Yacht Devices

User Manual

Voyage Recorder YDVR-03
also covers models
YDVR-03R, YDVR-03N
Firmware version
1.00

2015

Contents

Package Contents

Device	1 pc.
This Manual	1 pc.
MicroSD card with adapter	optional

Introduction

This Manual contains information on how to install, configure and operate Voyage Recorder YDVR-03 (hereinafter Recorder or Device) intended for use on pleasure crafts.

The Recorder is intended for storing data from the onboard 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 AIS data of nearby vessels. Digital data from the motor, water and fuel tanks, battery level, etc. may also be available.

The Recorder writes all network data into the memory card. It does not analyze the data, leaving that work for the software application that runs on 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.

The software that comes with the Recorder is installed on a desktop computer 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. This software lets you generate a log book with the collected data automatically.

On average, one second of recording requires 1000-1500 bytes on the memory card, and the average 16 GB card is enough for 100 days of sailing. The Device does not require configuration, and 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-03R has a connector similar to Raymarine SeaTalk NG Female. The model YDVR-03N has a connector similar to 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 (it is not supplied with the Device and must be purchased separately). Note that Recorder is not compatible with the NMEA 0183 protocol.

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 B 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
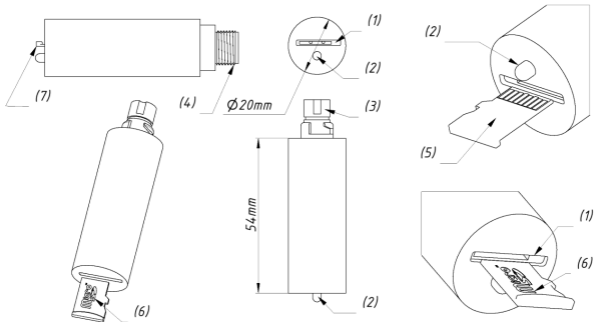
(1) MicroSD card socket, push–push type
(2) Bicolor 3-mm device LED (green and red)
(3) SeaTalk NG connector of YDVR-03R model
(4) NMEA 2000 connector of YDVR-03N model

(5) MicroSD card, pin side
(6) MicroSD card, label side
(7) MicroSD card, plugged in

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
Protection against reverse polarity	Yes	—
Average current consumption	23	mA
Load Equivalency Number	1	LEN
Operating temperature range	-25..+85	°C
Weight without MicroSD card	15	g
Recommended MicroSD card class	Class 10	—
Recommended MicroSD card size	16-32	GB
Compatibility of MicroSD card (1)	Unlimited	—
Estimated recording capacity for 16 GB (2)	100..200	days
Automatic overwrite of old data (3)	Yes, by default	—
Recording of data from bus, not less than (4)	99.5	%

Notes:

(1) The Device can work with cards of any size and class, but there are requirements concerning the performance of the cards (see III.6-III.8)

(2) This value is an estimate based on the real load on the data bus in modern cruise yachts

(3) This can be turned off in the settings (see VI.)

(4) This value is an estimation obtained by trial using recommended cards from various manufacturers.

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 its water resistance and reliability.

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

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 at I.).

> ⚠ 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 has an LED which flashes red or green. After the Device is connected to power, you may see the following signals:

1. Three green signals with a period of 0.5 seconds – this means that the Device has received the first message from the onboard network of the vessel. This signal occurs once after the Device is powered on to indicate that it is properly installed.

2. One green signal of a full second duration means that the Device has created a file on the MicroSD card and is ready to record data. This signal shows one time after the Device is powered on or if the card is changed.

3. Constant, random flashing green signals indicate that data recording on the MicroSD card is in progress. The intensity of the flashing indicates the load on the onboard network. This signal indicates normal functioning of the Device.

4. A red signal with a period of 0.5 seconds indicate that the Device cannot create a file on the MicroSD card or that there is no card in the Device.

A full list of signals is attached in Appendix A.

III. 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 mobile telephones.

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. MicroSD card is a complex electronic device. Keep cards away from static electrical fields and try not to handle 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. In our testing, regular cards (non-professional models) allowed recording of not less than 99.5% of network messages.

7. Network messages such as position, course, speed, depth, and wind have a frequency of not less than once per second. Speed and wind direction, for example, are sent ten times per second. For this reason, with 30 seconds of data sampling (which is more than adequate for cruise sailing) even 10% data loss is insignificant in most cases. Cards from obscure manufacturers or of lower Class did occasionally show differing results. Some cards demonstrated a very long response time – as much as 500 milliseconds – whereas Class 10 cards from well-known manufacturers averaged response time of less than 5 milliseconds. This delay could produce significant data loss. Low-speed cards might be adequate for amateur photo cameras, but are not adequate for capturing real-time data.

8. 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 use, this 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.

9. 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.

10. At the first sign of physical problems such as extended time needed for reading the data from the card or errors in reading, do not try to 'fix' the card, but immediately replace it. 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.

IV. Formatting MicroSD Cards

The Recorder supports MicroSD memory cards of all sizes and classes, but has performance requirements for cards (see III.6-III.8). 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 files of up to 20 clusters, which totals 1.3MB with a cluster size of 64K. Such files typically hold 15-25 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.

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 Ridgecrop Consultants Ltd:

http://www.ridgecrop.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.

V. Organization of Files 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", 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 at one time. The exact number of folders used and the maximum number of files in a folder depends on the size of the card. The Recorder cannot fully utilize the available space on memory cards larger than 200 GB. When cards of this size become commonly used, we will test them with the Recorder and release updated firmware to support them.

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=NO at VI.).

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

VI. Configuration of the Device (YDVR.CFG File)

The Device settings are defined in the optional YDVR.CFG text file, which must be located in the root folder of the MicroSD.

Between the parameters and the values there should be no other characters except the equal sign. All parameters and values should be written in capital letters. Each parameter must be placed on a separate line. The # symbol at the beginning of the line indicates that the line contains a comment.

Example file YDVR.CFG:

```
# This is a sample YDVR.CFG file
SILENT=ON
AIS=OFF
DELETE=NO
IGNOREPGN=130814
IGNOREPGN=129029
IGNOREPGN=129540
IGNOREADDR=5
IGNOREADDR=26
```

Description of the settings:

SILENT=ON

This setting blocks the sending of Device information (message with PGN 126996). The Device will not appear in the list of devices on the chartplotter (see VIII.). This setting is designed for covert installation.

AIS=OFF

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

DELETE=NO

This prevents the Device from erasing files and rename folders on the MicroSD card. In this case, you need to keep track of the available space on the card (see V.).

IGNOREPGN=xxxxxx

This setting can be used up to five times. The xxxxxx is a decimal number with the PGN of an NMEA 2000 message. In this way, you can block up to five different types of messages from being recorded in the file.

IGNOREADDR=yyy

This setting can be used up to five times. The yyy is a decimal number with the address of a device on the NMEA 2000 network. Thus, with this setting, messages from up to five different devices can be ignored by the Recorder – the data will not be written to the file.

VII. Processing Data on Computer

To process the data, they 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 III.9). Scanning the card is recommend only after transferring the data to the computer.

The software for processing data is available free on www.yachtd.com. Documentation for the software is available in electronic form along with the software download.

VIII. 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.

From 5-15 seconds after powering on, the LED will light up and change color from green to red and back for 15 seconds. This indicates that the firmware update is successfully completed.

If the Recorder already is 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.
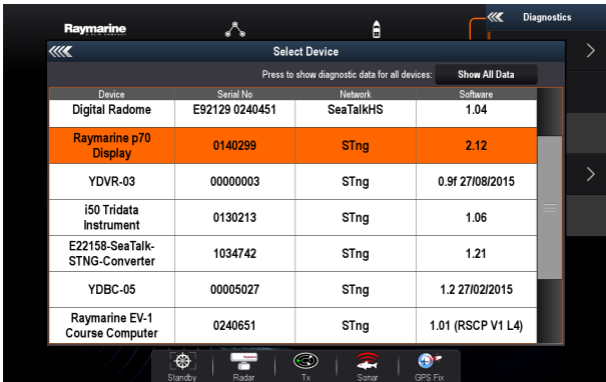
Figure 1. Raymarine c125 MFD devices list with Recorder (YDVR-03)

Appendix A. LED Signals of the Device

Description	Meaning and comment
3 green flashes with a period of 0.5 seconds	The Device has received the first message from the onboard network of the vessel. This signal occurs after each time the Device is powered on and indicates that the Device is properly connected.
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 is given each time after the Device is connected to the onboard network and once after changing of the MicroSD cards.
Constant, unsynchronized green flashing	Normal regime for recording data. Signal intensity depends on the load on the onboard network.
Red signals with a period of 0.5 seconds	Device cannot create a file on the MicroSD card or there is no card in the Device
Short red signal after powering off	Indicates that the Device has successfully completed all file operations after power off. If this signal does not appear, then the opposite should be assumed, and replacing the card is recommended (see III.6-III.8).
Signal changes from green to red and back for 15 seconds	Update of firmware is successfully completed.

Appendix B. Troubleshooting

Situation	Possible cause and correction
The LED does not signal after the Device is turned on	**1. No power supply on the bus**. Check if the bus power is supplied (NMEA 2000 network requires a separate power connection and cannot be powered by a plotter or another Device connected to the network). **2. Loose connection in the power supply circuit**. Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another connector.
Memory card is inserted into the Device, but red light is flashing.	1. **Card is not formatted correctly**. Reformat card (see IV.). 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**. Check the card and whether the value of the parameter DELETE=NO in the YDVR.CFG file (see VI.)
Card is inserted into the Device, but only 1 single green signal is given when powered on.	**1. Loose connection in the data circuit.** Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another connector.
File system of MicroSD card is corrupted	**1. Device cannot complete the shutdown of the file system after power off.** Replace the card by MicroSD Class 10 card from well-known manufacturer (see III.7-III.9).

Appendix C. NMEA 2000 Messages

Message	Receive	Transmit	Period
ISO Acknowledgment PGN 59392 (0xE800)	Yes	Yes	—
ISO Request PGN 59904 (0xEA00)	Yes	Yes	(1)
ISO Address Claim PGN 60928 (0xEE00)	Yes	Yes	—
PGN List Group Function PGN 126464 (0x1EE00)	No (2)	Yes	—
Product Information PGN 126996 (0x1F014)	Yes	Yes (3)	—
Time & Date PGN 129033 (0x1F809)	Yes	No	—

(1) The Recorder sends a PGN 126996 (Product Information) request to all equipment present on the network once every 64 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 configuration file YDVR.CFG (see VI.). "No" means that Recorder will not process this message during communication with other devices on network.

(3) Transfer of this message can be turned off in the configuration file YDVR.CFG (see VI.) for the purpose of running the Device in covert mode.

Appendix D. Data File Format

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. **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 integer); 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 integer 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 0xffffff). The internal time of the Recorder in minutes is reset to zero every 10 days.

When power is turned off (see III.9), the Recorder does not save the contents of the internal cache (up to 512 bytes) to the 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. Device Connectors

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

V–
SCREEN
CAN H
CAN L
V+

CAN H
V–
CAN L
V+
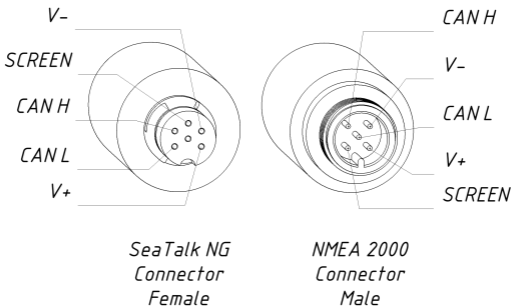SCREEN

SeaTalk NG
Connector
Female

NMEA 2000
Connector
Male

Figure 1. Connectors of the YDVR-03R (left) and YDVR-03N (right) models