

Yacht Devices

User Manual

Voyage Recorder YDVR-04

also covers models

YDVR-04R, YDVR-04N

Firmware version

1.00

2018

Package Contents

Device	1 pc.
This Manual	1 pc.
MicroSD card with adapter	not supplied
Audio cable	not supplied
NMEA 2000 drop cable	not supplied

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

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Introduction

This Manual contains information on how to install, configure and operate Voyage Recorder YDVR-04 (hereinafter Recorder or Device) intended for use on pleasure crafts.

The Recorder is intended for storing data from the NMEA 2000 network of the vessel on a MicroSD memory card. The onboard network of a typical cruise yacht has data about the position, course, speed, depth, water temperature, log, wind speed and direction, and the AIS data of nearby vessels. Digital data from the engine, water and fuel tanks, battery voltage, etc. may also be available.

The Recorder writes all network data to the memory card in data files with a .DAT extension. It does not analyze the data, leaving that work for the software application that runs on a personal computer. Because of that, the Recorder supports all message types broadcasted through the network by any other equipment present on the vessel's network. It is also compatible with other CAN networks using 250 kbps speed, for example J1939 and Volvo Penta EVC.

In addition to all the features of the previous model (YDVR-03), this model also has audio input and allows recording of audio from a VHF line out (and from speaker output of some models) or microphone amplifier output. Audio data are stored to standard audio files with a .WAV extension, which can be played by virtually all software.

The software that comes with the Recorder works on Microsoft Windows, Mac OS X and Linux and allows GPX files to be generated with the vessel's track and extensive information about the sailing conditions, including weather, depth, engine, and even tracks of nearby vessels with AIS. These files can be viewed in Google Earth, Garmin MapSource and other applications. They can also be loaded into newer models

of Garmin and Raymarine chartplotters.

Data files contain internal links to the audio files, and the software places links to audio files at the geographical points in the GPX file where they were recorded. In this way, you can select a point on your track, check what the weather was, and, for example, find the file with the weather forecast recorded from VHF at the same time. Or listen to your VHF conversations with other vessel. This allows reconstruction of your sailing in full detail!

You can also connect a microphone (an amplifier is required for most types) to the input of the Recorder and use audio recording as a “voice log book”; your recordings will be linked to the time and place where they were done.

This software also can generate a spreadsheet file with the data recorded. It can be useful to analyze your boat’s behavior in different weather conditions if you are a racer, easily find coordinates with depth extremes if you are fisher, and analyze weather or sailing trends if you are a cruiser.

You can also generate a log book with the collected data automatically and convert it to other formats. Even if you do not have a Recorder yet, you can download the PC software from our web site and play with the test data.

On average, one second of the data recording requires 1000-2500 bytes on the memory card, so the average 16 GB card is enough for 100 days of sailing. Audio recording takes 1.4 MB per minute without compression and 0.35 MB with compression on. Therefore, a 16 GB card can contain up to 32 days of audio data.

Nowadays a 256 GB memory card costs less than USD \$100; with it you can record audio and network data non-stop for a full year. But for the most of applications, a 32 GB or 64 GB cards are enough. Automatic deletion of old data means you do not have to worry about running out of space. Plug the Device into your onboard

network, insert the card, and you can forget about it until you need the data.

Did you accidentally erase your track from the plotter? Are you writing about a storm that you were caught in? Do you rent out your yacht? There are many instances where only a Recorder can help you get all the details right.

The Recorder 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 and 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 that is compatible with the DeviceNet Micro connector. Our Recorders are 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. The model YDVR-04R has a connector compatible with Raymarine SeaTalk NG. The model YDVR-04N has a connector compatible with NMEA 2000 Micro Male, DeviceNet Micro Male and Garmin NMEA 2000 Male (see Appendix E). To connect to other types of NMEA 2000 networks, a cable adapter is required (not supplied with the Device and must be purchased separately).

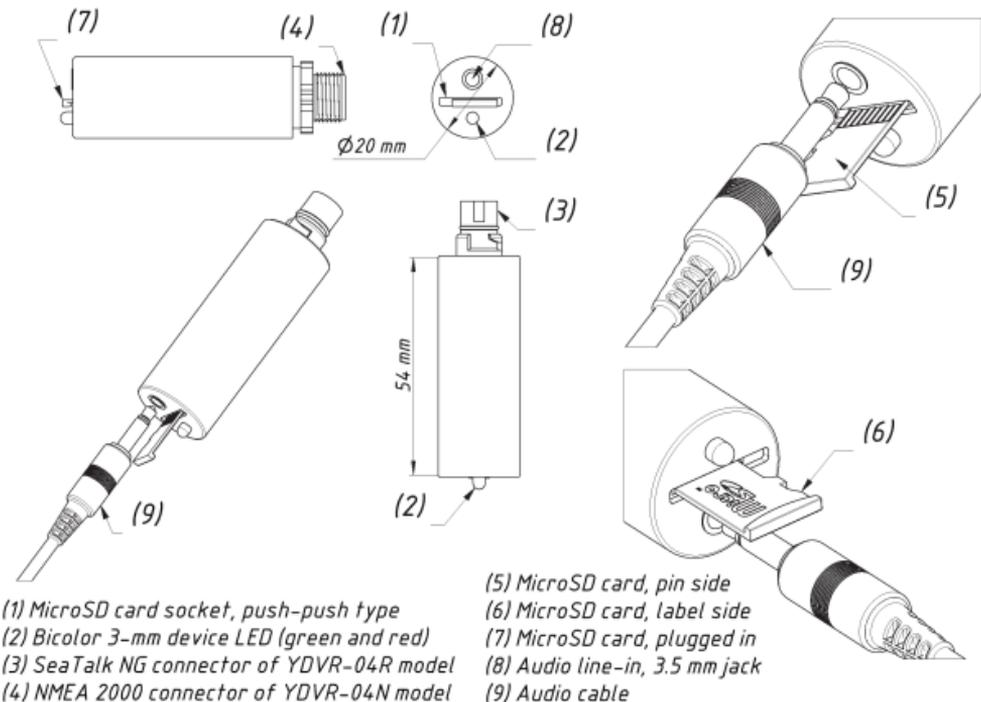
The Recorder also has a “player” mode designed for developers and exhibitors. This allows sending of recorded data back to the NMEA 2000 network, reproducing your sailing in the lab or at an exhibition booth. The CAN Log Viewer software can “re-play” recordings on a PC screen, which is useful for remote diagnostics. This software is free, works on Microsoft Windows, Mac OS X and Linux and can be downloaded from our web site.

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. If a warranty request is accepted, the defective Device must be sent to the manufacturer.
4. 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.
5. Responsibility of the manufacturer in case of any damage as a consequence of the Device 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. 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



Note: audio cable and MicroSD card are not supplied with the Device

Figure 1. Drawing of YDVR-03R and YDVR-03N models of Recorder

Device parameter	Value	Unit
Operating voltage (from an NMEA 2000 network)	10.5..16	V
Average current consumption	23	mA
Load Equivalency Number	1	LEN
Operating temperature range	-25..+85	°C
Weight without MicroSD card	18	g
Recommended MicroSD card class (1)	Class 10	—
Audio input impedance	115	Ohm
Maximum audio line-in voltage	-15..+15	V
Minimum input level	-200..+200	mV
Programmable audio gain	-30..+14	dB
Galvanic isolation of audio input	1500	V _{RMS}

Note (1): The Device can work with cards of any size and class, but there are requirements concerning the performance of the cards (see Section IV).



Yacht Devices Ltd declares that this product is compliant with the essential requirements of EMC directive 2004/108/EC.



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

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

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

To operate properly, the Device requires a MicroSD card formatted with FAT or FAT32 file system. If you are not sure what file system your card uses, reformat it on a personal computer (see Section V.).

Carefully place the card into the Device's slot and carefully push the card inward until it clicks. Slowly withdraw your finger. To remove the card, push inward until a click is heard and then withdraw your finger (see drawing in previous section).



The Recorder can be connected to the speaker output in most cases for VHF, but with great caution. Connection to the speaker output of car audio will damage the Device. Be sure that peak power of speaker output is 5W or less and intended for 4 Ohm speakers. See Section VII.11 for details.

III. LED Signals

Table 1. Signals during normal operation

Signal	Meaning
One green signal lasting one full second	The Device has created a file on the MicroSD card and is ready to record data. This signal sending each time after the Device is connected to the onboard network and once after changing of the MicroSD cards.
3 green flashes with a period of 0.5 seconds after the device is powered on	The Device has received the first message from the onboard network of the vessel. This signal indicates that the Device is properly connected.
Red signals with a period of 0.5 seconds	No MicroSD card in the Device
Red signals with a period of one seconds	Device cannot create a file on the MicroSD: wrong file system, read/write error or the recording of data file and recording of audio are turned off in the settings or configuration file.
Constant, unsynchronized green flashing	Normal regime for recording data. Signal intensity depends on the load on the onboard network, whether audio is being recorded or not, etc.

Table continued

Constant, unsynchronized red flashing	Normal regime for recording data, but audio signal too high. Recommended to decrease gain setting.
Short red signal on powering off	Data and audio files were properly closed. Change the Micro SD card if you do not see the red signal on power off.

LED signals in the player mode are described in Section X. Signals during firmware update are described in the Section IX.

IV. Choice of MicroSD Cards and Working with Cards

We ask that you to familiarize yourself closely with this section. By observing these simple rules, you can be confident that your data is saved and safe.

1. MicroSD cards have a limited number of data rewrites, so do not use old cards. It is highly recommended not to use cards that have been used in smartphones.
2. Use MicroSD cards from a known manufacturer and purchase from a reputable retailer. Some well-known manufacturers offer their own cards with a lifetime warranty. For an additional level of assurance, use cards made with SLC technology, as they allow ten times the number of data rewrites of regular cards. There are also MicroSD cards made for industrial use.
3. A MicroSD card is a complex electronic device. Keep cards away from static electrical fields and try not to touch the contacts of the card. Do not deform or bend the cards or leave them exposed to sunlight. We do not recommend removing the card when the Recorder is powered on – this could result in a logic error in the file system.
4. The internal controller of MicroSD cards has a complex algorithm for caching, maintaining data integrity and replacing corrupted memory blocks with reserved blocks on the fly. The Recorder works with the card in such a way as to avoid premature deterioration. A 16 GB card fills up over the course of 100-200 days of sailing. A regular MicroSD card generally claims to function for 10,000 data rewrites, which means that a single card is adequate for a few decades of uninterrupted work. For this reason, we generally recommend regular MicroSD cards.

5. Winter storage of the card and Device can be on board the vessel. Note the temperature tolerance of the card – most have a range of -40 to +85° C, and a working temperature range of -25 to 85° C.
6. The Recorder is sensitive to the response time and write time, so cards of MicroSD Class 10 or higher are recommended for use with the Device. The Device has an embedded capacitor, the power from which is used to shut down the file system safely after the power from the network is turned off. If a card of lower than Class 10 is used, the Device might not managed to complete the shutdown of the file system. When the network power is turned off, the red LED will confirm that work with the file system has been shut down properly.
7. During system shutdown, the Device tries to minimize the work with the file system, indicating the correct file size, but without releasing the cluster chain reserved for it. This behavior is correct, but some disc checkers will try to correct this by increasing the file size to the end of the cluster chain. This will result in ‘garbage’ at the end of the file. The Recorder’s software can handle such ‘corrections’, but it is not desirable.
8. At the first sign of hardware problems such as extended time needed for reading the data from the card or read errors, do not try to ‘fix’ the card, but replace it immediately. The probability is very high that such cards will soon stop functioning altogether, resulting in loss of all data on the card.

In conclusion, new cards from reputable manufacturers are extremely reliable, and with proper care you can be confident that your voyage data is safe and sound.

V. Formatting MicroSD Cards

The Recorder supports MicroSD memory cards of all sizes and classes, but has performance requirements for cards (see IV.6). The MicroSD card must be formatted on a personal computer before use in the Recorder. The Recorder supports the following file systems: FAT (FAT12, FAT16, MS-DOS) and FAT32. It does not support exFAT, NTFS, or any other file systems.

When formatting, use a cluster size of 65,536 bytes (64K) or the maximum available for your card. This will improve the performance of the Recorder and extend the life of the card. During operation, the Recorder produces data files of up to 80 clusters, which totals 5.2MB with a cluster size of 64K. Such files typically hold 30-40 minutes of data recording. If a smaller cluster size is used, the Recorder will have to create new files more often, increasing the number of calls to the file system. Audio file length is up to 120 clusters or 7.6 MB with a 64K cluster or up to 22 minutes of audio recording when compression is on.

The FAT32 file system can be used on disks up to 2048 GB. Microsoft Windows, Linux and Mac OS X do not restrict work with files on memory cards of any size with the FAT32 file system.

However, in Microsoft Windows, there is an artificial restriction, so you cannot select the FAT32 file system for memory cards of 64 GB or more in the formatting program supplied with the operating system. This limitation is the consequence of Microsoft's promotion of its new exFAT file system. So, to format large cards in Windows, you will need to use a third-party freeware formatting program, like the one supplied by Ridgescrop Consultants Ltd:

<http://www.ridgescrop.demon.co.uk/guiformat.htm>

In Linux or Mac OS X operating systems, there is no such limitation, and you can use the OS utility to format cards of any size.

VI. Files and Folders on the Card

To store files, the Recorder creates folders named “YDVRdddd” in the root directory, where dddd is the serial number of the folder from 0001 to 9999. In the folder, the Recorder creates files named “ddddnnnn.DAT” and “ddddnnnn.WAV”, where dddd is the folder number where the file is stored, and nnnn is the file sequence number in the folder, from 0001 to 0300.

The Recorder tries not to store more than 100 files in a single folder, and never stores more than 300 files together. The Recorder never creates more than 500 folders on the card. The exact number of folders used and the maximum number of files in a folder depends on the size of the card.

If the number of the last file in the folder exceeds the maximum number of files in a folder for this card, the Recorder creates a new folder with the next serial number.

The Recorder erases the folder with the lowest serial number and its contents, if:

- the number of folders created by the Recorder has reached the maximum value for the card;
- the free space available on the card is not enough for 20 Recorder files.

After completing data collection in a folder named YDVR9999, the Recorder renames all folders on the card, giving them new numbers starting with 1. The files inside the folder are not renamed.

In this way, you do not have to worry about the amount of space left on the card, as the Recorder will automatically delete the oldest recordings when more space is needed (see the description for the parameter DELETE at the next Section).

We recommend that you use a separate memory card for the Recorder, and do not store other data on it.

VII. Configuration of the Device (YDVR.TXT File)

To configure the Device, a text file with the configuration should be created and named YDVR.TXT in the root folder of the MicroSD card. Note previous model (YDVR-03) uses the file named YDVR.CFG. A sample of the configuration file with factory settings is in Appendix A. 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.

To get the current settings, create a blank YDVR.TXT file and insert the card to Device. After a second you can eject the card; current settings will be saved to the file YDVRSAVE.TXT.

Settings loaded from YDVR.TXT will be act while the Device powered and until MicroSD card in the Device is changed. When the Recorder is powering on, it load the settings stored in the EEPROM. To save settings from YDVR.TXT to the EEPROM, it should contains CDFSAVE keyword (see below). You can specify only those parameters that you need to change. It is not necessary to specify all supported parameters in the configuration file.

1. *CFGSAVE*

This is the only keyword (it has no value, see example in the Appendix A) and can be placed anywhere in the file. This keyword triggers saving of the current configuration to the EEPROM after processing of the YDVR.TXT file.

2. *NMEA2000=ON|OFF*

Specify OFF to disable network data recording and transform the Device to a simple

audio recorder.

3. *FORMAT=DAT|CAN*

DAT format is used by default. Files of DAT format can be processed by YDVR Converter (see the next Section) and converted to CAN format with it. The DAT format is designed for a NMEA 2000 network and described in the Appendix D. CAN format can be converted to DAT format using CAN Log Viewer software. Files of CAN format can be played by the Recorder back to NMEA 2000 network or used to record messages from other CAN networks than NMEA 2000. See Section X. for details.

4. *AIS=ON|OFF*

Value OFF disables AIS messages in the data file. In areas of intense navigation, the majority of messages in the onboard network can come from AIS.

5. *DELETE=YES|NO*

Value NO prevents the Device from erasing files (data and audio) and rename folders on the MicroSD card. In this case, you need to keep track of the available space on the card (see Section VI.).

6. *IGNOREPGN=[pgn1 [, pgn2 [, ...]]]*

Example: IGNOREPGN=0x1FD06, 130311, 130314

The list of blocked PGNs separated by comma. List can contain decimal or hexadecimal values (starting with an 0x prefix). The value is empty in factory settings.

7. *IGNOREADDR=[addr1 [, addr2 [, ...]]]*

The list of addresses of blocked network devices separated by comma. List can contain

decimal or hexadecimal values (start with an 0x prefix). The value is empty in factory settings.

8. IGNORE=[msgid1 mask1 [,msgid2 mask2 [,...]]]

Allows blocking of specific messages from specific devices. This setting actually contains pairs of message identifiers and a mask. The identifier is compared by processing the NMEA 2000 message identifier and the second value (mask) defines the comparison concerning which bits are significant. The identifier contains a PGN (Parameter Group Number, described in NMEA 2000 Standard) and a source device address. You can use decimal and hexadecimal numbers (which start with an 0x prefix).

For example, to stop recording of message with PGN 0x1FD06 sent from address 1 and PGN 0x1FD07 sent from addresses 0, 1, 2 or 3, use the following setting:

```
IGNORE=0x1FD0601 0x1FFFFFF, 0x1FD0700 0x1FFFFFC
```

Using of this setting may require knowledge of NMEA 2000 Standard.

9. AUDIO=ON|OFF

ON/OFF audio data recording. ON in factory settings.

10. COMPRESSION=ON|OFF

Turns on/off ADPCM audio compression. One minute of compressed audio takes 0.35 MB on the card, and uncompressed audio takes 1.4 MB. Uncompressed audio has better quality. In both cases, the Recorder produces 12 kHz 16-bit mono audio files with WAV extension.

11. GAIN= x

Where: x – the decimal number from 0.03 to 5.00, factory setting is 2.70

If the audio signal is too strong or the gain is set too high, the signal will be clipped-off (distorted in the loud parts) and the LED flash red chaotically during the audio recording. In case of a weak signal, the recording will be too quiet. However, it is better to have a quiet recording than an overamplified one, because the waveform will not be distorted and part of the signal will not be lost (see Figure 1).

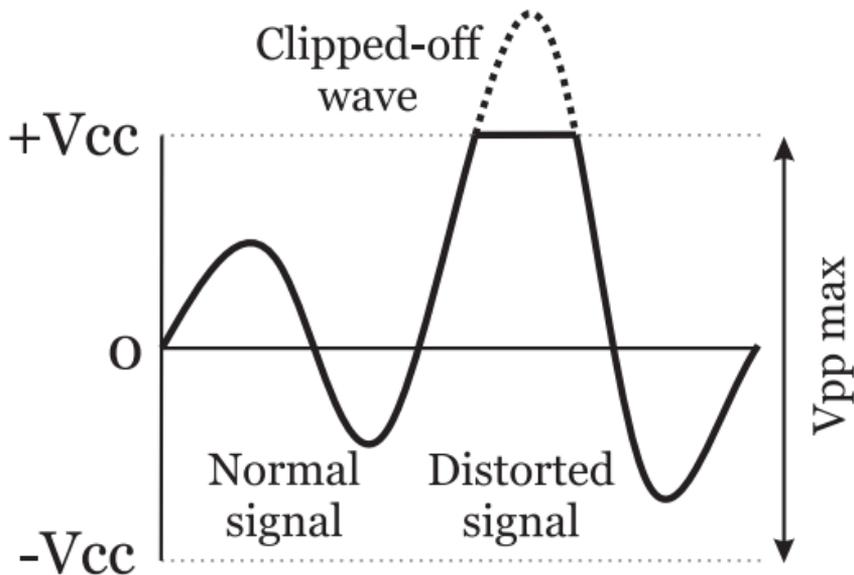


Figure 1. Normal and over amplified signal

The factory gain setting of 2.70 corresponds to the normal level of audio line-in signal, 0.894 Vpp (peak-to-peak amplitude, Volts) used in consumer audio. The gain value is a multiplication, 0.894 Vpp will be amplified 2.7 times to 2.4 Vpp. The maximal peak-to-peak voltage of the amplified signal should not exceed 3 V (or the signal will be clipped), the best recording quality is attained when the amplified signal is about 70 – 80% of the maximal internal Vpp.

The speaker output voltage can be over 100V and voltage over 15 V (30 Vpp) may damage the Device. However, the Recorder can be connected to low power speaker output (up to 3.5 watts, 5 watts peak, designed for speakers with 4 Ohms resistance) instead of the speaker or in parallel with the existing speaker. In this case, the volume of the recording also depends on the current volume settings on the equipment.

Many inexpensive VHF options, like Raymarine Ray49E, Ray55E, Ray218E, have no line-out. At the maximal volume, these VHF's has 20 Vpp at the speaker output. You can order a 3rd party Line Out Converter (these devices lower the power of the speaker output to a point where it is similar to the power level of an actual line level output) to get a constant level for the recording, not dependent on the volume setting on the VHF. Or, in the cheaper scenario, you can connect speaker output to the Recorder, the recommended GAIN setting is 0.50 (or even 0.15 if you listen to the VHF at full volume).



Note, that some VHF's (for example, Raymarine Ray218E) has powerful output for a fog horn (30W or above). Connection to this output may damage the Device.

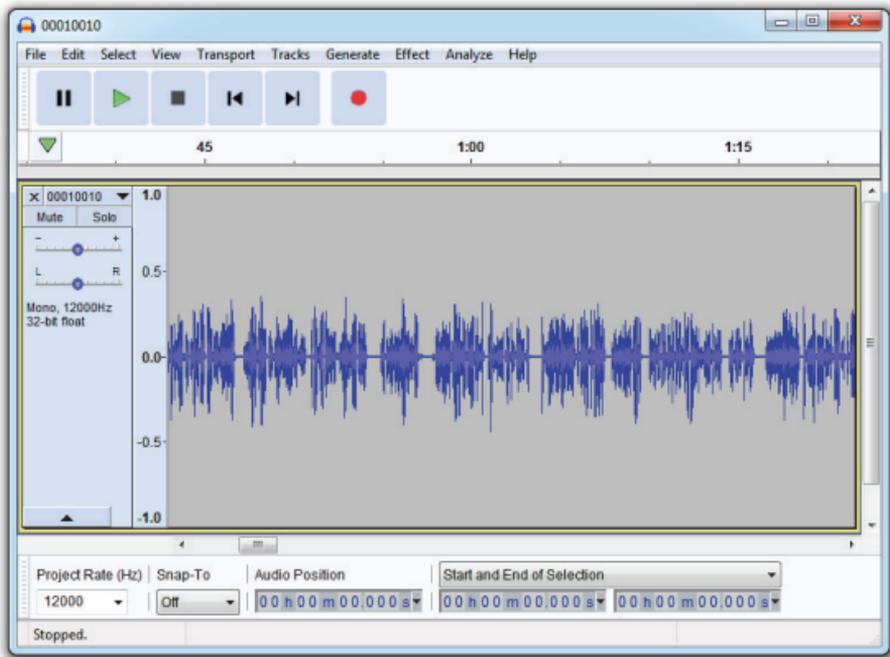


Figure 2. Free Audacity software

To check your settings, open the recorded audio in the software, where you can visually check the recording level. We can recommend Audacity's free software; it runs on Microsoft Windows, Mac OS X and Linux (<https://www.audacityteam.org/>). In Figure 2 you can see that gain is too small (up to 50% of maximal amplitude, when 70– 80% is recommended).

Some online services also offer visualization of audio files, for example TwistedWave Online (<https://twistedwave.com/online>).

12. *DELAY=x*

Where x – decimal number from 0.50 to 16000.00, factory setting 30.0

The silence interval in seconds, after which the audio file is closed. The tail of the audio file with the silence is cut off upon closing. During VHF conversations, and especially when the vessel is calling, pauses are usual. If you are using an audio input for VHF recordings, you can enlarge the interval to avoid creating multiple audio files for the same conversation. If you are using it as an “audio log book”, you can set smaller intervals.

13. *FILTER=ON|OFF*

Turns ON or OFF the low-pass filter, which reduce the noise level. Factory setting is ON.

14. *THRESHOLD=x*

Where x – decimal number from 0 to 50, factory setting 2.50

Recording activation level as a percentage of the maximum level. A low value may cause recording of noise. Too high a value may cut-off first the milliseconds of recording or even prevent quiet transmissions from being recorded. To start recording, the signal should be higher than the threshold value for several milliseconds.

15. *PLAYER=ON|OFF*

The “ON” value activates the “player” mode intended for marine installers and developers. The Device will play the contents of the PLAYNOW.CAN or PLAY.CAN files on the network if these files are present in the root folder of the MicroSD card.

Please see Section X for details. No data will be recorded when the player mode is activated.

16. LOOP=ON|OFF

This setting acts when the player mode is ON. When this setting is ON, the Recorder will play the file again and again until power off or until new MicroSD card is inserted. Otherwise, the file will be played only once.

17. SILENT=ON|OFF

This setting blocks the sending of Device information (NMEA 2000 message with PGN 126996). The Device will not appear in the list of devices on the chartplotter (see Section IX). This setting is designed for covert installation. When this setting is OFF, it does not save to the YDVRSAVE.TXT file.

VIII. Processing Data on Computer

To process the data, files must be copied or moved from the memory card to the computer in any convenient manner.

If the operating system offers to execute a scan on the card, you should refuse this offer, unless you have specific reasons to do so (see IV.7). Scanning the card is recommend only after transferring the data to the computer.

The software for data processing is available free at www.yachtd.com and works on Microsoft Windows, Linux and Mac OS X:

- YDVR Converter software (also known as PC Software for Voyage Recorder) allows generation of tracks in GPX format with extended sailing data (including tracks of other vessels with AIS, weather conditions, detailed data about engine operation, etc.), can export data to a spreadsheet applications (CSV format), can generate the editable and printable log books by template, and convert files with recordings to other formats (including .XML and .CAN).
- CAN Log Viewer is a free viewer, player and converter of files in .CAN format. This format is used in the player mode of Voyage Recorder (see Section X). The Device instance and system instance of the Recorder can be changed using this program.

Documentation for the software is available in digital format along with the software download.

IX. Firmware Updates

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

For 5-10 seconds after powering on, the LED will light up and change color from green to red and back for 5 seconds. This indicates that the firmware update is successfully completed.

If the Recorder 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 immediately transfers 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 chartplotter (see third line at Figure 1 on the next page). Usually, access to this list is in the Diagnostics, External Interfaces or External devices menu of the chartplotter.

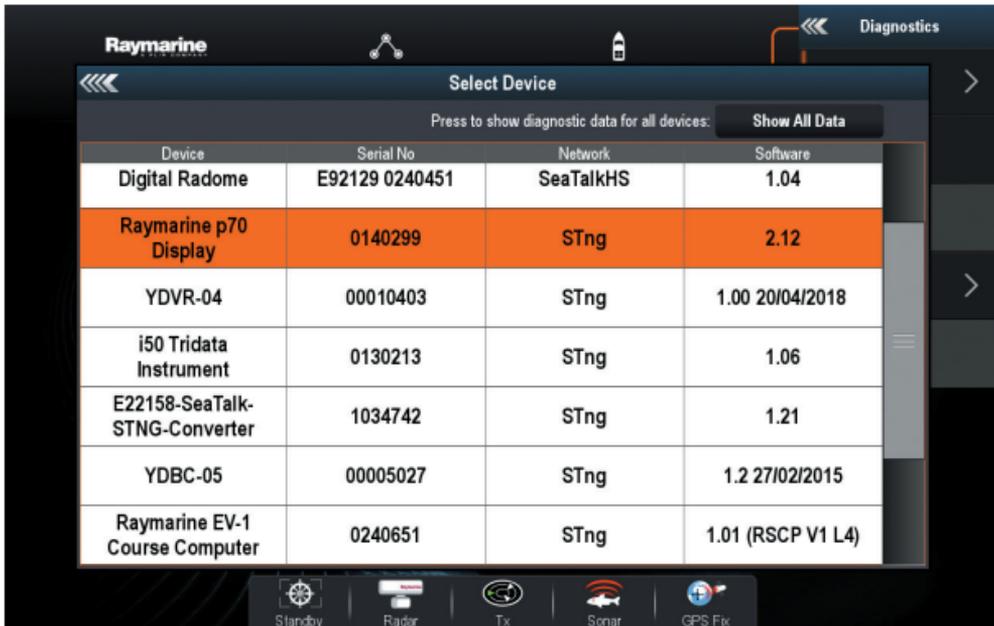


Figure 1. Raymarine c125 MFD devices list with Recorder (YDVR-04)

X. Player Mode



This mode is intended for demonstration, emulation or testing of marine equipment. Use this mode at your own risk. This mode may affect operation of other equipment and possibly damage it.

The player mode is activated by the setting `PLAYER=ON` in the configuration file (see VII.15).

If the mode is activated, the Device checks the root folder of the MicroSD card for the `PLAYNOW.CAN` file. If this file is absent, the Device checks for a `PLAY.CAN` file. If neither file is not found (or in case of a file read or format error), the Device produces three red flashes with 1 second period and returns to normal operation.

Otherwise, the Device produces three green flashes with 1-second period and playback begins.

CAN files contain the internal time of the recording device. In the case of a `PLAYNOW.CAN`, Voyage Recorder set its internal time to the time of the first file's record, and actually begins playback of data immediately. In the case of a `PLAY.CAN` file, the Device waits until its internal time is the same as the time of the first file's record. Note that the time counter in the CAN file overflows and resets to zero every 1024 minutes, so actual playing of data may be delayed up to 17 hours.

The Device tries to send messages from a file to a network with the same speed as they were recorded. The accuracy of maintaining the speed of sending depends on the actual load of the CAN bus.

A CAN file may contain data received from two CAN interfaces (the Recorder has only one). Each message in a file contains a mark indicating whether it was received

by a recording device (RX) or transmitted (TX). The Recorder sends to the network all messages with an RX flag, regardless of what interface (CAN0 or CAN1) they were received from during recording. The Device supports 11-bit and 29-bit messages with variable data length (from 1 to 8 bytes).

When playback is completed, the Device turns on the red LED light and holds until power off or card ejecting if the LOOP setting (see VII.16) has value OFF. Otherwise, it starts playback again from the beginning (in case of PLAY.CAN file, the playback will be re-started with the same delays, like the first time).

To convert Voyage Recorder's .DAT files to .CAN format, use the YDVR Converter software. To edit messages in .CAN files or filter messages, use the free CAN Log Viewer application (see Section VIII).

CAN Log Viewer allows export of .CAN files to and import from .CSV (Comma Separated Values) format. Files in this format may be opened in any spreadsheet application, like Microsoft Excel or LibreOffice Calc. It also can convert .CAN files back to .DAT format. The .CAN log format is open and described in the CAN Log Viewer documentation.

The .DAT format contains assembled NMEA 2000 messages (some NMEA 2000 messages encapsulates two or more CAN messages) and is designed to save space during NMEA 2000 recording. If you need to reproduce the equipment's behavior in the CAN layer, or you are using the Recorder not on an NMEA 2000 network (for example, in J1939 or Volvo Penta EVC), choose the CAN format of recording using the FORMAT setting of configuration file (see VII.3).

Appendix A. Example of Configuration File

File contents listed below correspond to the factory settings.

```
# Voyage Recorder YDVR-04 (www.yachtd.com), serial number: 00000000
# Firmware version: 1.00 20/04/2018

# Settings in this file match the settings in device's EEPROM

# SAVE TO EEPROM
# To save settings, rename this file to YDVR.TXT and
# remove # symbol from the line below
# CFGSAVE

# NMEA 2000 RECORDING
NMEA2000=ON
FORMAT=DAT
AIS=ON
DELETE=YES
IGNOREPGN=
IGNOREADDR=
IGNORE=

# AUDIO RECORDING
AUDIO=ON
COMPRESSION=OFF
GAIN=2.70
DELAY=30.0
FILTER=ON
THRESHOLD=2.50

# PLAYER MODE (disables recording when ON)
PLAYER=OFF
LOOP=OFF

# End of file
```

Appendix B. Troubleshooting

Situation	Possible cause and correction
The LED does not signal after the Device is turned 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>
Memory card is inserted into the Device, but red light is flashing	<p>1. Card is not formatted correctly. Reformat card (see Section V.).</p> <p>2. Card contains logic error. It is possible for such errors to go unnoticed by scanning utilities, recommendation to reformat card. 3. No more free space on card and deleting of old files is prohibited (see VII.5).</p>
Card is inserted into the Device, but only 1 single green signal is given when powered on.	<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>

File system of MicroSD card is corrupted	<p>1. Device cannot complete the shutdown of the file system after power off. Replace the card with a MicroSD Class 10 card from a well-known manufacturer (see Section IV).</p>
Bad quality of audio recording	<p>1. Audio gain is too low or too high. Check the recording level (see VII.11).</p> <p>2. Turn on low-pass filter and turn off the compression to improve the quality (see Section VII).</p> <p>3. Check the audio cable and source audio signal. Record audio with another device (for example, from laptop) and replace the audio cable for a shielded one if there is excessive noise.</p>

Appendix C. NMEA 2000 Messages

Message	Receive	Transmit
ISO Acknowledgment, PGN 59392 (0xE800)	Yes	Yes
ISO Request, PGN 59904 (0xEA00)	Yes	Yes (1)
ISO Transport Protocol (DT), PGN 60160 (0xEB00)	Yes	No (2)
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 (4)	Yes
PGN List (Received / Transmitted), PGN 126464 (0x1EE00)	No	Yes
Heartbeat, PGN 126993 (0x1F011)	No	Yes
Product Information, PGN 126996 (0x1F014)	No	Yes (3)
Configuration Information, PGN 126998 (0x1F016)	No	Yes
Local Time Offset, PGN 129033 (0x1F809)	Yes	No
System Time, PGN 126992 (0x1F010)	Yes	No
GNSS Position Data, PGN 129029 (0x1F805)	Yes	No

- (1) The Recorder sends a PGN 126996 (Product Information) request to all equipment present on the network once every 60 minutes. These messages are divided up over that time to avoid excessive load on the bus.*
- (2) The Recorder stores all messages in the data file if they are not turned off in the settings (see Section VII). “No” means that the Recorder will not process this message during communication with other devices on network.*
- (3) Transmission of this message can be turned off in the settings (see VII.17) for the purpose of running the Device in covert mode.*
- (4) The NMEA 2000 device instance and system instance of the Device can be changed using PGN 126208 with CAN Log Viewer (see Section VIII) or other software.*

Appendix D. Data File Format (.DAT Files)

This section is intended for those who plan to create their own software for the Device or to support its data format in their own software.

The format of the file is open and free for commercial or non-commercial use.

The Recorder's data files with the .DAT extension contains a set of records of variable length. Each record is either a record of a received NMEA 2000 message, or a service record of the Recorder. Multi-frame messages recognized by the Recorder (see point 6 below) are saved to the file in assembled form. Records have the following structure (each letter stands for a single byte; d[B] means an array of "d" with "B" size):

mm PPPP (ddd | dddddddd | sB d[B])

Where:

1. **mm** – Internal time of the Device in milliseconds from the moment of powering on. Resets after reaching 60000.
2. **PPPP** – Identifier of NMEA 2000 messages consisting of PGN and addresses of the sender, receiver, and other fields. Or the value 0xffffffff for the Recorder's service records.
3. **(1 | 2 | 3)** – One of three options for saving message data.
4. **ddd** – Three-byte message data, used only with PGN 59904.
5. **dddddddd** – Eight-byte message data, used with all PGN except those mentioned in points 4 and 6.
6. **s** – Sequence number for a multi-frame message, used with following PGNs: 65240, 126208, 126464, 126720, 126983-126988, 126996, 126998, 127233,

127237, 127489, 127496-127498, 127503, 127504, 127506, 127507, 127509-127514, 128275, 128520, 129029, 129038-129041, 129044, 129045, 129284, 129285, 129301, 129302, 129538, 129540-129542, 129545, 129547, 129549, 129551, 129556, 129792-129810, 130052-130054, 130060,130061,130064-130074, 130320-130324, 130567, 130577, 130578, 130816.

7. **B** – Length in bytes of multi-frame message data.

8. **8.d[B]** – bytes of data (quantity equal to B) for a multi-frame message.

Service records of the Recorder (field PPPP is 0xffffffff) contain 8-byte data and may be of three types:

- a) The text **“YDVR v04”** – is the mandatory first record in a file with the number of the data format version (v04 in this case).
- b) **‘E’,TT,FFFF,o** – last record in the file, where: ‘E’ is the letter ‘E’; TT- length of the file in minutes (unsigned short); FFFF – time of the last record in FAT format (resolution 2 seconds, local time), o – offset from GMT to local time in 15-minute intervals (signed value).
- c) **‘T’,NN,LL,rrr** – record between messages between which more than 1 minutes has passed. ‘T’ is the letter ‘T’; NN is the internal Recorder time, in minutes, of the next message; LL – internal time of the Recorder, in minutes, of the last message; rrr – reserved field in version v04 (value 0xffffffff). The internal time of the Recorder in minutes is reset to zero every 10 days
- d) **‘Y’,‘W’,FR,FE,TT** – record with the link to the audio file. FR – folder number (unsigned short), FE – file number (for example, if FR is 1 and FE is 2, the record pointing to the file YDVR0001\00010002.WAV). The highest bit of TT is set if the file is already closed (otherwise, it is still recording); other bits of TT contain the length of the recording in seconds at this moment. During

audio recording, links to the current audio file are stored to the data file every second.

When power is turned off (see IV.7), the Recorder does not save the contents of the internal cache (up to 512 bytes) to the data file. Neither does it save the type b) service record to the end of file. So in a file whose size is an exact multiple of 512 bytes, the last network message might not be complete, and the record of type b) may be absent.

The format of NMEA 2000 messages is available in documents which can be obtained on the site www.nmea.org.

Appendix E. Network Connectors of the Device

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

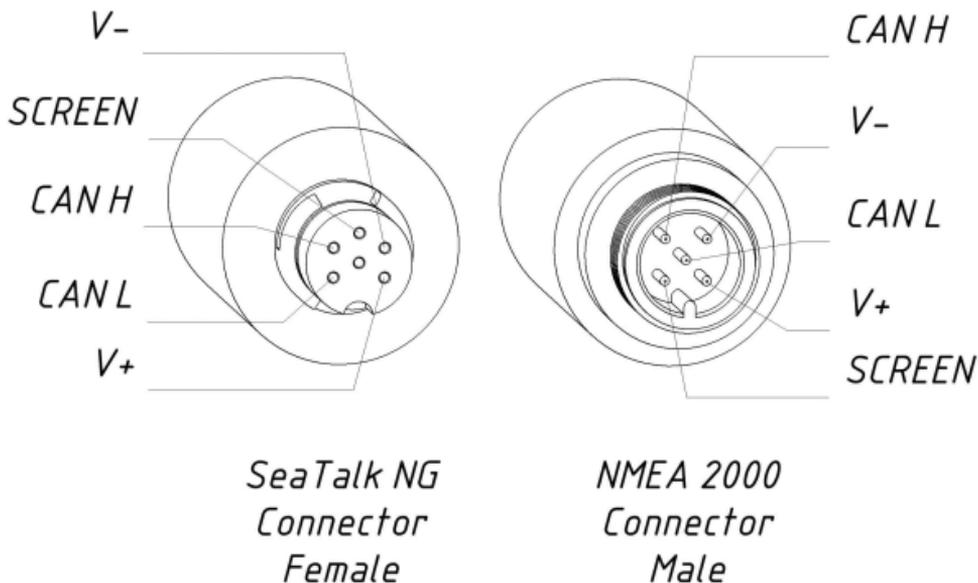


Figure 1. Connectors of the YDVR-04R (left) and YDVR-04N (right) models

