

Yacht Devices

User Manual

J1708 Engine Gateway YDES-04

also covers models

YDES-04R, YDES-04N

Software version

1.04

2019

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Package Contents

Device	1 pc.
This Manual	1 pc.
Male connector with two pins for J1708 interface	1 pc.
Stickers for MicroSD slot sealing	6 pc.

Introduction

The J1708 Engine Gateway YDES-04 (hereafter Gateway or Device) is a gateway for engines with a J1708 serial interface to a NMEA 2000 marine digital network. With it, you can see engine revolutions, temperature, working hours, fuel rate and other information on the screen of a chart plotter and other display devices on an NMEA 2000 network.

We expect that the Gateway will work right out of the box in the most cases. It automatically detects the protocol used (it supports the two protocols that work over J1708: standard J1587 used by many manufacturers and the proprietary Volvo Penta protocol used in engines with EDC I, for example KAD 44 and KAD 300), and detects what data is broadcasted by an engine and what data are available by request.

The Gateway is configured at the factory for use with a port engine or single engine, for other engines on a vessel, its number from the port should be specified in the settings (see Section VI.6).

The Gateway is equipped with a slot for a MicroSD card, which can be used to configure its settings (loading a text file with the settings), retrieve the current configuration, update the Device firmware and record the data from the J1708 and NMEA 2000 interfaces for configuration and diagnosis of the Device.

As of version 1.03, the Gateway allows configuration of user alerts for high revolutions, boost pressure, coolant temperature and other parameters (see VI.25-29). With version 1.04, it allows adding or replacing of engine data by data from NMEA 2000 temperature and pressure sensors (see VI.31).

A J1708 interface used for connection of gauges, electronic displays, diagnostics equipment and other vehicle modules. This interface was very popular until 2005-2007, when it began to be quickly replaced by the J1939 protocol based, the same as NMEA 2000, on a faster CAN network. If your engine supports both protocols, it may be preferred to choose another our product, the Engine Gateway YDEG-04 designed for J1939, Volvo Penta EVC, MEFI4B, EGC, EDC III and EDC IV engines. The only known exceptions are Volvo Penta marine engines equipped with EDC II (Volvo Penta D12C-A MP for example), where the CAN bus is used for synchronization of engines revolutions and has no other data.

This product is the only NMEA 2000 gateway for engines with a J1708 interface. We want to thank our testers from many countries who helped us with the pre-release version of the product, thank you for purchasing our Devices and we 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, the sales receipt may be requested when applying for a warranty claim.
2. The Device warranty is terminated in case of violation of the instructions in this Manual, case integrity breach, or repair or modification of the Device without the manufacturer's written permission.
3. If a warranty request is accepted, the defective Device must be sent to the manufacturer.
4. The warranty liabilities include repair and/or replacement of the goods and do not include the cost of equipment installation and configuration, or shipping of the defective Device to the manufacturer.
5. Responsibility of the manufacturer in case of any damage as a consequence of the Device's operation or installation is limited to the Device cost.
6. The manufacturer is not responsible for any errors and inaccuracies in guides and instructions of other companies.
7. The Device requires no maintenance. The Device's case is non-dismountable.
8. In the event of a failure, please refer to Appendix A before contacting technical support.
9. The manufacturer accepts applications under warranty and provides technical support only via e-mail or from authorized dealers.
10. The contact details of the manufacturer and a list of the authorized dealers are published on the website: <http://www.yachtd.com/>

I. Product Specification

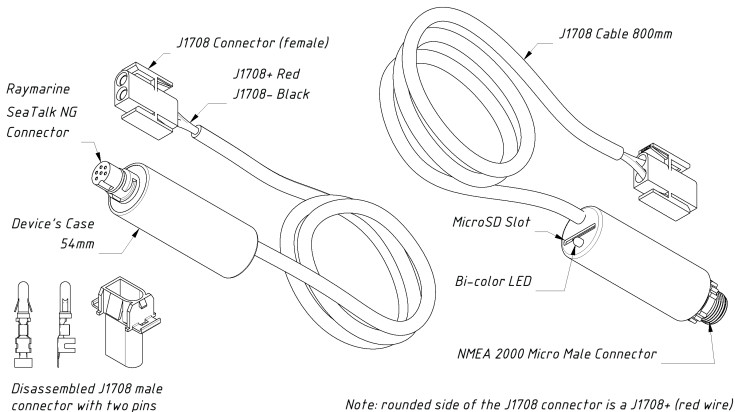



Figure 1. Drawing of YDES-04R (left) and YDES-04N (right) models of Gateway

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

The Device is equipped with a TE CONNECTIVITY 1-350344-0 connector (female connector at the end of J1708 cable) and supplied with a disassembled male connector 1-350345-0 with two pins (350389-1). Spare connectors and pins are widely available from well-known international suppliers like DigiKey Electronics (www.digikey.com), Mouser Electronics (www.mouser.com) and others.

Device parameter	Value	Unit
Current consumption from NMEA 2000 network	30	mA
Supply voltage from NMEA 2000 network	7..16	V
Load equivalency number	1	LEN
Galvanic isolation between NMEA 2000 and J1708	2500	V _{RMS}
J1708 cable length	800	mm
Device case length	54	mm
Weight	60	g
Operating temperature range	-20..55	°C

Note: The Gateway is powered from the NMEA 2000 network.

 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. MicroSD Slot and Card's Compatibility

The Device has a slot for a MicroSD card that allows you to configure the Device (see Section VI), update the firmware (see Section VIII) and record diagnostics data (see Section VII).

Since the MicroSD slot is usually not in use when the Device is working, we recommend sealing it with the sticker that is included with the Device or with a piece of tape to prevent water from entering the Device through the slot.



The Device slot has a 'push-push' mechanism that works on a spring and ensures proper card fixation. Improper loading or unloading (withdrawing your finger to quickly or not waiting for the click) can result in the card being propelled out of the Device up to 5 meters. To avoid possible eye injury, loss of or damage to the card, and other hazards, insert and remove the card with caution.

The Device supports MicroSD memory cards of all sizes and classes. The MicroSD card must be formatted on a personal computer before use in the Device. The Device supports the following file systems: FAT (FAT12, FAT16, MS-DOS) and FAT32. It does not support exFAT, NTFS, or any other file systems.

Be careful when inserting the MicroSD card into the Device. The card is inserted with the label side toward the LED and with the pin side toward the J1708 cable.

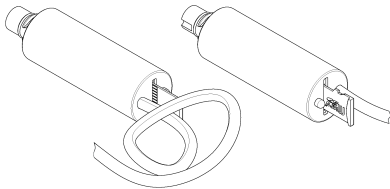


Figure 1. Device with MicroSD card (pin side visible at left, label side at right)

III. J1708 Basics

J1708 is the standard protocol of SAE (Society of Automotive Engineers, www.sae.org) for serial communications used in heavy vehicles. Electrically it is a modified RS-485 interface that operates at 9600 bit/s, with two wires usually marked as «A» and «B» or «+» and «-». This protocol allows a minimum of 20 devices to be connected and defines bus arbitrary rules: any device can send messages when the bus is free and all devices receive all messages sent.

The message format is defined in J1587 standards. A message contains a 1-byte identifier of the sender (MID), one or several pairs of parameter identifiers (PID) and parameter data (one or multiple bytes) and a checksum. A device (for example, a ECU – Engine Control Unit) can periodically transmit critical parameters (engine speed, coolant temperature), while other parameters (for example, serial number of ECU) are available on request. Requests for data can be addressed to a device (by MID) or sent globally.

Example of J1587 message (hexadecimal) periodically sent by ECU of Volvo D12 engine:

```
80 54 00 5B 00 5C 00 BE 00 00 B7
```

It contains an MID, four pairs of PID/data, and a checksum. Interpretation of this message (MID and PIDs are decimal):

```
MID 128 (Engine #1). PID 84 'Road Speed' : 00. PID 91 'Percent Accelerator  
Pedal Position' : 00. PID 92 'Percent Engine Load' : 00. PID 190 'Engine  
Speed' : 00 00. Checksum (B7) is correct.
```

Despite the fact that the standard defines update rate for some parameters (PIDs), implementations can vary from manufacturer to manufacturer. Marine engines often contain a special firmware which differs from the firmware of the same engine used on trucks or gensets.

The Gateway allows recording of J1708 data to a MicroSD card to determine what data are available and allows scheduling of requests to get data required. Note that many PIDs (for example, fuel temperature or throttle position) has no corresponding data type in NMEA 2000. And some NMEA 2000 data types (engine tilt/trim for example) have no corresponding data type in J1587.

In addition to J1587, the Gateway supports a proprietary protocol used in Volvo Penta KAD engines (KAD300, KAD44). Major data types such as engine speed (RPM), engine hours, coolant temperature, fuel rate, boost pressure and some others are supported. This protocol is based on J1708 also, but is not compatible with J1587. In the settings, you can choose what protocol to use, «J1587» or «KAD».

From the factory, the Gateway has the «AUTO» setting for protocol and detects the protocol automatically. It also has the «Smart Requests» feature activated, which monitors what data are available in the network and temporary turns off unanswered data requests to minimize the J1708 network load.

IV. Installation and Connection of Device



All connections should be made when the power is cut off at the circuit breaker. This will protect against accidental short circuits during installation.

The Device requires no maintenance. 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. The engine room is not recommended due to possible high temperature and humidity, and the possibility of flooding from damaged or improperly fixed hoses.

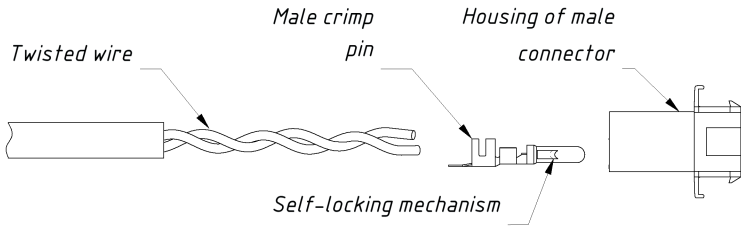
In some cases, the Gateway can be connected to J1708 engine instruments. This is a good option, because the NMEA 2000 backbone is usually located near here and no additional wires or cables are required.

The Device is equipped with a female connector compatible with Volvo Penta EDC diagnostics connectors (male) used on EDC I engines. For the owners of other engines, use the disassembled male connector supplied with the Gateway to make an adaptor cable for your engine yourself (see Appendix B). It is better to crimp wire with a crimping tool or a pliers than to solder them. Soldered connections can quickly break down in the marine environment and require isolation from air with paint or lacquer. The crimped contact is inserted into the connector housing from the backside and is self-locking.

However, in most cases, the connection point to J1708 is an engine diagnostics connector located in a fuse box or near it. In this case, you may need to elongate the J1708 cable of Gateway.

The total length of the J1708 network should not exceed 40 meters (131 feet). A minimum of 18-gauge twisted-pair wire, with a minimum of one twist per inch (360 degrees/2.54 cm) is required. The twists shall be distributed evenly over the length of the wire.

If the cable is located near sources of electromagnetic interference (EMI) like fridges or gensets, it is preferable to use shielded cable. For short connections, you may use widely available Ethernet cable (usually 24 - 26 AWG), but note that Gateway wires should be connected to twisted wires of one pair (Ethernet cable have four pairs).



Pin inserting direction ▷

Figure 1. Assembling of adaptor

The Device can be directly connected to the NMEA 2000 network backbone without a drop cable. But for models equipped with a NMEA 2000 Micro Male connector (YDES-04N) a drop cable may be used. Cables up to 10 meters (32 feet) are widely available (for example, Garmin part number 010-11076-02).

When possible, it is better to use a longer NMEA 2000 drop cable and shorter J1708 cable. The backbone length of NMEA 2000 is limited to 100m (328 feet) for regular cables and 250m for heavy cables.

Before connecting the Device, turn off the NMEA 2000 bus power supply. Refer to the manufacturer's documentation if you have any questions regarding the use of NMEA 2000 connectors:

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

After connecting the Device, close the lock on the connection to ensure its water resistance and reliability.

The Device is powered from the NMEA 2000 network and has an LED which flashes red or green. After turning the power in the NMEA 2000 network on, the Device's LED produces a short single green flash indicating that it is powered. If this does not happen, see Appendix A.



If your boat has no NMEA 2000 network installed, you should establish a basic NMEA 2000 network first. You cannot simply connect the Gateway to a NMEA 2000 port of your chart plotter. Many manufacturers offer a “Starter Kit” which contains all that is necessary to establish a basic network and connect two devices:

- for Raymarine SeaTalk NG, see Raymarine part number T70134;*
- for NMEA 2000, see Garmin part number 010-11442-00.*

To check the NMEA 2000 connection, open the devices list on the NMEA 2000 chart plotter (see Section VIII) and get sure that Gateway is present in the list of NMEA 2000 devices.

Device produces a series of five flashes every five seconds (see the next Section) during the normal operation. If the Device does not work as expected, check its state by LED signals and possible reasons in Appendix A. If in doubt, record the diagnostics log (see Section VII) and contact support.

V. LED Signals

The Device is equipped with a bi-color LED that indicates the Device's state. The Device produces a short single green flash after powering on, indicating that the Device is functioning.

1. Signals during normal operation

During normal operation, Device produces a series of five flashes every five seconds. The flashes indicate the state of Device interfaces over the last five seconds and have the following meaning:

- **Flash #1.** GREEN if data is received from the NMEA 2000 interface, otherwise RED. Device use hardware filters to filter out unnecessary NMEA 2000 messages. But it receives many periodic messages including GNSS position and system time, and RED usually indicates problems at the level of the physical connection.
- **Flash #2.** GREEN if data transmitted to NMEA 2000. RED means that no useful (interpreted) data was received from the J1708 interface.
- **Flash #3.** GREEN if data (even corrupted or not interpreted) was received from J1708 interface. A RED signal usually indicates problems with the physical connection.
- **Flash #4.** GREEN if requests were successfully transmitted to engine. The Gateway sees its own requests on the bus, and it means that J1708 data link is normal. RED may mean that Gateway has nothing to send (because data are available from the engine without requests, in this case all other flashes should be green), or requests are turned off in device settings (turned on by default, see Section VI.19) or it indicates problem with physical connection.
- **Flash #5.** RED if the number of corrupted messages on J1708 interface exceeds 10% or nothing was send and received from J708. GREEN otherwise.

With factory settings, the Gateway usually flashes GREEN-RED-RED-GREEN-GREEN while ignition is off. This means that it receives messages from NMEA 2000 (first flash), transmit J1708 requests to detect engine's presence (last two flashes), but receives nothing from J1708 (third flash) and correspondingly nothing is sent to NMEA 2000 (second flash).

In case of a problem with the J1708 connection (for example, a short circuit), the Gateway will not see

its own messages on the bus and the last two flashes will be RED.

When the ignition is on, the Gateway should blink only GREEN. If the last flash is periodically RED or constantly RED when all other are GREEN, it can mean a bad contact or electromagnetic interference from power equipment. If in doubt, you can record diagnostics data (see Section VII) and contact support to determine the reason (please read Appendix A before).

2. Three flashes, one time after inserting the MicroSD card into the Device

Three GREEN flashes: the YDES.TXT file has been read and changes have been made to the current Device settings. The YDESSAVE.TXT file on the card has been saved with the updated configuration.

GREEN, RED, RED: the YDES.TXT file has been read from the card, but the current configuration of the Device has not been changed (either the configuration file does not differ from the current settings or there are no settings in the file). The YDESSAVE.TXT file on the card has been saved with the current configuration.

Three RED flashes: the YDES.TXT was not found on the MicroSD card or the file system is not supported.

You can safely remove the MicroSD card when the flash sequence is finished.

3. Other signals

LED signals during diagnostics recording and during firmware updates are described in Sections VII and VIII.

VI. Device Settings

To configure the Device, a text file with the configuration should be created and named YDES.TXT in the root folder of the MicroSD card. A sample of the configuration file is in Appendix E. The file contents must conform to these rules:

- parameters and their values must be entered in UPPER CASE;
- each parameter must be on its own line;
- commentary lines must start with the # symbol.

Insert the card with a configuration file into the Device and in a few seconds you will see three LED signals (see Section V) indicating that the configuration file has been processed. A file YDESSAVE.TXT will be created on the memory card with the current configuration of the Device. After the three LED signals, you can remove the card and check the new YDESSAVE.TXT file to be sure that the configuration file has been properly interpreted. You also can load an empty configuration file (zero length) into the Device to get the YDESSAVE.TXT file with the full configuration of the Device and then use it as a template to configure the Device.

A vertical line in the list of parameters below means that the setting may have one of these values.

1. *PROTOCOL=*AUTO|J1587|KAD

Factory setting: AUTO

J1587 is a standard protocol used by many manufacturers. KAD is a Volvo Penta proprietary protocol used in Volvo Penta EDC I engines (KAD 44, KAD 300, etc). You can specify the protocol of your engine there, but AUTO (auto detection of protocol) should work in most cases.

2. *HOURS_OFFSET=*x

x – decimal positive number

Factory setting: 0

Offset in seconds for engine work hours reported by ECU. Some boats have replaced ECU which reporting the motor hours since installation of ECU (smaller than actual motor hours since engine installation). This setting allows getting the same readings on all gauges.

3. *FUEL_TYPE=DIESEL|GASOLINE*

Factory setting: DIESEL

The type of fuel in the fuel tanks where fuel level is reported on the J1708 network. This type is sent with fuel level data to NMEA 2000 network.

Note that many chart plotters cannot display level in gasoline tanks; use DIESEL as the value if there are compatibility issues.

4. *TANK_PRIMARY_CAPACITY=DEFAULT|x*

x – decimal positive number (1.. 65500)

Factory setting: DEFAULT

The volume in liters of the primary fuel tank. The volume is reported with the fuel level to NMEA 2000. DEFAULT setting means that the volume is reported as unknown (may be specified in the settings of some chart plotters).

5. *TANK_SECONDARY_CAPACITY=DEFAULT|x*

The same as previous setting, but for the secondary tank.

6. *ENGINE_ID=x*

x – decimal number 0..252

Factory setting: 0

Identifier of the engine for NMEA 2000. The port engine (or the only engine on the vessel) has an identifier

of 0; the identifier increases from port to starboard.

The Gateway is connected to the starboard engine in twin engine installations must have the following setting:

```
ENGINE_ID=1
```

```
7. ENGINE_ALERT_MASK=x
```

x – decimal or hexadecimal (starting with 0x prefix) 32-bit unsigned number

Factory setting: 0x00ffffff

Only bits set in this mask can be set by the Gateway in the engine status for NMEA 2000. See bits description in Table 2 of Appendix D. For example, to block the «Low Oil Level» warning, you should clear the 3-rd bit in this mask, it will be 0xFFFFFB (binary 111111111111111111011).

Most of the engine status bits (includes warnings) are set when the DTC (Diagnostics Trouble Code) is received. The DTC is a pair of PID (the source of problem) and FMI (Failure Mode Identifier) numbers. The DTC list is sent in PID 194 of J1587. Some bits of the status are set according status bits reported in other PIDs (for example, PID 87 «Water in Fuel»). See in Table 2 of the Appendix D for details.

This setting does not block alerts generated by the Gateway according the settings in VI.25 – VI.29. These settings allow you to define your own alarms (in addition to alarms sent by the engine) for high engine revolutions, boost pressure, coolant temperature, low voltage and low oil pressure.

KAD protocol (EDC I) does not support alarms, and settings VI.25 – VI.29 are the only way to get engine alerts.

```
8. TRANSMISSION_ALERT_MASK=0xff
```

x – decimal or hexadecimal (starting with 0x prefix) 8-bit unsigned number

Factory setting: 0xff

The same as previous setting, but the mask is 8-bit and intended for transmission status bits. See Table 3 in Appendix D for details.

9. *TANK_PRIMARY_ID=OFF|x*

x – decimal number, 0..15

Factory setting: 0

Identifier of primary fuel tank for NMEA 2000. Usually the first or the only or primary tank must have an identifier of 0. If you have four fuel tanks connected to two engines, the following settings may be suitable for this configuration:

# Port configuration	# Starboard configuration
ENGINE_ID=0	ENGINE_ID=1
TANK_PRIMARY_ID=0	TANK_PRIMARY_ID=2
TANK_SECONDARY_ID=1	TANK_SECONDARY_ID=3

10. *TANK_SECONDARY_ID= OFF|x*

x – decimal number, 0..15

Factory setting: 1

The same as the previous setting, but for the secondary tank.

11. *ALTERNATOR_SOURCE=PID_167|PID_158|PID_168*

Factory setting: PID_167

This setting is only for J1587 and defines what data to be reported as alternator voltage to NMEA 2000: data from PID 167 «Alternator Potential (Voltage)», from PID 158 «Battery Potential (Voltage)—Switched» (electrical potential measured at the input of the electronic control unit supplied through a switching device) or PID 168 «Battery Potential (Voltage)».

The KAD protocol provides only one measurement of voltage, which is reported in the alternator field.

12. *BATTERY_1_ID=OFF|x*

x – decimal number, 0..252

Factory setting: 0

The Gateway can report the status (voltage and current) of two batteries. This setting defines the identifier of the first battery for NMEA 2000. Usually the first, the only, or the primary battery must have an identifier of 0. OFF turns off sending of the first battery status.

Data source for this battery is defined in the next setting.

13. *BATTERY_1_SOURCE= PID_167|PID_158|PID_168*

Factory setting: PID_158

The set of parameters is described in VI.11 above. If the PID 168 is set, the Gateway also uses data from PID 114 to report the battery current. If PID 167 is set, Gateway use data from PID 115 to report battery current. The current is not reported if PID 158 is used.

In the KAD protocol, only one voltage measurement is available and this setting is not applicable. You can turn first battery reporting off or on only with the VI.12 setting. This setting has no effect in the KAD protocol.

14. *BATTERY_2_ID= OFF|x*

x – decimal number, 0..255

Factory setting: 1

The same as VI.12, but for the second battery.

In the KAD protocol only one voltage measurement is available. This measurement is reported in alternator voltage field to NMEA 2000 and can be reported as battery voltage too. But usually it has no practical purpose and this parameter can be set to OFF, the same as for VI.12.

15. *BATTERY_2_SOURCE=PID_167|PID_158|PID_168*

Factory setting: PID_168

The same as VI.13 but for the second battery.

16. *MID_GATEWAY=x*

x – decimal number from 1 to 254

Factory setting: 180

For J1587 protocol only. MID numbers identify the sender of the message and are assigned by SAE. MID 128 is assigned to Engine #1, MID 130 to transmission and so on.

This setting defines the MID of Gateway and is used to send requests to other J1587 modules. Recommended values are 172 (Off-board Diagnostics #1) and 180 (Off-board Diagnostics #2). Some modules may reply to requests sent from concrete MIDs only. Using of an improper MID (for example, already used by the ECU) may cause a conflict on the network with unpredictable results.

17. *MID_FILTER=ANY|x*

x – decimal number from 0 to 255

Factory setting: ANY

For J1587 protocol only. By default, the Gateway processes data from all modules in J1587 network (with factory setting ANY). This setting allows processing of data from a specified MID only.

For example, your J1708 network has two engines with MID 128 (port engine) and MID 175 (starboard engine) connected. The Gateway can report only one engine to NMEA 2000 and in this case you need two gateways with the following settings:

# Port engine gateway	# Starboard gateway
ENGINE_ID=0	ENGINE_ID=1
MID_FILTER=128	MID_FILTER=175

18. *THROTTLE_AS_LOADING=OFF|ON*

Factory setting: OFF

For KAD protocol only. KAD has no data field for engine load. The Gateway can send the throttle position in this field to NMEA 2000. These parameters are not the same. This setting is added by request of our customers.

19. *REQUESTS=ALL|USER|BUILTIN|OFF*

Factory setting: ALL

The Gateway has a list of predefined requests for KAD and J1587 protocol. It contains all PIDs from Table 1 in Appendix D. The BUILTIN value instructs the Gateway to use its internal list only. The USER instructs the Gateway to use only user-defined requests (see the next setting). OFF turns off requests and makes the Gateway «listen only».

In case of the ALL value, the Gateway loads PIDs from internal lists (according protocol setting VI.1) and adds user requests (see the next setting). If the PID and MID of the user request matches the PID and MID in the built-in list, the user setting overrides existing settings. This allows you to change schedule or turn off built-in requests.

20. *REQ_a=b,v|ONCE|OFF,d|ANY*

a – decimal number from 0 to 19, the number of user request record

b – PID, decimal number from 1 to 4094

v – interval between requests in milliseconds, decimal number from 50 to 204700

d – MID, decimal number from 0 to 254

User can define 20 custom requests with the record number from 0 to 19. The Gateway will modify only those records, which are specified in configuration file (and valid). All other user requests saved in non-volatile memory remains intact. For example, to «delete» a request from user record 19, you should set it to OFF:

REQ_19=1, OFF, ANY

The list of supported PIDs is available in Appendix D. You can use unsupported PIDs there (any from 1 to 4094) for diagnostics purposes.

The value in the interval field is rounded to 50 milliseconds, the smallest possible interval between requests of PID is 50 milliseconds and maximal is above 3 minutes. The ONCE value in this field instructs the gateway to request this PID until an answer is received (2500 milliseconds interval used). It is useful to request static data. The OFF value turns this request off.

The MID field is not used in requests when KAD protocol is set (VI.1). In case of J1587 protocol, ANY value instructs the Gateway to send a non-addressed request for the PID.

21. SMART_REQUESTS=ON|OFF

Factory setting: ON

With smart requests on, the gateway analyzes what requests remain unanswered when the engine is on and other data are available. The Gateway stops sending these requests.

Usually, analyzing is finished within 15-20 seconds after the ignition is turned on. If some requests were turned off by «Smart Requests», the list will be printed at the end of the YDESSAVE.TXT file. An example is available in Appendix E.

22. KAD_RELATIVE_BOOST=ON|OFF

Factory setting: OFF

For KAD protocol only. Boost pressure in NMEA 2000 is an absolute value (0..6553.2 kPa), and the analog gauge of KAD shows boost relative to atmospheric pressure (so the value can even be a bit less than zero). It is not correct to pass relative value to NMEA 2000, but it is also distracting to see different numbers. Moreover, KAD reports absolute (PID 258) and relative (PID 265) pressure both.

23. *KAD_COOLANT_ADD=x and KAD_COOLANT_MUL=y*

x – number from -32.7 to 32.7 (degrees Fahrenheit)

y – number from 0.0001 to 6.5

Factory settings: *x* – 0, *y* – 1 (no effect)

EDC I (KAD and TAMD) engines have two coolant temperature sensors, one is connected exclusively to the EDC and the other one is connected exclusively to the coolant temperature gauge on the panel. One of our customers observes a stable difference of 10 °F.

The issue is in NTC thermistors used in sensors, and they usually have non-linear characteristics. You can adjust the readings if you face this situation. The Gateway adds the first (*x*) to the received data and then multiplies the result to the second (*y*).

Of course you do not need to change both parameters. It looks like the following settings work well for our customer with 10°F difference in readings:

```
KAD_COOLANT_ADD=-10
```

```
KAD_COOLANT_MUL=1
```

24. *KAD_VOLTAGE_ADD=x and KAD_VOLTAGE_MUL=y*

x – number from -32.7 to 32.7 (Volts)

y – number from 0.0001 to 6.5

Factory settings: *x* – 0, *y* – 1 (no effect)

Align settings for the voltage (KAD protocol only). See previous parameters (VI.23) for details.

25. *MAX_RPM=OFF|x*

x – integer from 1 to 65000

Factory setting: 10000

Generate «Rev Limit Exceeded» alert of NMEA 2000 if engine revolutions are exceed specified value. This alert cannot be turned off with VI.7 setting, set the value to OFF to turn it off.

26. *LOW_VOLTAGE=OFF|x*

x – decimal number from 1.0 to 25.2

Factory setting: 7.0

Generate «Low Voltage» alert of NMEA 2000 if the engine is on and the alternator voltage is below of specified value. This alert cannot be turned off with VI.7 setting, set the value to OFF to turn it off.

27. *OVER_TEMP_C=OFF|x*

x – integer from 1 to 500 (degrees of Celsius)

Factory setting: 200

Generates «Over Temperature» alert of NMEA 2000 if the engine is on and the coolant temperature is above the specified value. This alert cannot be turned off with VI.7 setting; set the value to OFF to turn it off.

28. *HIGH_BOOST_KPA=OFF|x*

x – integer from 1 to 2000 (kPa)

Factory setting: 600

Generates «High Boost Pressure» alert of NMEA 2000 if the engine is on and the boost pressure (sent to NMEA 2000; relative or absolute pressure, depends on protocol used and setting VI.22) is above the specified value. This alert cannot be turned off with VI.7 setting; set the value to OFF to turn it off.

29. *LOW_OIL_KPA=OFF|x*

x – integer from 1 to 2000 (kPa)

Factory setting: 10

Generates «Low Oil Pressure» alert of NMEA 2000 if the engine is on and the oil pressure is below the specified value. This alert cannot be turned off with VI.7 setting; set the value to OFF to turn it off.

30. PRIVATE_MID=*x*

x – empty, or from one to 4 numbers (0..254) separated by comma

Factory setting: empty

J1587 protocol has private messages sent from one electronic component to another one. PIDs transferred in such messages are proprietary and (in most cases) does not match with definitions of J1587 PIDs and has different meanings.

At your own risk, you can instruct the gateway to intercept and process private messages sent by up to four MIDs. If the setting VI.17 (MID filter) has a numeric value, only the messages from the MID set in the VI.17 (sender) to MIDs defined in this setting (recipients) are processed.

This setting has no effect on non-addressed messages, sent globally to all devices.

31. GROUP OF SETTINGS: SUBSTITUTE_*xxxx*=OFF|*y*

xxxx – BOOST, FUEL_PRESSURE, OIL_PRESSURE, OIL_TEMP, CLNT_PRESSURE, CLNT_TEMP, TRANS_PRESSURE, TRANS_TEMP

y – sensor data instance, decimal number from 0 to 252

Factory setting: all settings are OFF

This group of settings allows replacing of engine data by data from NMEA sensors. Temperature data (engine oil, coolant, transmission oil) are replaced by data from temperature sensors (PGN 130312 or 130316); pressure data (boost, fuel, engine oil, coolant or transmission oil pressure) are replaced by data from pressure sensors (PGN 130314). The data instance of the sensor (not to be confused with NMEA 2000 device or system instance, or with a data type like «Air Temperature» or «Sea Temperature») should match the specified data instance in the setting.

For temperature data types, we recommend using Exhaust Gas Sensor YDGS-01. This measures

temperatures up to 800 Celsius; the data instance can be configured with YD:DAT command. For pressure data types, we recommend the Tank Adapter YDTA-01. This product is an NMEA 2000 adapter for resistive and voltage sensors, and can work in parallel with analog and digital gauges. Initially designed for fuel level sensor, it has a setting to «convert» it to a pressure sensor.

For example, Volvo Penta KAD and TAMD engines have oil pressure sensors, but they are connected only to an analog gauge and are not connected to EDC. The Tank Adapter can be used to add data from this sensor to NMEA 2000.

VII. Recording of Diagnostics Data

The Device allows all processed data to be recorded to the MicroSD card for the purpose of diagnostics and configuration.



Recording of diagnostics data is not a normal operation mode. Recording to the MicroSD card can cause delays in messages processing and some messages may be skipped. High-speed MicroSD cards from proven manufacturers can reduce the impact..

Create a file called YDES.TXT with the following lines included:

```
DIAGNOSTICS=60  
LOG_NMEA=ON
```

Where 60 is the duration of diagnostics recording in seconds (1 - 3600 is allowed); this is one minute in the example above. LOG_NMEA can have ON or OFF values. If this parameter is wrong or omitted, OFF is used (diagnostics of NMEA 2000 is usually not required for end users).

Note that the given settings are not saved in the non-volatile memory and will no longer apply after the card is removed or when the NMEA 2000 network is powered off or if the recording finishes after a specified time.

Insert the MicroSD card into the Device. The Device will produce a 1-second green LED flash that indicates that recording has started. Do not eject the card during recording, or the recording will be lost and the file system of the MicroSD card may be corrupted.

The Device will inform you with a 1-second red flash of the LED that recording is finished. After this, the memory card can be safely removed from the Device. The card will contains YDESLOG.TXT file. Here is an example of the file contents:

```
# Yacht Devices J1708 Engine Gateway YDES-04 (www.yachtd.com)
# Firmware: 0.97 14/08/2017
00:00:01.715 R J1708 ER 80 54 00 5B 00 5C 00 BE 00 00 BF
00:00:01.718 R J1708 OK 80 55 60 B7 00 00 14
00:00:01.723 T J1708 OK B4 00 BE 8E
00:00:01.740 R J1708 OK 80 BE 00 00 C2
00:00:01.741 R J1708 OK 88 31 CD 97 3F FF A8 FF FF FF
00:00:01.744 R J1708 OK 80 54 00 5B 00 5C 00 BE 00 00 B7
00:00:01.746 R J1708 OK 80 54 00 5B 00 5C 00 BE 00 00 B7
00:00:01.750 R J1708 OK 80 55 60 B7 00 00 14
00:00:01.752 T 09F20055 00 00 00 FF FF 7F FF FF
00:00:01.753 T 09F20155 A1 63 FF 7F 00 00 FF FF
00:00:01.754 T 09F20155 A2 FF FF FF FF FF FF 7F
00:00:01.756 T 09F20155 A3 00 00 00 00 00 FF
00:00:01.760 R J1708 OK 80 54 00 5B 00 5C 00 BE 00 00 B7
```

'R' and 'T' (after the record time) indicating the message direction (received or transmitted by Gateway), 'J708 ER' indicates a line with a corrupted J1708 message (or unrecognized message when wrong protocol is selected or, is case of AUTO setting, is not detected yet), 'J1708 OK' indicates a line with a valid J1708 message with correct checksum, and other lines contain NMEA 2000 messages (29-bit identifier and 1 - 8 data bytes in hexadecimal).

Analyzing logs requires knowledge of J1708 and/or J1587 standards; it can be purchased from SAE (www.sae.org). Analyzing NMEA 2000 messages requires knowledge of NMEA 2000 standard; it can be purchased from the National Marine Electronics Association (www.nmea.org).

However, in simple cases, the knowledge outlined in Section III may suffice to check what data are available and what are not.

```
00:00:01.723 T J1708 OK B4 00 BE 8E
```

The line above contains a message sent by the Gateway ('T') using MID 180 (B4). It is a non-addressed request (PID 00) for PID 190 (BE) «Engine Speed».

```
00:00:01.740 R J1708 OK 80 BE 00 00 C2
```

And this line contains a message received by the Gateway ('R') from MID 128 (80), which contains PID 190 (BE) with data 00 00, the checksum C2 at the end is correct (as the line contains 'J1708 OK').

VIII. Firmware Updates

In the root folder of the MicroSD card with FAT or FAT32 file system, copy SUPDATE.BIN, which contains the firmware update of the Device. Insert the card into the Device and turn on the power in the NMEA 2000 network.

For 5-15 seconds after powering on, the LED will flash 5 times with a green light. This indicates that the firmware update is successfully completed.

If the Device is already using the given version of the firmware, or if the Device cannot open the file or the file is corrupted, the boot loader will immediately transfer control to the main program. This is done without visual cues.

The Device information including the firmware version is displayed in the list of NMEA 2000 devices (SeaTalk NG, SimNet, Furuno CAN) or in the common list of external devices on the chart plotter (see the third line in Figure 1 on the next page). Usually, access to this list is in the Diagnostics, External Interfaces or External devices menu of the chart plotter. You can also get the actual firmware version from the first lines of YDESSAVE.TXT file (see Section VI).

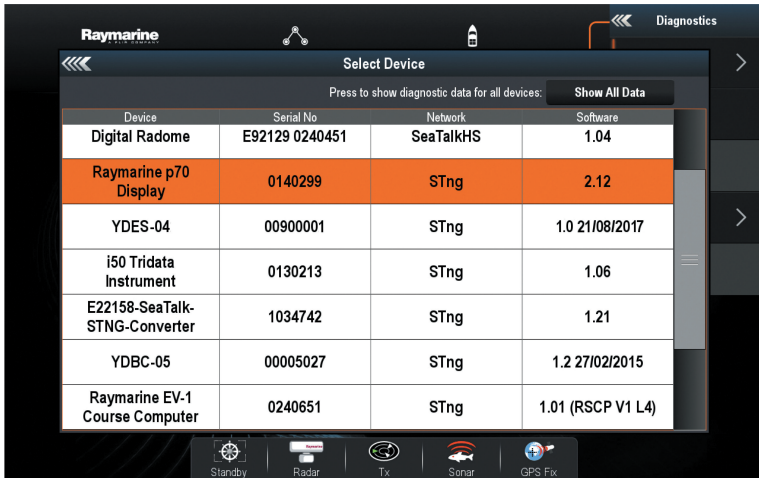


Figure 1. Raymarine c125 MFD devices list with Gateway (YDES-04)

IX. Coexistence with other equipment

J1708 network allows coexistence of multiple devices. However, in practice the data link usually is exclusively used by the diagnostic tool, display or digital gauge. J1587 engines transmit most of the data by schedule (without requests from other devices), but in the case of KAD protocol, all data are receiving in response to the request.

To provide maximum refresh rate of the data, these devices, the same as our Gateway, transmit requests with the maximum frequency. This can lead to collisions, and other devices can display a «Data link error» or similar messages.

The following steps are recommended to solve this problem:

1. Disconnect or turn off all other J1708 devices. Run the engine for 5 minutes and save the configuration of the Gateway. The YDESSAVE.TXT will contain a list of requests not supported by your engine (see VI.21).
2. Configure the protocol (VI.1). It will reduce the number of requests to detect the type of the engine.
3. Turn off the gateway's requests (VI.19, set the value of the setting to OFF). Connect (turn on) all other J1708 devices. The gateway will use the data sent by the engine by schedule or send in response to requests of other devices. Check what data are available and what data are not.
4. Set the setting VI.19 value to USER and configure requests (VI.20) for the data which is not available. Do not use small intervals between requests.

For example, you have a KAD/TAMD engine and have a conflict with the EDC Display. When the Gateway's requests are off, you have all data except the alternator potential. The PID of this request is 293 (see KAD column of the Table 1 in the Appendix D). A one-second interval is adequate for this request. One request and answer (12 bytes) will take about 1.5% of the bandwidth (9600 baud or about 900 bytes per second). The configuration for this case is:

```
PROTOCOL=KAD  
REQUESTS=USER  
REQ_0=293,1000,ANY
```

In case of trouble, record 5 minutes of the diagnostic log (see VII) started before the ignition and engine turned on, and apply technical support.

Appendix A. Troubleshooting

Situation	Possible cause and correction
LED does not signal after the NMEA 2000 network is powered on	<p>1. No power supply on the bus. Check if the bus power is supplied (NMEA 2000 network requires a separate power connection and cannot be powered by a plotter or another device connected to the network).</p> <p>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.</p>
First flash in 5-flashes sequence (NMEA 2000 RX) is RED	<p>1. Loose connection in the data circuit. Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another connector.</p> <p>2. There are problems in the NMEA 2000 network. The network segment is not connected 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 (see Section VIII).</p>
Last three flashes in 5-flashes sequence are RED	If requests are not turned off (see VI.19) and ignition is on, it can only mean a short circuit or other electrical problem in the J1708 connection. Disconnect the Gateway from the J1708 network and be sure that last 3 flashes are RED-GREEN-GREEN (terminals «J1708+» and «J1708-» of the Gateway must not be connected together).
Last three flashes in 5-flashes are GREEN-GREEN-RED when the ignition is ON	<p>The last RED flash means that rate of corrupted messages exceeds 10%. This can be caused by:</p> <p>1. Wrong protocol selected (see VI.1). Set the protocol to AUTO.</p> <p>2. Bad electrical contact. Check J1708 connection.</p> <p>3. Electromagnetic interference from power equipment. Check that cable is not located near alternators, fridges, gensets and other power equipment. Use shielded cables if possible.</p> <p>4. High J1708 network load. Record the diagnostic file (see Section VII) and apply support.</p>

Appendix B. Device Connectors

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

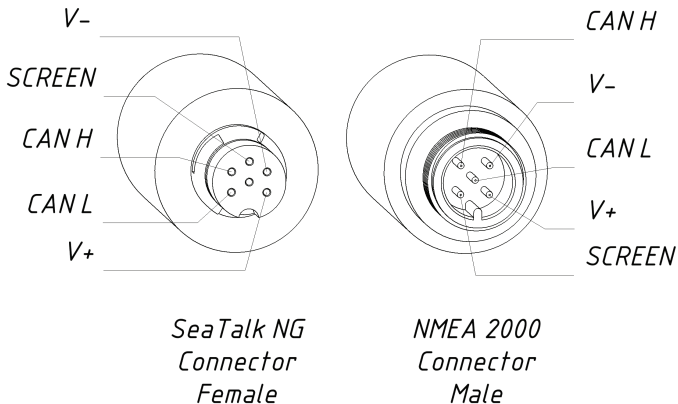


Figure 1. NMEA 2000 connectors of the YDES-04R (left), and connectors of the YDES-04N (right) models

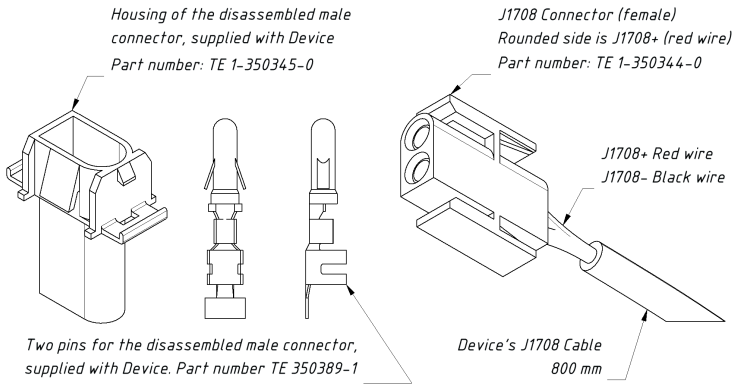


Figure 2. Supplied disassembled connector (left) and J1708 connector of the Gateway (right)

Appendix C. NMEA 2000 Messages Supported by Device

Message	Receive	Transmit
ISO Acknowledgment, PGN 59392 (0xE800)	Yes	Yes
ISO Request, PGN 59904 (0xEA00)	Yes	No
ISO Transport Protocol (DT), PGN 60160 (0xEB00)	Yes	No
ISO Transport Protocol (CM), PGN 60416 (0xEC00)	Yes	No
ISO Address Claim, PGN 60928 (0xEE00)	Yes	Yes
ISO Commanded Address, PGN 65240 (0xFED8)	Yes	No
NMEA Group Function, PGN 126208 (0x1ED00)	Yes	Yes
PGN List Group Function, PGN 126464 (0x1EE00)	No	Yes
System Time, PGN 126992 (0x1F010)	Yes	No
Heartbeat, PGN 126993 (0x1F011)	No	Yes
Product Information, PGN 126996 (0x1F014)	No	Yes
Configuration Information, PGN 126998 (0x1F016)	No	Yes
Engine Parameters, Rapid Update, PGN 127488 (0x1F200)	No	Yes
Engine Parameters, Dynamic, PGN 127489 (0x1F201)	No	Yes
Transmission Parameters, Dynamic, PGN 127493 (0x1F205)	No	Yes
Engine Parameters, Static, PGN 127498 (0x1F20A)	No	Yes
Fluid Level, PGN 127505 (0x1F211)	No	Yes
Battery Status, PGN 127508 (0x1F214)	No	Yes
GNSS Position Data, PGN 129029 (0x1F805)	Yes	No
Local Time Offset, PGN 129033 (0x1F809)	Yes	No

Table continued

Temperature, PGN 130312 (0x1FD08)	Yes	No
Actual Pressure, PGN 130314 (0x1FD0A)	Yes	No
Temperature, Extended Range, PGN 130316 (0x1FD0C)	Yes	No

Note: NMEA 2000 Device Instance, System Instance, Installation Description Field 1 and Installation Description Field 2 can be changed with PGN 126208 (professional NMEA 2000 installer software and hardware may be required).

Appendix D. J1587 and KAD PIDs Supported by Device

Table 1. Mapping of PIDs to data fields of NMEA 2000 messages.
 [] - alternative PID used if main PID's data are not available.
 () - alternative PID may be specified in Gateway settings.

NMEA 2000 PGN	NMEA 2000 Parameter Name	Protocol PID		Comment
		J1587	KAD	
127488	Engine Speed	190	256	See VI.22
	Engine Boost Pressure	439 [102]	258 / 265	
	Engine tilt/trim			
127489	Engine oil pressure	100		KAD: see VI.31
	Engine oil temp	175		
	Engine coolant temp	110	259	
	Alternator potential	167 (see #1)	293	
	Fuel rate	183	289	
	Total engine hours	247	266	
	Engine coolant pressure	109		
	Fuel Pressure	94		
	Engine Discrete Status	194, 97, 44, 45		
	Percent Engine Load	92	(291)	
	Percent Engine Torque	68		
127493	Transmission Gear	163 [64]	263	KAD: see #6
	Transm. oil pressure	127		
	Transm. oil temperature	177		
	Transmission Status	194		
				J1587: see #2

Table 1 continued

NMEA 2000 PGN	NMEA 2000 Parameter Name	Protocol PID		Comment
		J1587	KAD	
127498	Rated engine speed VIN Software ID	189 237 234 [243]	 775 771 [769]	
127505	Fuel Type Fuel Level Tank Capacity	96, 38		See #5 Primary, secondary See #5
127508	Battery Potential Battery Current	168 (167, 158) 114 (115, ---)	293	293 J1587: see #4

Note (1): PID 167, 168 and 158 can be set as alternator data source in the Gateway settings (see VI.11).

Note (2): Gateway does not request, but does processes DTC received in PID 5 and PID 6.

Note (3): Throttle opening percent (KAD PID 291) can be set to be transmitted in this field (see VI.18).

Note (4): Battery current PID use depends on PID selected for battery potential (not available for PID 158).

Note (5): Constant value can be set for this field in the settings.

Note (6): KAD does not report the direction of gear engaged, Gateway always shows «Forward» when gear is engaged.

Table 2. Mapping of J1587 DTC (PID/FMI) and PIDs (PID/[bits]) to engine status in NMEA 2000

Bit number	Mask (hex)	Meaning in NMEA 2000	PID/FMI or PID/[bits]
1	1	Check Engine	
2	2	Over Temperature	110 / 0
3	4	Low Oil Pressure	100 / 1
4	8	Low Oil Level	98 / 1
5	10	Low Fuel Pressure	94 / 1
6	20	Low System Voltage	158, 168 / 1, 4
7	40	Low Coolant Level	111 / 1
8	80	Water Flow	73 / 0,1,3
9	100	Water in Fuel	97 / [8]
10	200	Charge Indicator	
11	400	Preheat Indicator	45 / [6-5]
12	800	High Boost Pressure	102, 439 / 0
13	1000	Rev Limit Exceeded	190 / 0
14	2000	EGR System	173 / 0
15	4000	Throttle Position Sensor	51/ 0,1,2
16	8000	Engine Emergency Stop Mode	
17	10000	Warning Level 1	44 / [4-3]
18	20000	Warning Level 2	44 / [1-2]
19	40000	Power Reduction	44 / [6-5]

Table 2 continued

Bit number	Mask (hex)	Meaning in NMEA 2000	PID/FMI or PID/[bits]
20	80000	Maintenance Needed	
21	100000	Engine Comm Error	
22	200000	Sub or Secondary Throttle	
23	400000	Neutral Start Protect	
24	800000	Engine Shutting Down	

Note (1): you can define your own alerts based on actual engine data with the settings in VI.25 – VI.29.

Table 3. Mapping of J1587 DTC (PID/FMI) to transmission status in NMEA 2000

Bit number	Mask	Meaning in NMEA 2000	PID/FMI or [bits]
1	1	Check Transmission	
2	2	Over Temperature	177 / 0
3	4	Low Oil Pressure	127 / 1
4	8	Low Oil Level	124 / 1

Appendix E. Example of Configuration File

Contents listed below of the file correspond to the factory settings. It also contains comments (four lines before the end of file) generated by «Smart Requests» feature (see VI.21).

```
# Current configuration of Yacht Devices J1708 Engine Gateway
# Firmware: 1.04 20/05/2019

# Vessel Settings
PROTOCOL=AUTO
HOURS_OFFSET=0
FUEL_TYPE=DIESEL
TANK_PRIMARY_CAPACITY=DEFAULT
TANK_SECONDARY_CAPACITY=DEFAULT

# NMEA 2000 Settings
ENGINE_ID=0
ENGINE_ALERT_MASK=0x00ffffff
TRANSMISSION_ALERT_MASK=0xff
TANK_PRIMARY_ID=0
TANK_SECONDARY_ID=1
ALTERNATOR_SOURCE=PID_167
BATTERY_1_SOURCE=PID_158
BATTERY_2_SOURCE=PID_168
BATTERY_1_ID=0
BATTERY_2_ID=1

# J1587 Protocol Settings
MID_GATEWAY=180
MID_FILTER=ANY
PRIVATE_MID=
```

```
# KAD Protocol Settings
THROTTLE_AS_LOADING=OFF
KAD_RELATIVE_BOOST=OFF
KAD_VOLTAGE_ADD=0
KAD_VOLTAGE_MUL=1
KAD_COOLANT_ADD=0
KAD_COOLANT_MUL=1

# Replace by NMEA 2000 sensor data, specify data instance
SUBSTITUTE_BOOST=OFF
SUBSTITUTE_FUEL_PRESSURE=OFF
SUBSTITUTE_OIL_PRESSURE=OFF
SUBSTITUTE_OIL_TEMP=OFF
SUBSTITUTE_CLNT_PRESSURE=OFF
SUBSTITUTE_CLNT_TEMP=OFF
SUBSTITUTE_TRANS_PRESSURE=OFF
SUBSTITUTE_TRANS_TEMP=OFF

# Custom alerts (max or min positive values), OFF to turn off
MAX_RPM=10000
LOW_VOLTAGE=7.0
OVER_TEMP_C=200
HIGH_BOOST_KPA=600
LOW_OIL_KPA=10

# Custom requests (PID,milliseconds,MID)
REQUESTS=ALL
REQ_0=1,OFF,ANY
REQ_1=1,OFF,ANY
REQ_2=1,OFF,ANY
REQ_3=1,OFF,ANY
REQ_4=1,OFF,ANY
```

```
REQ_5=1, OFF, ANY
REQ_6=1, OFF, ANY
REQ_7=1, OFF, ANY
REQ_8=1, OFF, ANY
REQ_9=1, OFF, ANY
REQ_10=1, OFF, ANY
REQ_11=1, OFF, ANY
REQ_12=1, OFF, ANY
REQ_13=1, OFF, ANY
REQ_14=1, OFF, ANY
REQ_15=1, OFF, ANY
REQ_16=1, OFF, ANY
REQ_17=1, OFF, ANY
REQ_18=1, OFF, ANY
REQ_19=1, OFF, ANY
SMART_REQUESTS=ON
```

```
# End of file
```