NMEA 2000 Devices» item in the «View» menu.
2. Click the «Refresh» button (see Figure 1 at the next page) in the opened window and wait for the Device to appear in the list.
3. Select the Device and click the «Firmware Update» button.
4. Locate and select the update file YDGS01.BIN on the disk.
5. Wait while the firmware is uploading.

If in doubt, watch the video with the update procedure on our web site. During the firmware upload, the Device's LED flashes very fast. When the firmware is updated, Devices produce five half-second signals and the CAN Log Viewer also informs you that the update is successfully done.

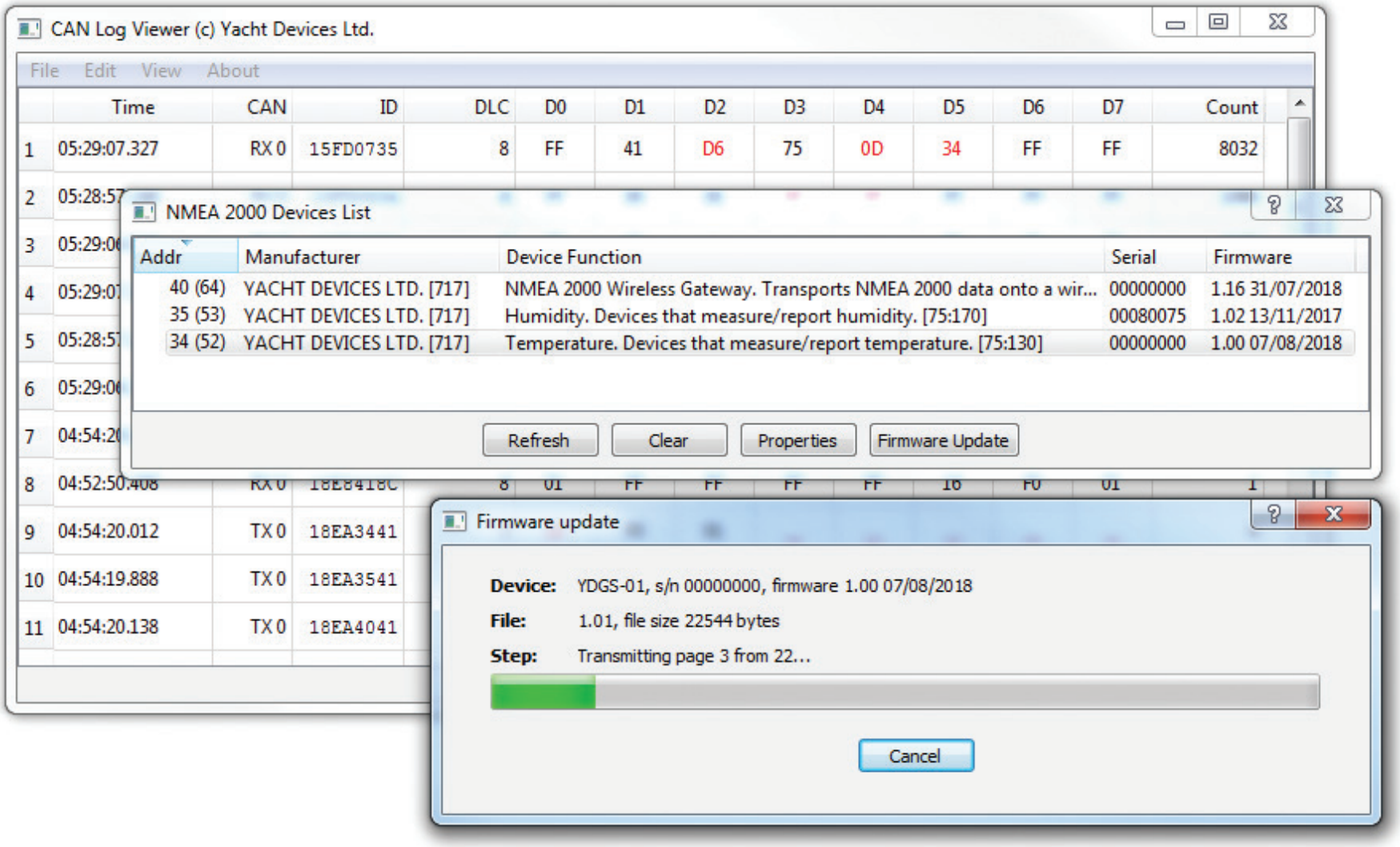


*Figure 1. Firmware update of Exhaust Gas Sensor*

# Appendix A. Troubleshooting

| Fault | Possible reasons and solution |
|---|---|
| The LED does not signal after the Device 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).<br>**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 is not displayed in the list of external devices on the plotter, data do not appear, LED lights up full second every seven seconds | **1. Loose connection in the data circuit.** Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another connector.<br>**2. There are problems in the NMEA 2000 network.** The network segment is not connected to the plotter or there are missing terminators in the network. Plug another device into the selected connector and make sure it appears in the list of devices on the plotter. |
| The Device is displayed in the list of Devices, but data do not appear on the screen | **1. Incorrect Device settings.** Reset Device's settings to the factory settings (see Section III).<br>**2. Incompatible equipment.** Make sure that your hardware supports PGN messages sent by the Device. Check if your hardware is capable to display the selected temperature type. Not all chartplotters and instruments support the «Exhaust Gas Temperature» data type. Update the firmware of your equipment if necessary |
| LED stays lit all the time | Thermocouple open circuit failure. Check the thermocouple for mechanical failure. |

## Appendix B. Description of Connectors

V+, V- - Battery 12V; CAN H, CAN L - NMEA 2000 data;
SCREEN - Not connected in the Device.

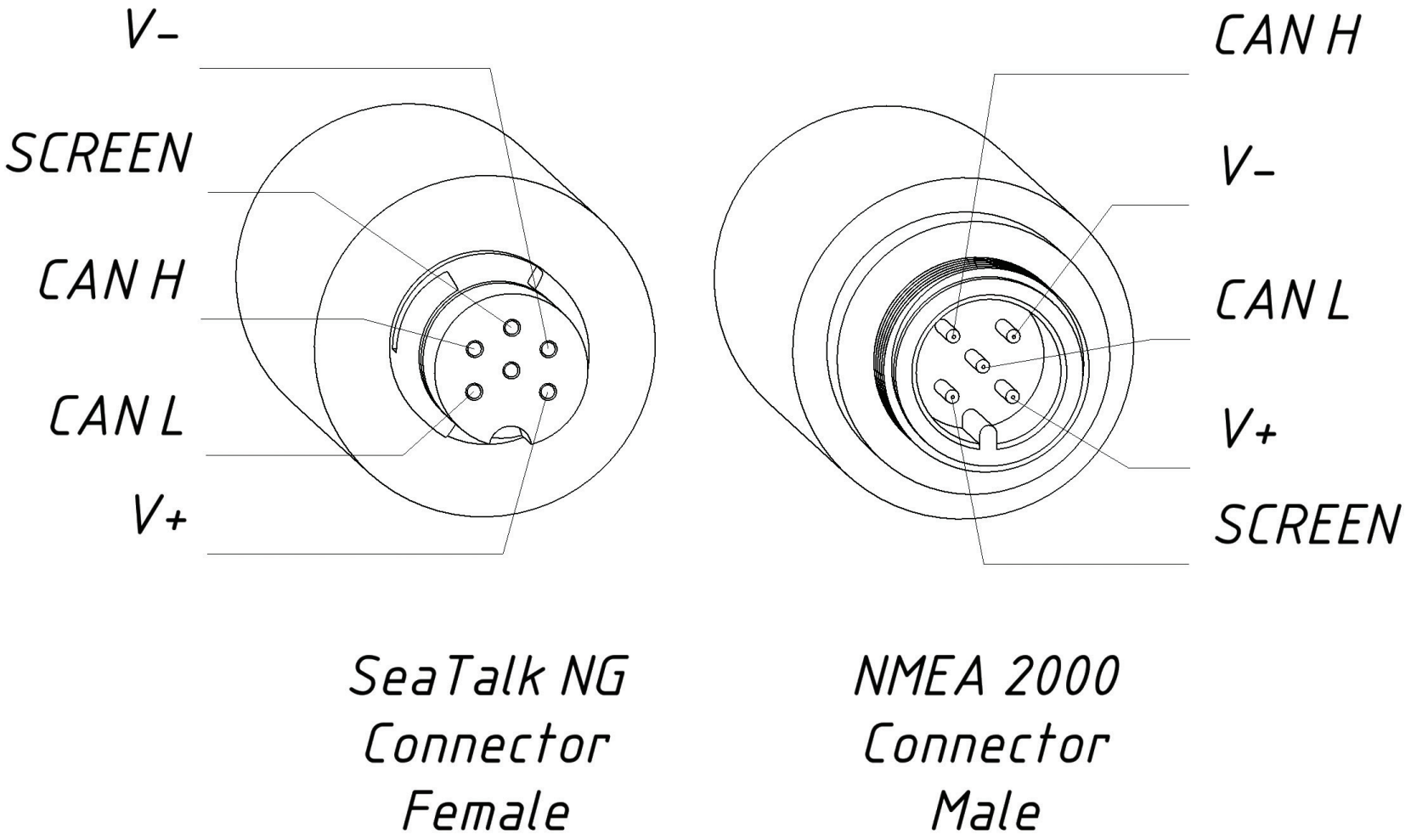


*Figure 1. Connectors of the Devices with indices R (left), N (right) in the end of model name*

# Appendix C. NMEA 2000 Messages

| Message | Received | Transmitted | Period, sec | Note |
|---|---|---|---|---|
| PGN 59392 ISO Acknowledgment | Yes | Yes | — | |
| PGN 59904 ISO Request | Yes | — | — | |
| PGN 60160 ISO Transport Protocol (DT) | Yes | — | — | |
| PGN 60416 ISO Transport Protocol (CM) | Yes | — | — | |
| PGN 60928 ISO Address Claim | Yes | Yes | — | |
| PGN 65240 ISO Commanded Address | Yes | — | — | |
| PGN 126208 NMEA Group Function | Yes | Yes | — | 1 |
| PGN 126464 PGN List (Received / Transmitted) | — | Yes | — | |
| PGN 126993 Heartbeat | — | Yes | 60 | |
| PGN 126996 Product Information | — | Yes | — | |
| PGN 126998 Configuration Information | — | Yes | — | |
| PGN 127258 Magnetic Variation | Yes | — | — | 2 |
| PGN 129044 Datum | Yes | — | — | 2 |
| PGN 130310 Environmental Parameters | — | Yes | 0.5 | 3 |
| PGN 130311 Environmental Parameters | — | Yes | 0.5 | 3 |
| PGN 130312 Temperature | — | Yes | 2 | 3 |
| PGN 130316 Temperature, Extended Range | — | Yes | 2 | 3 |

*Note 1: Request Message, Command Message and Write Fields are supported.*

*Note 2: Used in Device programming (see Section V).*

*Note 3: User can change the period or turn off transmission of this message (see Section IV).*