Yacht Devices

User Manual

Yacht Devices Python Gateway YDPG-01

also covers models

YDPG-01N, YDPG-01R

Software version

1.00

2024

Contents

Package Contents

Device	1 pc.
This Manual	1 pc.
Stickers for USB connector sealing	6 pc.
USB cable from Mini-B (M) to Type-A (M), 20 cm	1 pc.

Introduction

The Yacht Devices Python Gateway (hereafter referred to as Gateway or Device) is a Swiss Army knife for connecting NMEA 0183 and NMEA 2000 devices. It is equipped with two serial ports (one for receiving NMEA 0183 data and one for transmitting), a CAN bus interface (for NMEA 2000) and a USB port for connection to a PC. The USB connection provides two interfaces at the same time: a virtual disk for uploading user programs, and a serial port with interactive Python prompt for debugging user code or monitoring its execution.

The Device allows the creation of gateways between NMEA 0183 and NMEA 2000, at UART and CAN bus level with the standard Python library, or at NMEA level with the Yacht Devices library. It also allows to connect NMEA 0183 devices working at different speeds, to process, filter and modify data on the fly. The Device's internal disk can be used by user code to store logs and other data.

The Gateway hosts MicroPython (www.micropython.org). This is a very popular implementation of the Python 3 programming language that includes a small subset of the standard Python library. The Gateway's processing power is limited, and you may not be able to use resource-intensive libraries popular on the PC, such as numpy, and you may have difficulty porting the code with the long list of imports designed for the PC.

However, you will have all the flexibility and power of the Python language, and the Yacht Devices library allows you to create tiny and elegant programs. For example, AIS decoding from NMEA 0183 to NMEA 2000 takes about 1.5 milliseconds per message. Therefore, the performance is sufficient for real-time applications.

Please note that programming requires knowledge of the NMEA protocols. NMEA 0183 standard or NMEA 0183 standard can be obtained from the National Marine Electronics Association (www.nmea.org).

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 Specifications

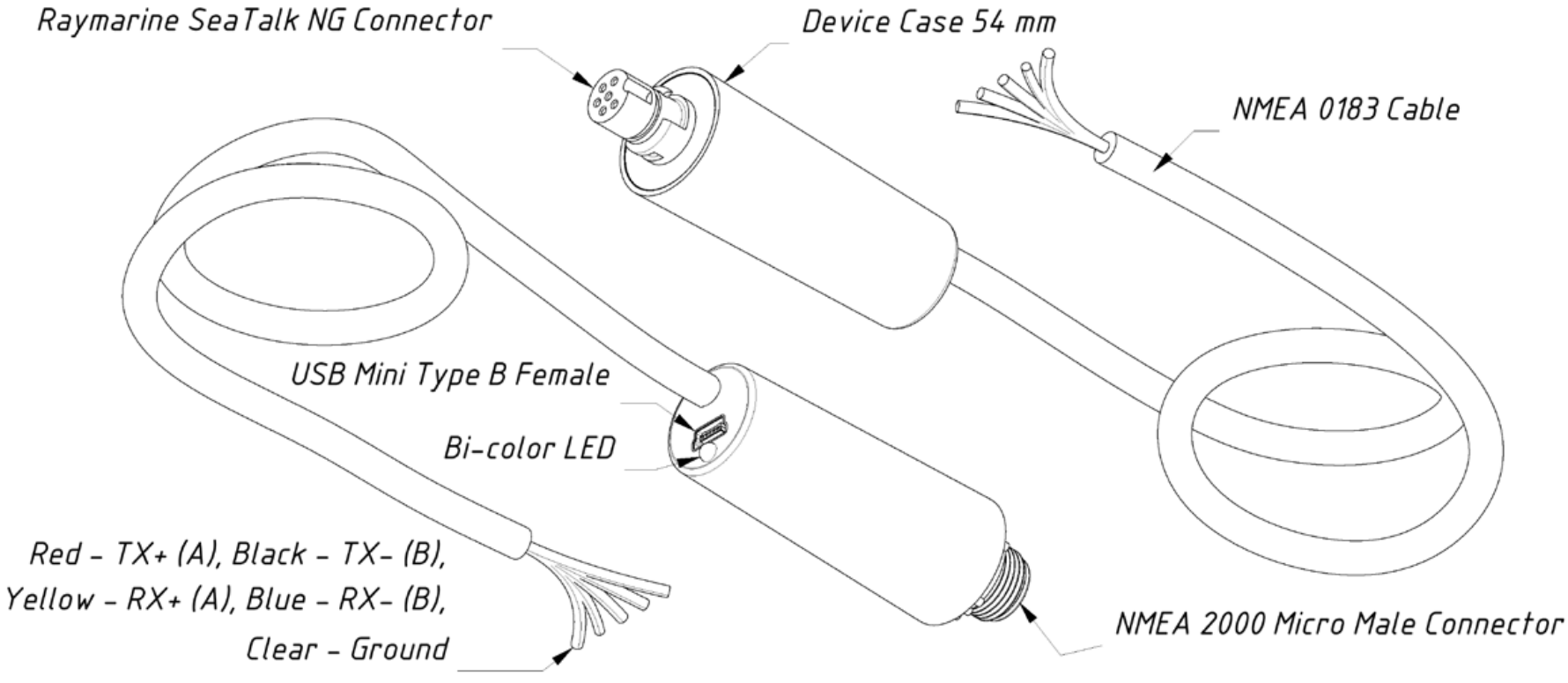


Figure 1. Drawing of YDPG-01N (left) and YDPG-01R (right) models of Gateway

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

Device parameter	Value	Unit
Current consumption from USB (see note 1), maximum / average	90/37	mA
USB interface specification supported	1.1, 2.0	—
USB Device VID / PID	0483/A217	hex
Supply voltage from NMEA 2000 network	9..16	V
Current consumption from NMEA 2000 network (see Note 1), max. / avg.	68/32	mA
Load equivalency number	2	LEN
Galvanic isolation between NMEA 2000 and USB	N/A	
Galvanic isolation between NMEA 2000 / USB and NMEA 0183	2 500	V_{RMS}
NMEA 0183 cable length	450	mm
NMEA 0183 receiver input resistance	96	kOhm
Internal disk space for user programs	16	MBytes
Device case length	54	mm
Weight	38	g
Operating temperature range	—20..+55	°C

Note 1: the Device can be powered from USB or from NMEA 2000 interfaces, measurements above are with 100 Ohm load connected to the NMEA 0183 port.

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

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

II. NMEA Basics

This section describes the basics of NMEA 0183 and NMEA 2000 networks. We recommend getting familiar with this section before connecting the Device.

These networks are very different at the electrical and software levels. NMEA0183 also has made a long evolutionary path, but thanks to its simplicity and cheapness, it is still very popular and widely used.

1. NMEA 0183

The default speed of a NMEA 0183 interface is 4800 baud. A high-speed interface is 38400 baud and was designed especially for AIS, but usually chart plotters and instrument displays allow any data (not only AIS) on a high-speed port. On a chart plotter, port speed can be configured in settings.

NMEA 0183 uses different wires for talking (transmitting, TX) and listening (receiving, RX) data. One talker can be connected to multiple listeners, but a listener can have only one talker connected. Special devices called «multiplexers» are used to join the output of multiple talkers to a single stream.

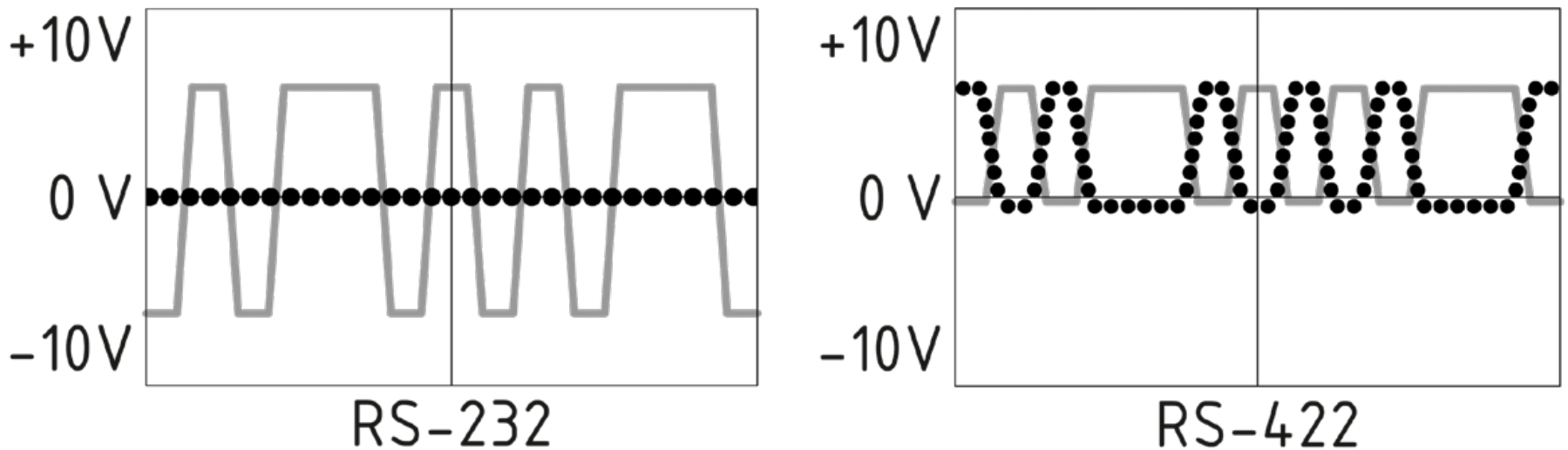


Figure 2. (a) RS-232 and (b) RS-422

NMEA 0183, until version 2.0 (1992), used a «single-ended» RS-232 interface with one TX line and one RX signal line (grey at Figure 2.a) and ground line (dotted at Figure 2.a) used as reference for TX and RX signals. Therefore, old devices have only three wires.

Since version 2.0, NMEA 0183 has been based on a «differential» RS-422 interface, which has two RX lines RX+ (can also be marked as «A») and RX- (or «B»), two TX lines TX+ (or «A», grey at Figure 2.b) and TX- (or «B», dotted at Figure 2) and ground (not shown at Figure 2.b). Modern devices use five wires.

Devices of different versions can be connected, but with one caution. TX- («B») is not equal to a ground line. Voltage on the TX- line (dotted on Figure 2.b) changes from 0 to 5V, and connecting this line to ground line can cause a short circuit.

The right connection schemes are shown in Figure 3.

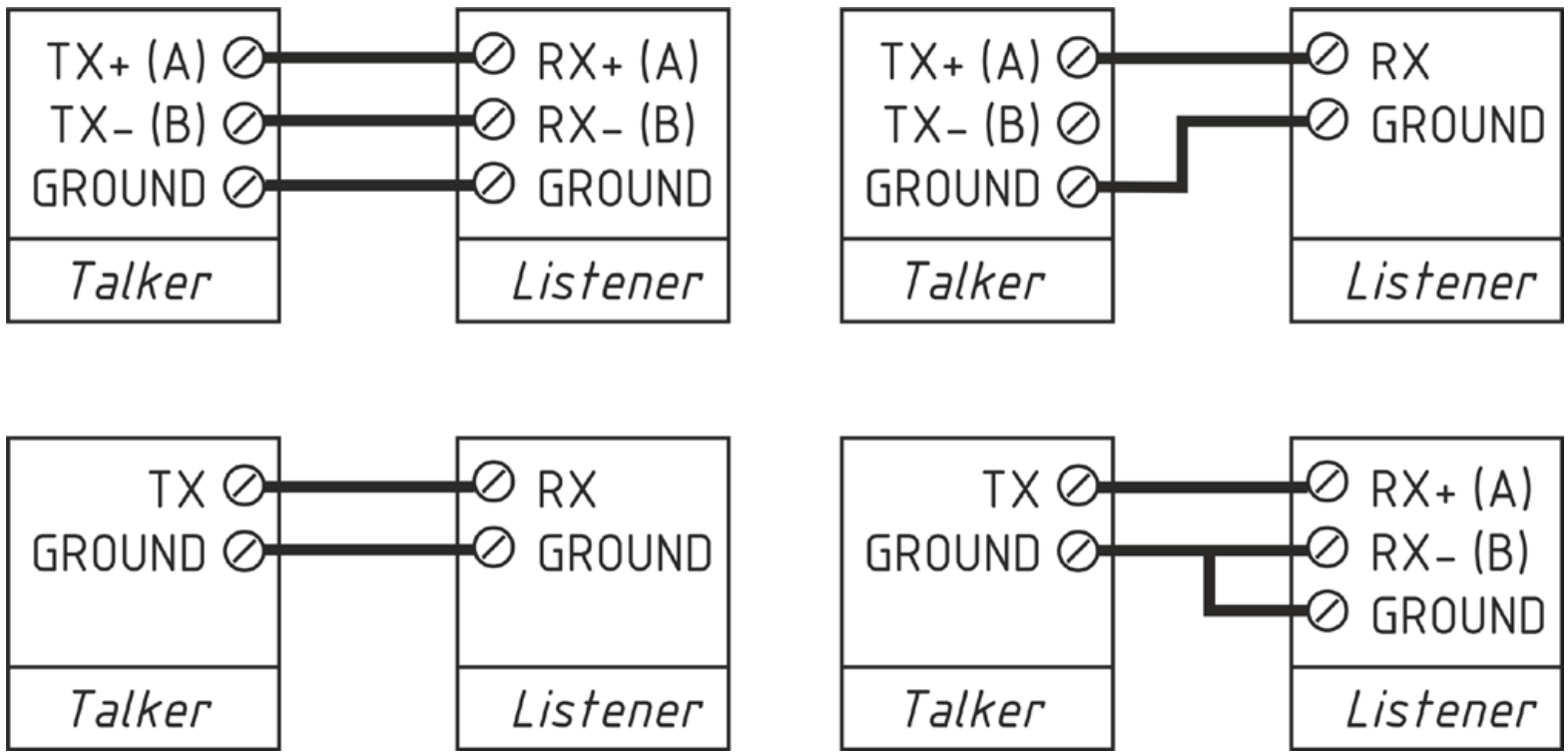


Figure 3. Connection of NMEA 0183 devices

2. NMEA 2000

NMEA 2000 network runs at 250 kbps and allows up to 60 physical devices to be connected. Unlike NMEA 0183, there are no «talkers» and «listeners». All devices can «talk» and all devices receive all messages. Many electronic manufacturers presented «branded» versions of NMEA 2000. Raymarine SeaTalk NG, Simrad SimNet, FurunoCAN differ only in the type of connectors used. However, in recent years manufacturers have been moving to NMEA 2000 connectors.

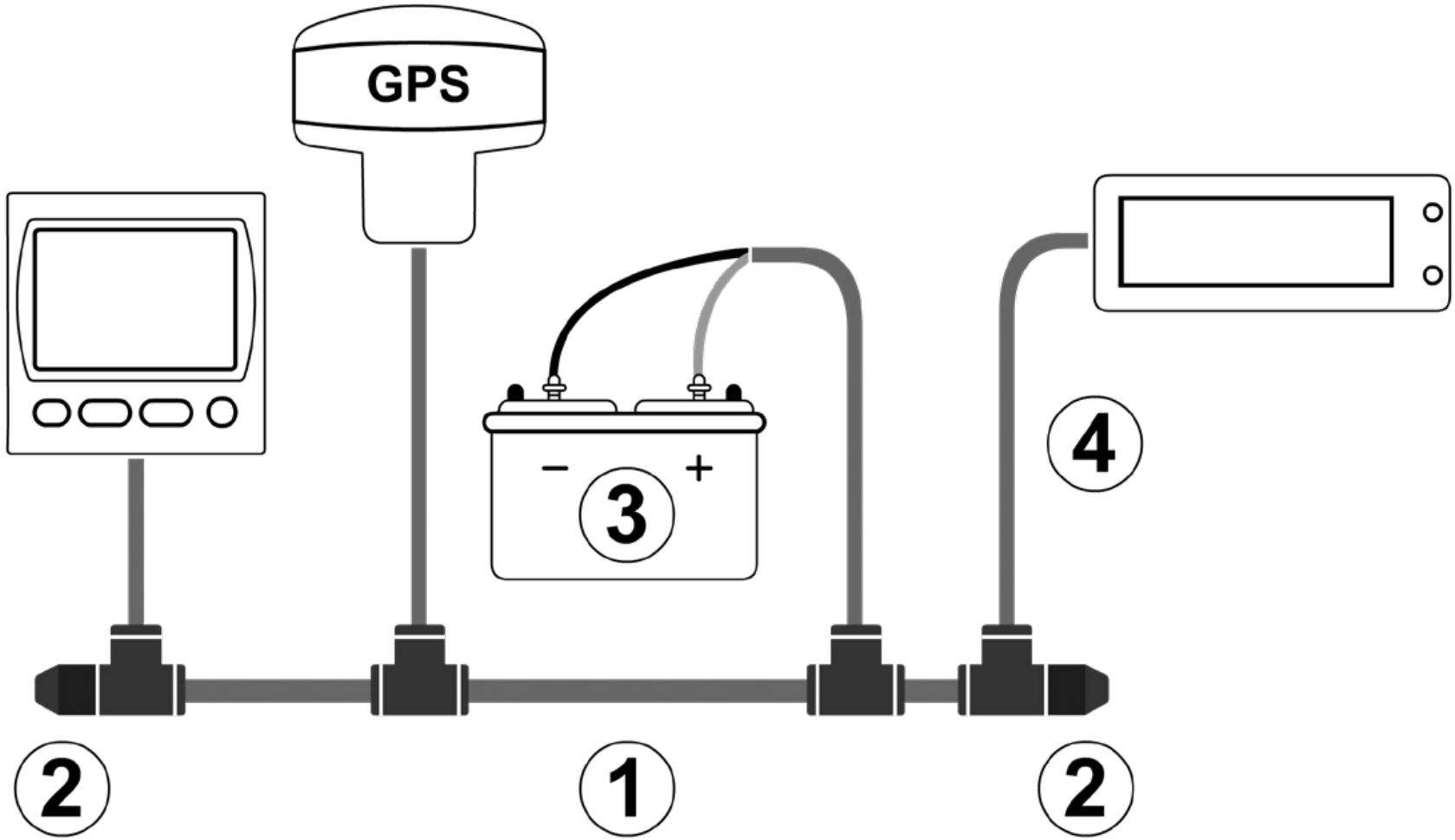


Figure 4. Basic NMEA 2000 network
(1 – backbone, 2 – terminators, 3 – dedicated power, 4 – drop cable)

The network backbone (between 2 and 2 at Figure 4) has two data lines (called CAN HIGH and CAN LOW and two power lines. Power lines should be connected to a 12-Volt power supply (see 3 at Figure 4). Low-powered devices, like our Gateway, take power directly from the network backbone.

Data lines are «terminated» at both ends with a 120-Ohm resistor (see 2 at Figure 4). Therefore, resistance between CAN lines is between 60 and 120 Ohms. Devices can be connected to any place of backbone (between terminators). The cable from network backbone to the Device is called a drop cable (see 4 at Figure 4). Our devices can be connected directly to a backbone.

All the above does mean that you can not simple connect the Gateway to a NMEA 2000 port of your chart plotter to connect a NMEA 0183 sensor to it. You should establish a simple NMEA 2000 network first. 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.

III. Installation of USB Drivers and Connection to PC

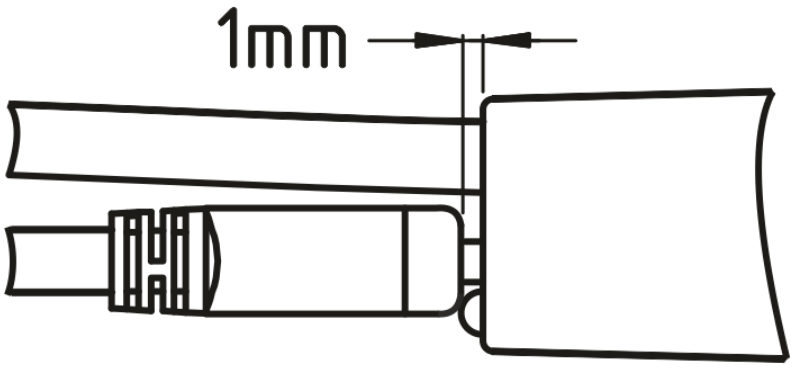
The Device is connected to a USB port of a PC and is compatible with the USB 1.1 protocol (1998) and later. It is therefore compatible with all modern laptops and PCs. The Device can be powered from the USB port (as well as from the NMEA 2000 port) and you will see LED signals after connection (otherwise it means that the cable or the USB port is damaged).

Note that the USB port is not galvanically isolated from the NMEA 2000 network. We recommend that you switch off the NMEA 2000 network or disconnect the Device from it when connecting to the PC. On the boat, we recommend that you run your laptop on battery and disconnect it from the inverter if you need to keep the NMEA 2000 connection while the instrument is connected via USB. Otherwise the potential difference to ground may damage the USB port or the Device.

At the software level, the Gateway implements two devices that operate simultaneously:

- a USB drive (mass storage device; class 8, subclass 6);
- serial port (virtual COM port; USB device class 2, subclass 2).

Serial ports do not require a special driver in Windows 10, Windows 11, Mac OS X and Linux; these operating systems automatically use a system driver. In older versions of Microsoft Windows, you should install a driver (.INF file only, no code) that links the standard system driver to a Device.



The USB connector in the Device is installed flush with the surface of the case. As a result, some cables may not be fully inserted, leaving a gap of about 1mm. This is normal, do not use force when connecting the USB cable.

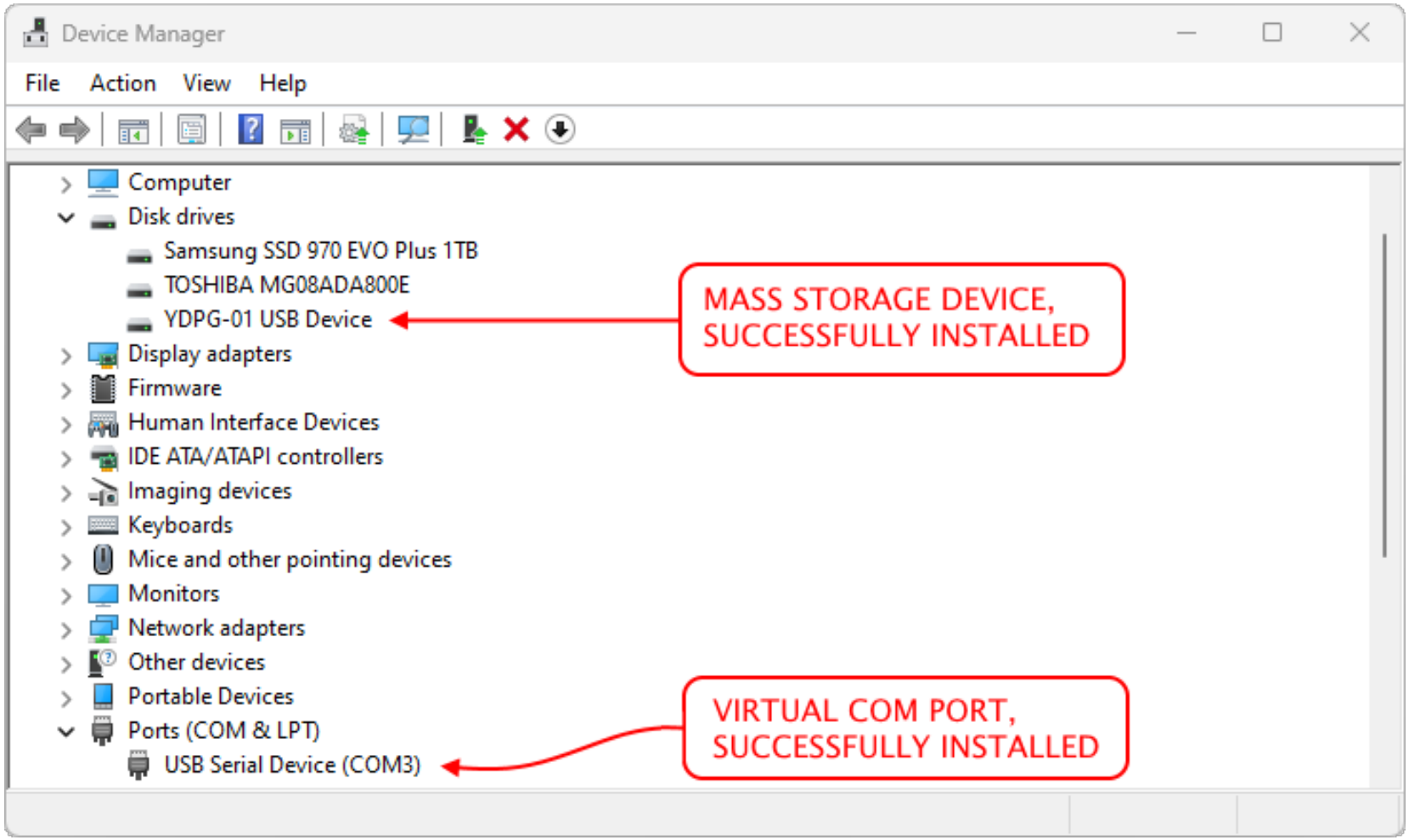


Figure 5. Device Manager on Windows 11

The Device uses Windows drivers and should be installed automatically. To check the installation, you can open the «Device Manager» from the «Control Panel» and check the presence of the YDPG-01 disk and the USB serial device.

2. Installation on Microsoft Windows 7 and earlier versions

The USB serial port driver for Microsoft Windows can be found in the root folder of the mass storage device (which does not require a driver and should be accessible immediately after connection) or in the Downloads section of www.yachtd.com.

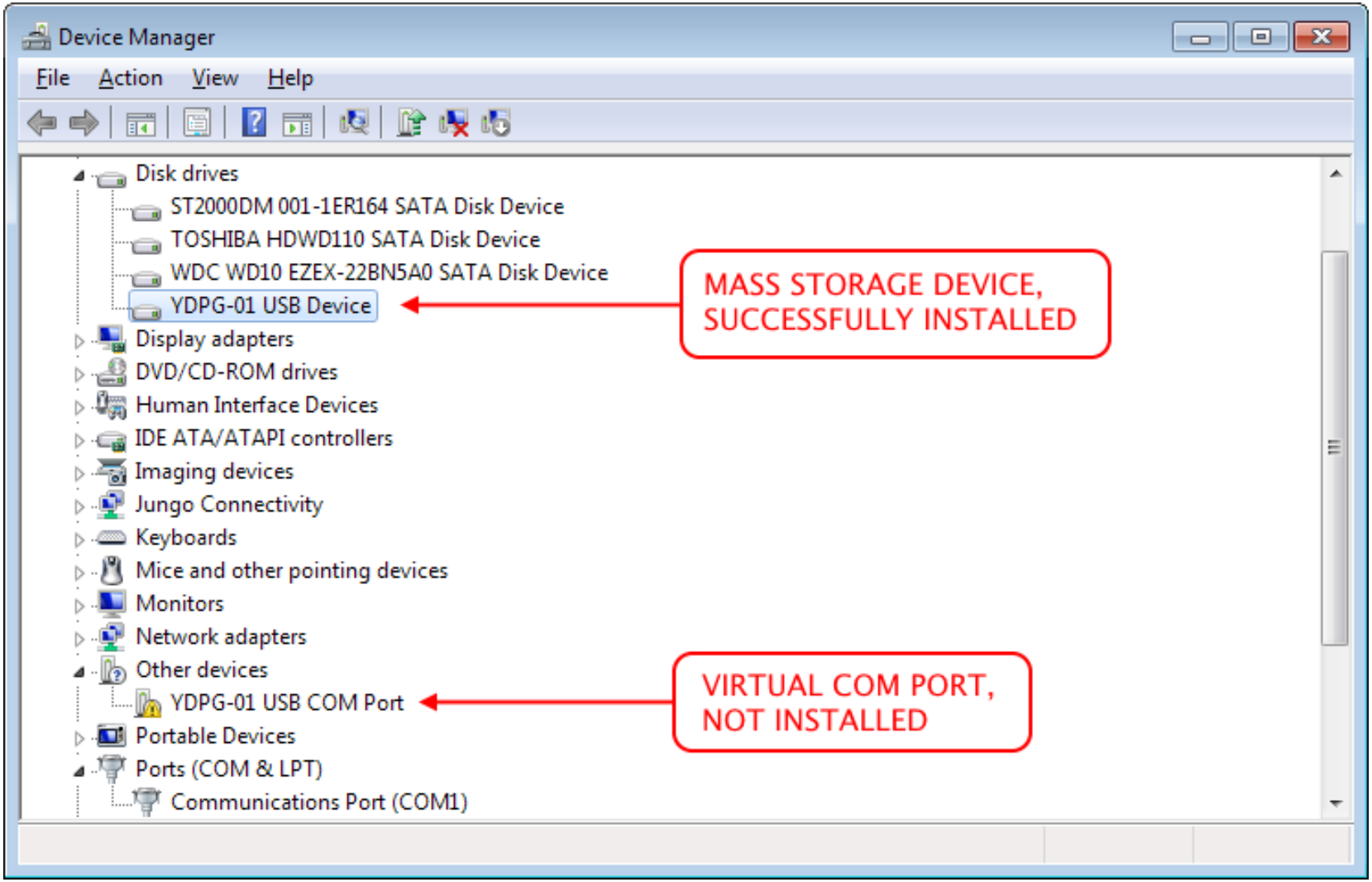


Figure 6. Device Manager on Microsoft Windows 7

To check the installation on Microsoft Windows 7 and earlier versions of Microsoft Windows, run «Device Manager» from «Control Panel». If the «YDPG-01 Virtual COM Port» is in the «Other devices» section (see Figure 6), run «Update Driver Software...» from the context menu, then select «Browse my computer for driver software» and on the next page click «Let me pick from a list of device drivers on my computer». Then select «Show All devices» or «Ports (COM and LPT)» from the list and click «Next». On the next page, select «Have disk...» and select YDPGDRV.INF from the Gateway's disk (see Figure 7).

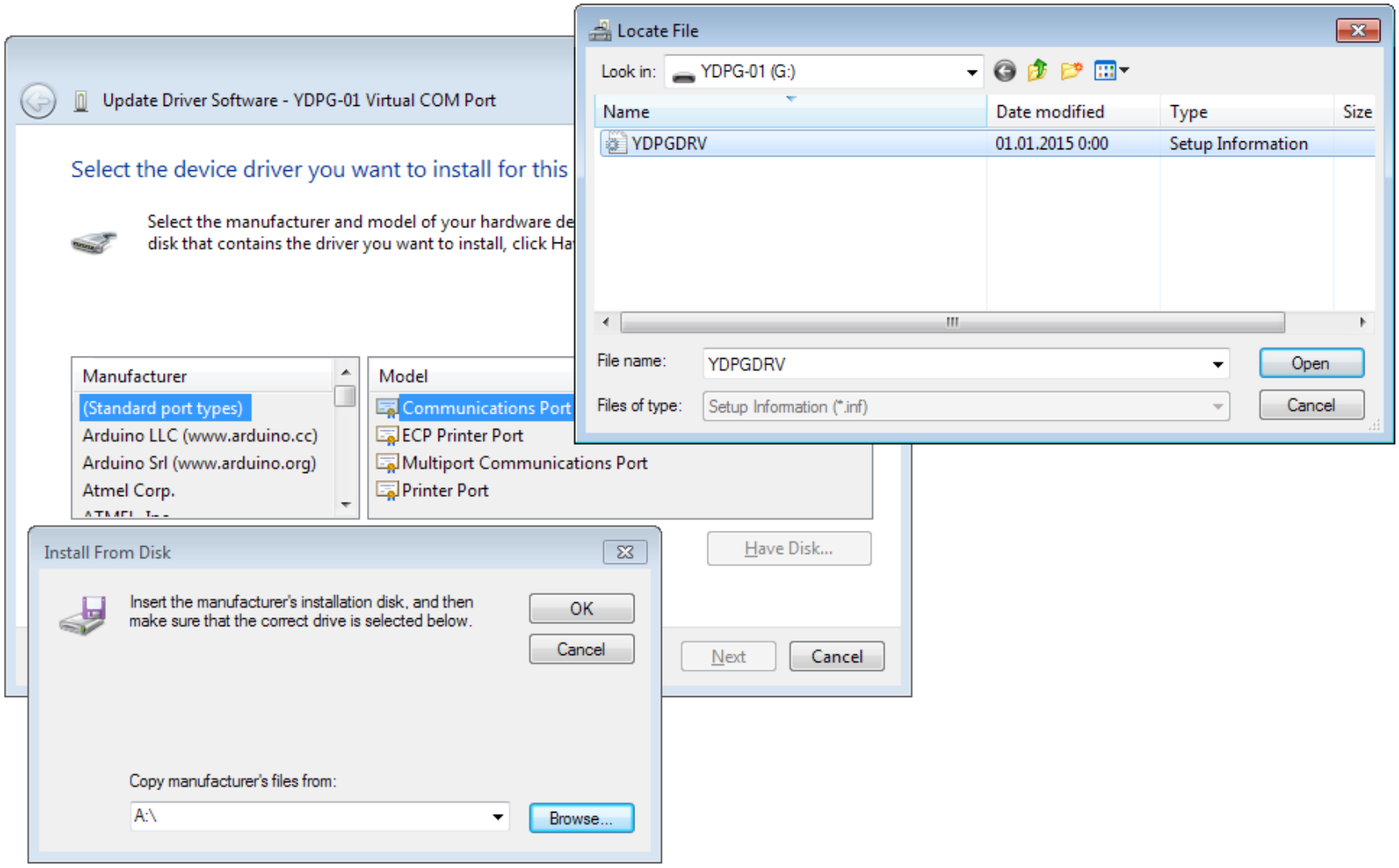


Figure 7. Installing YDPGDRV.INF

3. *Installation on Linux (Ubuntu)*

The Device uses a system CDC ACM driver. After connecting the Device, type the dmesg command in a terminal.

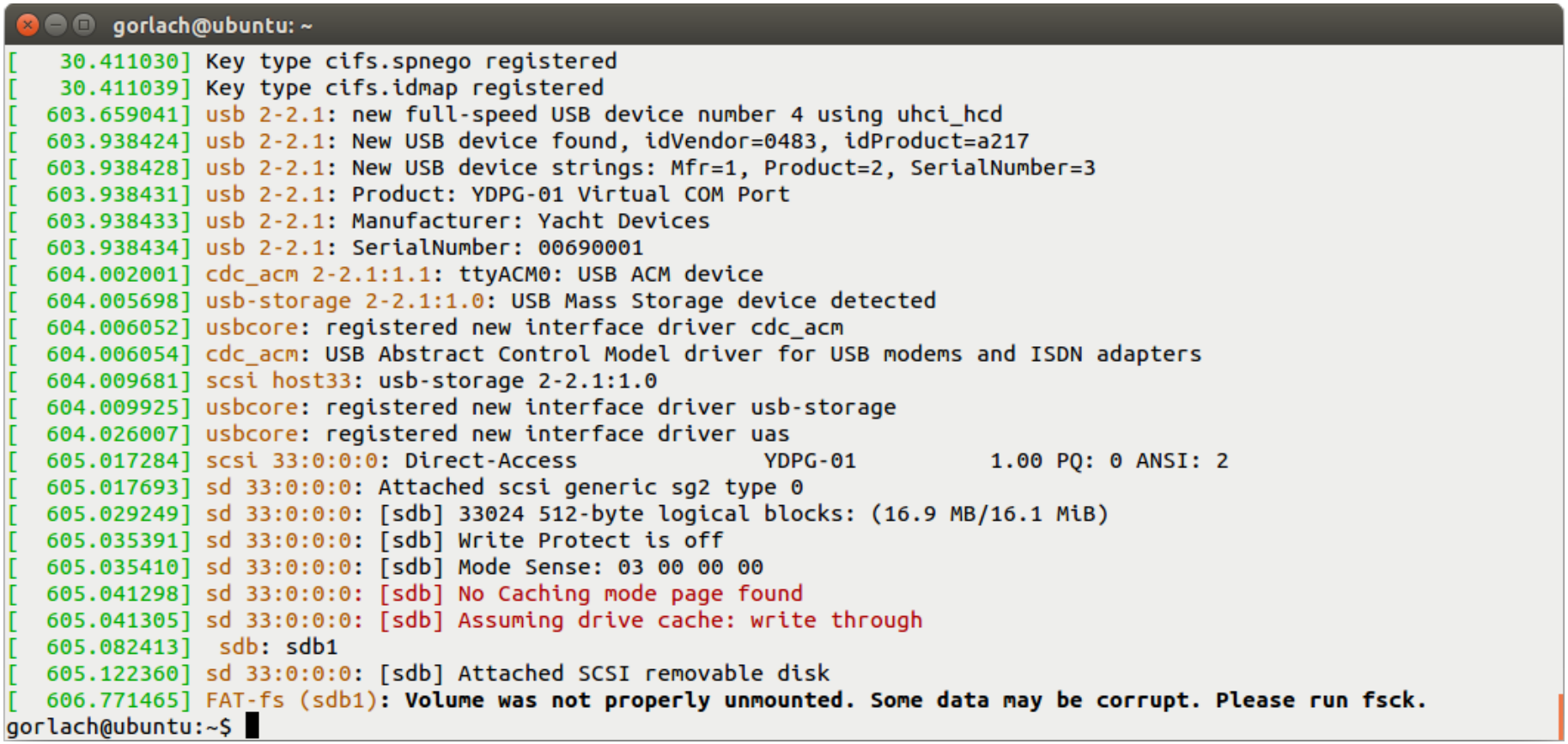


Figure 8. Output of dmesg command on Ubuntu

At the end of the output, you will see the properties of the Device, the name of the serial port and the name of the disk. To use the internal disk (see the Figure 8, line 605.082413), if it was not mounted automatically, type the command:

```
sudo mount /dev/sdb1 /mnt
```

To connect the terminal to the Python interactive prompt, type (see Figure 8, line 604.002001):

```
screen /dev/ttyACM0
```

4. Installation on Mac OS X

Once the Device has been connected, click on the Apple icon and select the «About This Mac» menu item. Click the «More Info...» and «System Report...» buttons in the window that opens. Locate «YDPG-01 Virtual COM Port» in the USB subsection of the Hardware section, as shown in Figure 9.

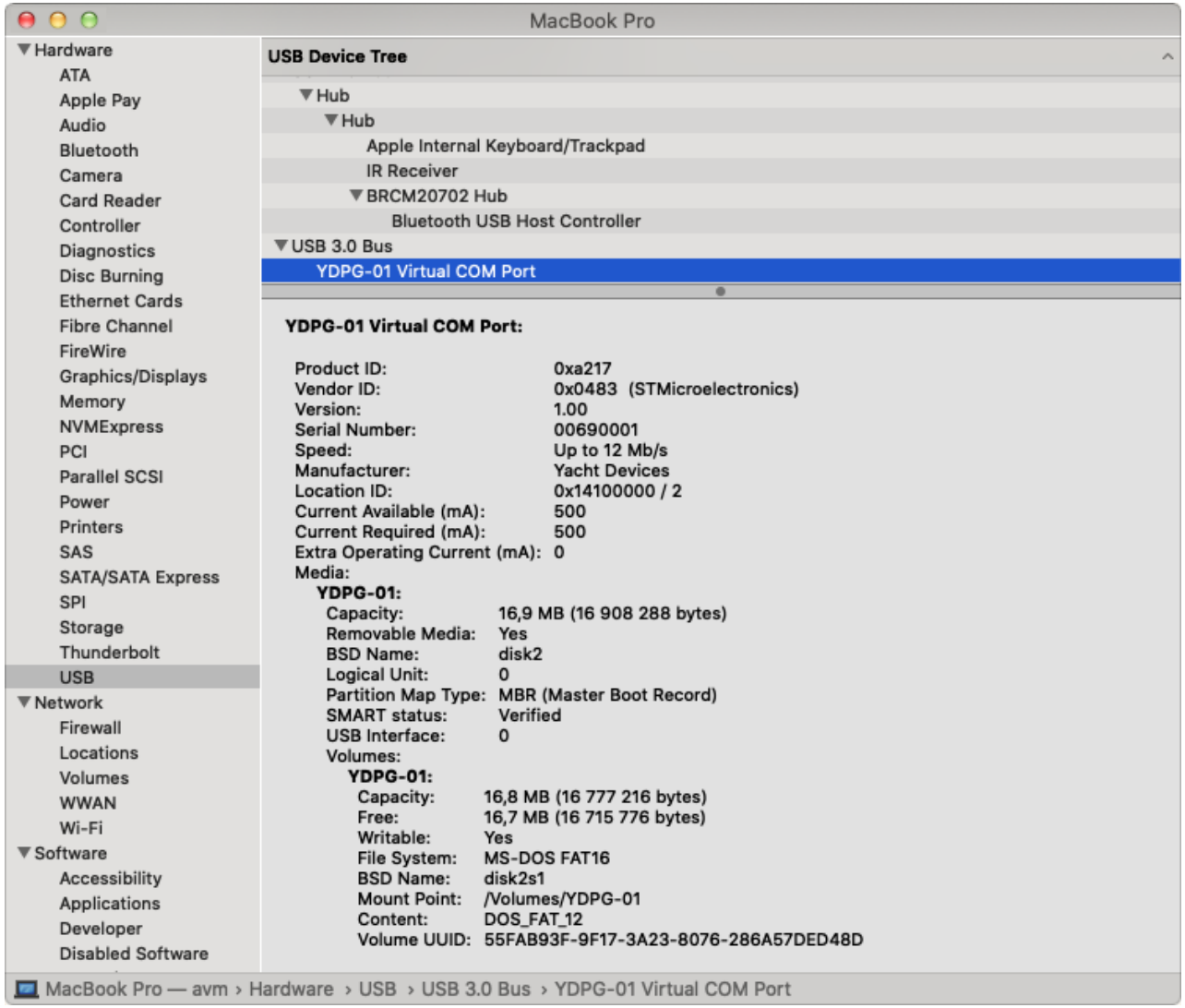


Figure 9. Python Gateway connected to MacBook

In the Device properties in Figure 9, you can see the Device's serial number and that the Device's disk drive has already been mounted. This Gateway has a serial number of 00690001 and the Gateway port to use in applications is `/dev/cu.usbmodem00690001`

IV. Installation and Connection to NMEA

The Device requires no maintenance. When deciding where to install the Device, choose a dry mounting location. Avoid places where the Device may be flooded with water, as this can damage it.

The Device has no galvanic isolation between NMEA 2000 and USB ports, please read the Section III before connecting the Device to USB.

1. Connection to NMEA 2000

The Device can be connected directly to the NMEA 2000 network backbone without a drop cable. Switch off the bus power supply before connecting the Device. Refer to the manufacturer's documentation if you have any questions about 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.

The Device is powered from the NMEA 2000 network (or USB) and has a LED, that blinks red or green. After powering up the NMEA 2000 network or connecting to USB, the Device's LED will flash green once to indicate that it is on. If this does not happen, see Appendix A.

You can check the NMEA 2000 connection with LED signals, see Section V. You can also check that the Device is present on the network and check the firmware version from a chartplotter. Please see Section VI for details.

2. Connection to NMEA 0183

The connection to the NMEA 0183 network varies depending on the version of the connecting equipment. Please, refer to Section II for connection schemas. The wrong wiring can damage the equipment!

Note that many NMEA 0183 devices, including the Gateway, have different wire colors than specified in the Standard. Please check the label on cable and/or documentation before connecting.

Table 1. NMEA 0183 Wire Colors

Signal	**NMEA 0183 Standard**	**Python Gateway**
Talker TX+ (A)	White	Red
Talker TX- (B)	Brown	Black
Listener RX+ (A)	Yellow	Yellow
Listener RX- (B)	Green	Blue
Ground	Black	Clear

All connections should be made with the power off to prevent accidental short circuits during installation.

It is recommended to connect wires by crimping or twisting rather than soldering. Soldered connections can break down quickly in the marine environment and require air insulation with paint or lacquer.

The Device is supplied with the serial port configured at 4800 baud (standard NMEA 0183 speed). When the connected equipment sends messages at this speed, their reception is confirmed by LED signals (see Section V). To change the speed in the Device settings, see Section VII.

V. LED Signals

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

1. Normal operation signals

During normal operation, the Device produces a series of five or six flashes every five seconds. The flashes indicate the status of the Device's interfaces during the last five seconds and have the following meaning:

- Flash #1: RED if an error is detected on the CAN bus (NMEA 2000), otherwise GREEN.
- Flash #2: GREEN if data is received from CAN bus, otherwise RED.
- Flash #3: GREEN when data has been sent to the CAN bus, otherwise RED.
- Flash #4: GREEN when line feed character (ASCII 10) is received from UART (NMEA 0183), otherwise RED.
- Flash #5: GREEN when line feed character has been sent to UART, otherwise RED.
- Flash #6: user defined, will be absent from the sequence if the user program doesn't set it's state (see Section VII).

2. User defined flashing

The LED behaviour can be completely controlled by the user program (color, frequency, duration) and you should refer to the documentation supplied with the user program if the flashing signals do not look like normal operation signals.

We kindly ask software developers not to use flashing sequences that can be confused with normal operation signals. For simple tasks, we recommend using the sixth flash in the sequence to indicate the status of the application program.

3. Other signals

LED signals during firmware update are described in Section VI. Signals during hardware reset are described in Section VIII.

VI. Firmware Updates

The firmware updates are available in the Downloads section of www.yachtd.com

Open the downloaded archive containing the update and read the README.TXT file, which may contain important information about the update.

> *The Device has no galvanic isolation between NMEA 2000 and USB ports, please read Section III before connecting the Device to USB.*

If the Device is connected to a NMEA 2000 network, switch it off or disconnect the Device.

Connect the Device to the USB port of a laptop or PC and copy the YDPG01.BIN file from the update archive to the root folder of the Python Gateway internal disk. Disconnect the Device from the USB port.

After connecting to the USB port or powering up the NMEA 2000 network, the update will start. It will take up to 30 seconds, no LED signals will be emitted during the update process. Do not disconnect the Gateway from the power source (USB or NMEA 2000) during the update.

When the update is complete, the LED will alternate between red and green for 5 seconds. The boot loader then deletes the update file from the Device's disk and transfers control to the firmware.

If the Device is already using the specified version of the firmware, or if the Device cannot open the file, or if the file is corrupt, the boot loader will immediately transfer control to the firmware. This is done without any visual indication.

Device information, including firmware version, is displayed in the NMEA 2000 device list (SeaTalk NG, SimNet, Furuno CAN) or in the common list of external devices on the chartplotter (see Figure 10). This list can usually be accessed from the plotter's «Diagnostics», «External Interfaces» or «External Devices» menu.

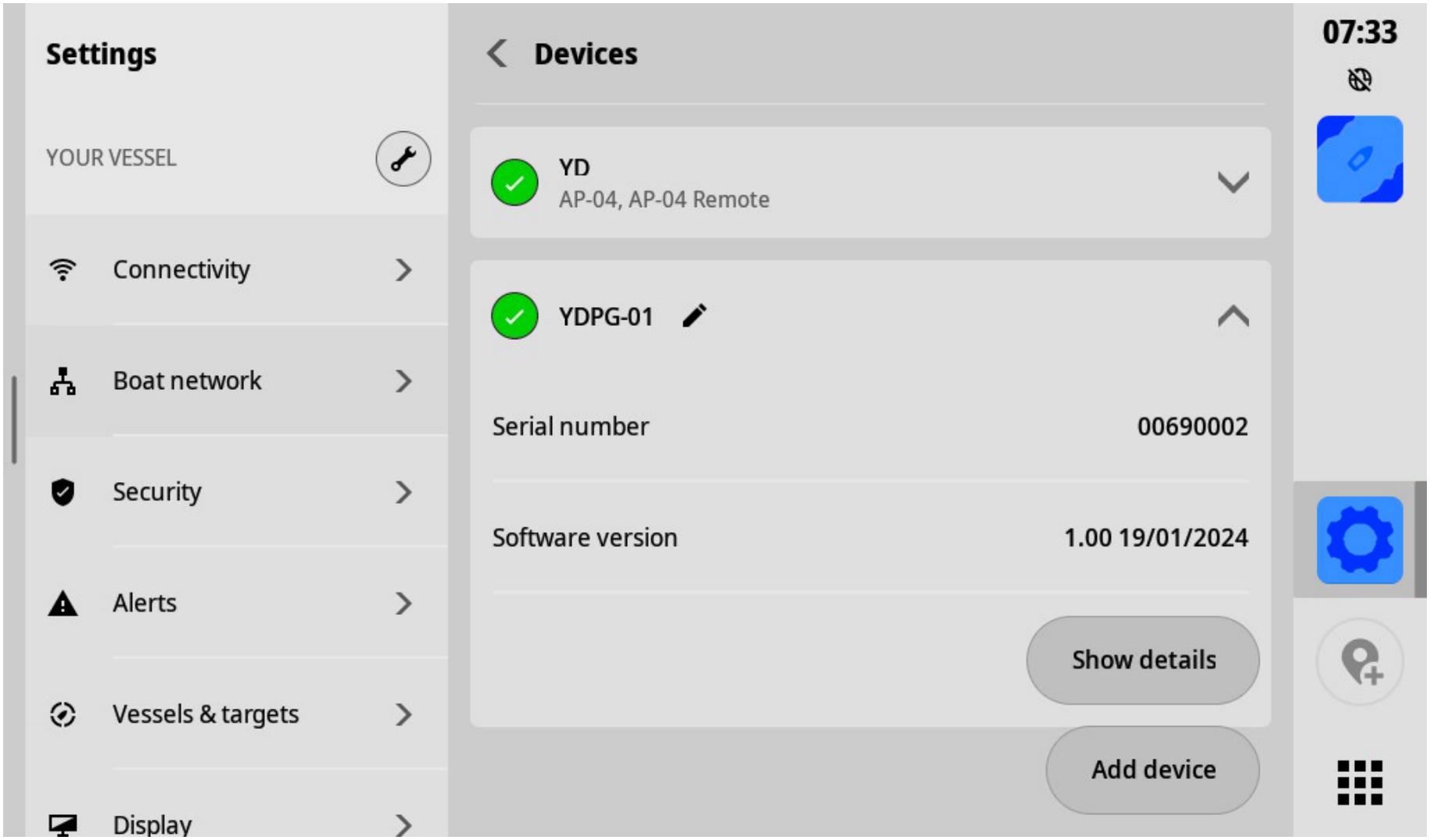


Figure 10. YDPG-01 in the list of boat network devices on Simrad NSX MFD

VII. Programming the Device

The internal disk of the Device contains the *boot.py* file (which initializes the libraries and configures the Device's peripherals, including the speed of the NMEA 0183 ports) and the *main.py* file (which is empty and intended for user code). These files are executed sequentially by the Device when it is powered on.

Your software supplier will provide these files, and the software supplied may also contain libraries (other files with a .py filename extension). Some libraries may be in subfolders. Copy all files and folders from the archive containing the software to the root of the internal disk of the Device and agree to replace all files with new ones.

Switch off the Device (disconnect it from USB and from NMEA 2000). The next time you switch it on, the new software will start. As the LED signals can be controlled by user code, ask your software supplier how to check the how to check the program status with LED signals (see also Section V).

The USB serial port of the Device provides access to the Python interactive prompt (REPL). There you can check the status of the running program, check for execution errors, or abort the program to run your own code.

You can use the serial port with the terminal program. For Microsoft Windows, we recommend the freeware Putty (also available for Linux, can be downloaded from www.putty.org). In Linux and Mac OS X, the screen command can be used. For the configuration shown in Section III, you can use the following commands to connect:

```
putty.exe -serial COM3
```

```
screen -a /dev/cu.usbmodem00690001
```

```
screen /dev/ttyACM0
```

If the Device does not have a running program, you will see the Python prompt, as shown in Figure 11. If you are using the terminal for the first time, use the *help()* command to get basic information about working with the terminal and interactive prompt (REPL).

The running program or code can be aborted by pressing Ctrl+C and (after that) the Python interpreter can be soft reset by pressing Ctrl+D. The soft reset is much faster than a Device reboot (power cycle) and it does not interrupt the terminal session. Note that after a software reset, *boot.py* and *main.py* will be executed. You can reset the interpreter with Ctrl+W instead of Ctrl+D to skip *main.py* at startup.

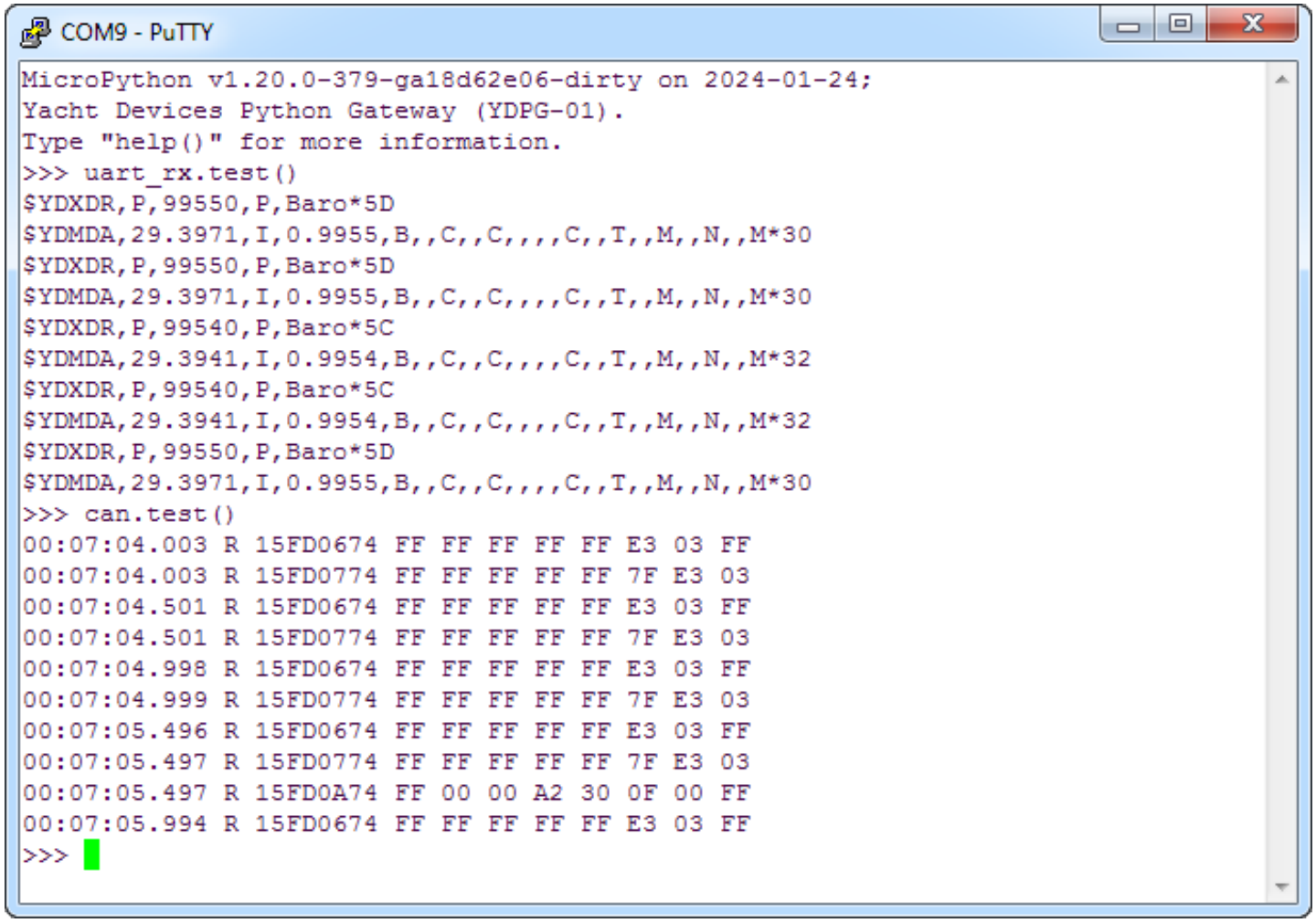


Figure 11. Test commands in the Putty terminal program

To test the NMEA 2000 connection, type the command *can.test()* in the REPL to receive and print ten 29-bit identifier messages (NMEA 2000 messages) from the CAN bus. To test NMEA 0183 reception, type the command *uart_rx.test()* to receive and print ten lines received from NMEA 0183. The result of these two commands is shown at Figure 11.

However, if you are a software developer, the most convenient way to interact with the Gateway is to use the freeware Thonny application, available for Microsoft Windows, Linux and OS X at www.thonny.org.

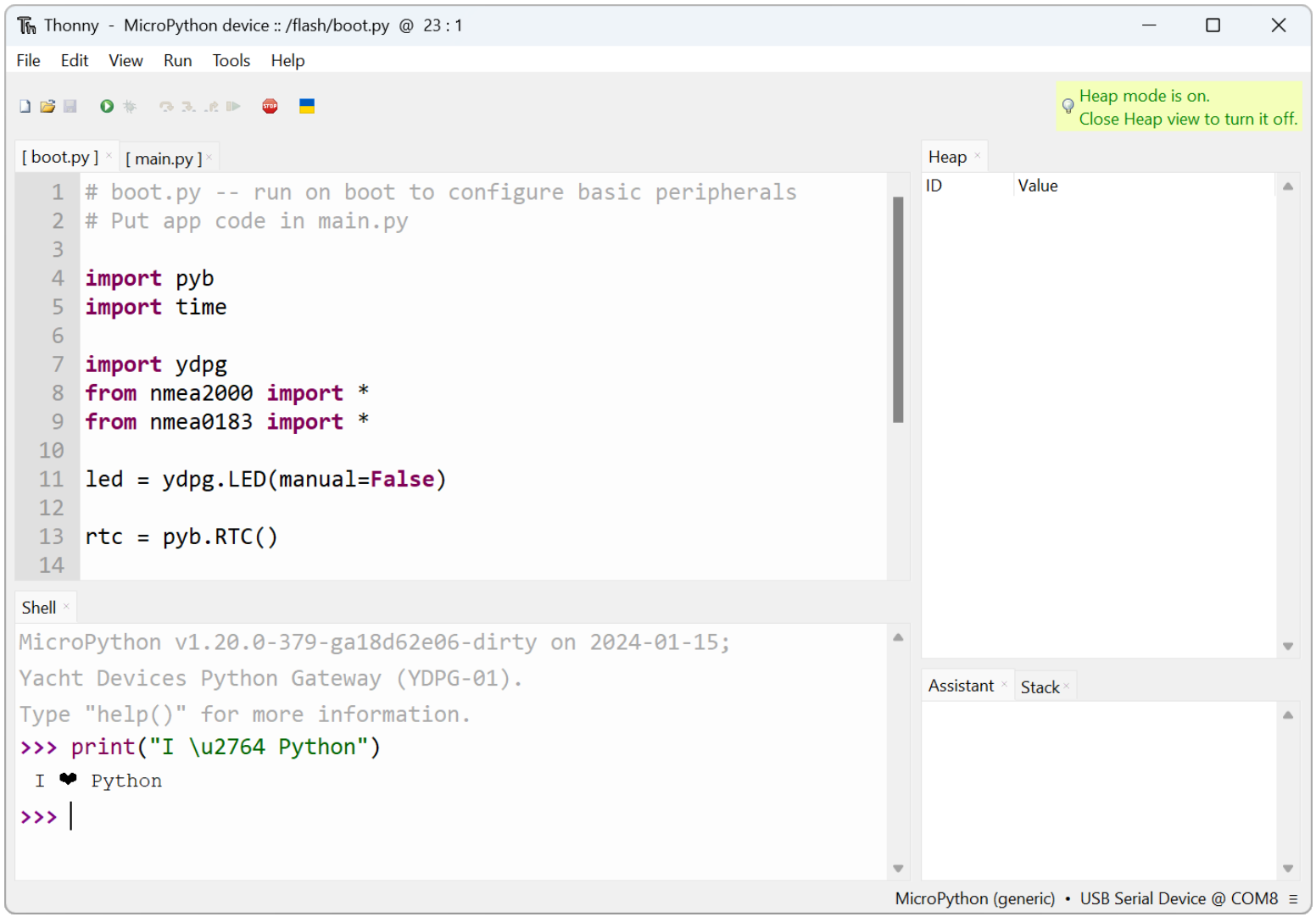


Figure 12. Thonny application connected to the Python Gateway

This simple IDE allows to edit files directly on the Gateway, highlight syntax, save backup files to PC, run and stop your code, interact with REPL, plot variables, etc. In the Thonny options («Run» menu, «Configure interpreter...» item) you should select «MicroPython (general)» and the Gateway's port at the «Interpreter» tab.

To test a new installation, you may need to change NMEA 0183 speed in the *boot.py* file. Find lines with the substring baudrate=4800 and replace the 4800 by the speed you need. To apply changes, you can cycle Device power or soft reset the Python interpreter.

To add the sixth flash to the normal operation signals sequence (see Section V), type in the REPL or add to the *main.py* the line *led.green()* or *led.red()* to select the corresponding color.

Documentation of Yacht Devices library for Python Gateway and code samples are published online at:

http://www.yachtd.com/products/python_gateway/lib.html

Please note that programming requires knowledge of the NMEA protocols. A copy of the NMEA 2000 or NMEA 0183 Standard can be obtained from the National Marine Electronics Association (www.nmea.org).

VIII. Device Reset

There are two types of reset: hardware reset and software reset. The Device can also be rebooted by switching it off (disconnecting it from both the USB and NMEA 2000 network, or switching off both NMEA 2000 and USB) and then switching it on again (from USB and/or NMEA 2000).

A hardware reset returns your Device to the state in which it was originally purchased. All settings will be lost and firmware updates will be rolled back. Original files on the internal disk will be restored, all user files will be deleted or overwritten. To reset the Device:

1. Disconnect the Device from NMEA 2000 or turn off the NMEA 2000 power.

2. Connect the Device to USB (to a laptop or just to the power cable) and disconnect during one second. Repeat this four times with at least 2 seconds between connections. There should be no LED signals during this procedure. If there are, it means that you have disconnected the Device too late and need to start the procedure again.

3. Connect the Device to USB for the fifth time and the LED will turn red. Wait about 5 seconds for it to change color to green and disconnect immediately. If you have changed your mind, do not disconnect the Device and wait two seconds for the LED to turn off and the Device to return to normal operation.

4. If you disconnected the Device while its LED was green in the previous step, it will perform the reset procedure the next time it is connected to USB or NMEA 2000 network. This can take up to a minute. During this time, the LED will be red. Do not disconnect the Device until its LED starts flashing to indicate normal operation.

Software reset is the term used for the Python interpreter. You can restart it without cycling the Device and without breaking the terminal session. In the terminal session (see Section VII), abort the current program by pressing Ctrl+C and then press Ctrl+D at the Python interactive prompt (REPL). This will reset the interpreter, and after reset, *boot.py* and *main.py* will be executed. You can reset the interpreter with Ctrl+W instead of Ctrl+D to skip executing of *main.py* at startup.

Appendix A. Troubleshooting

Situation	Possible cause and correction
No LED signals	**1. LED is controlled by user program.** Switch off the Device (disconnect the USB cable and switch off the NMEA 2000 network), and then switch it on again. For one second after switching on, the Device's LED should show a short green signal. All subsequent LED signals can be turned off by the user program. Contact your software supplier. **2. Power supply failure.** The Device can be powered from USB or NMEA 2000. If there is no LED signal after switching on the Device, neither from USB nor from NMEA 2000, it may mean that internal circuits of the Device are damaged and the Device is broken. Otherwise, check and clean the Device's contacts, try to replace the USB or NMEA 2000 cable, making sure that the cables are properly connected at both ends.
Chaotic or unrecognized LED signals	The LED can be controlled by a user program. Contact your software supplier for details. Perform a software reset (see Section VIII) with Ctrl+W (to avoid running *main.py* on startup) to check the LED signals.
Odd behavior of the Device, even when the user program is terminated	The program can use callbacks, which means that its code can still be executed (control LED signals, read and send messages) when it's main cycle is interrupted and the user can type commands in the terminal. Perform a software reset (see Section VIII) with Ctrl+W (to avoid running of *main.py* on startup) to check the behavior of the Device.

Table 3 continued

Situation	**Possible cause and correction**
Application or terminal program cannot open Device serial port	**1. Driver problem.** If you have connected the Device to a new USB port, re-connect it to the previously used port. Check that the USB device is correctly connected and recognized (see Section III). **2. Software problem.** Serial ports are not intended to be used by multiple applications at the same time. Close all applications that can use the Device port. In Linux, check the modem manager settings (after connection, it can open new ports for one minute and the port is not available for use by other applications at that time). Try to reconnect the Device.
Although the terminal program can access the COM port, REPL does not respond to any key press. Software reset does not work.	**1. REPL is controlled by the user program.** The program can request input from the terminal program. Typed characters are not displayed in this case. Contact your software supplier. **2. The Device is stuck in an endless loop.** The user program may cause the machine to get stuck in an infinite loop. Try to remove the files boot.py and/or main.py from the disk. Don't forget to back up the files to a safe location.

Appendix B. Supported NMEA 2000 Messages

This appendix contains messages used in service communication with other devices on the network. «No» in the table below means that the Gateway will not process or send these messages during service communication with other devices. Note that service communications are not affected by user program.

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 (Received / Transmitted), PGN 126464 (0x1EE00)	No	Yes
Heartbeat, PGN 126993 (0x1F011), see Note 2	No	Yes
System Time, PGN 126992 (0x1F010)	Yes	No
Product Information, PGN 126996 (0x1F014)	No	Yes
Configuration Information, PGN 126998 (0x1F016) , see Note 3	No	Yes
GNSS Position Data, PGN 129029 (0x1F805) , see Note 3	Yes	No
Local Time Offset, PGN 129033 (0x1F809) , see Note 3	Yes	No

Note 1: *NMEA 2000 Device Instance, System Instance, Installation Description Field 1 and Installation Description Field 2 can be changed with PGN 126208. It may be supported by some models of chart plotters or this can be done with professional PC software (with a hardware connector to the NMEA 2000 network). If you have Yacht Devices NMEA 2000 Wi-Fi, USB or Ethernet gateways or routers, you can download our free CAN Log Viewer software (runs on Microsoft Windows, Mac OS X and Linux) at http://www.yachtd.com/downloads/.*

Note 2: *The «Equipment Status» field of the Heartbeat message is controlled by the user program (class NMEA2000, method **equipment()**, see the link to library documentation in Section VII).*

Note 3: *These messages are used for real time clock synchronization (class NMEA 2000, method **rtc()**, see the link to library documentation in Section VII). The RTC can also be synchronized by NMEA 0183 ZDA and RMC sentences.*

Appendix C. Device Connectors

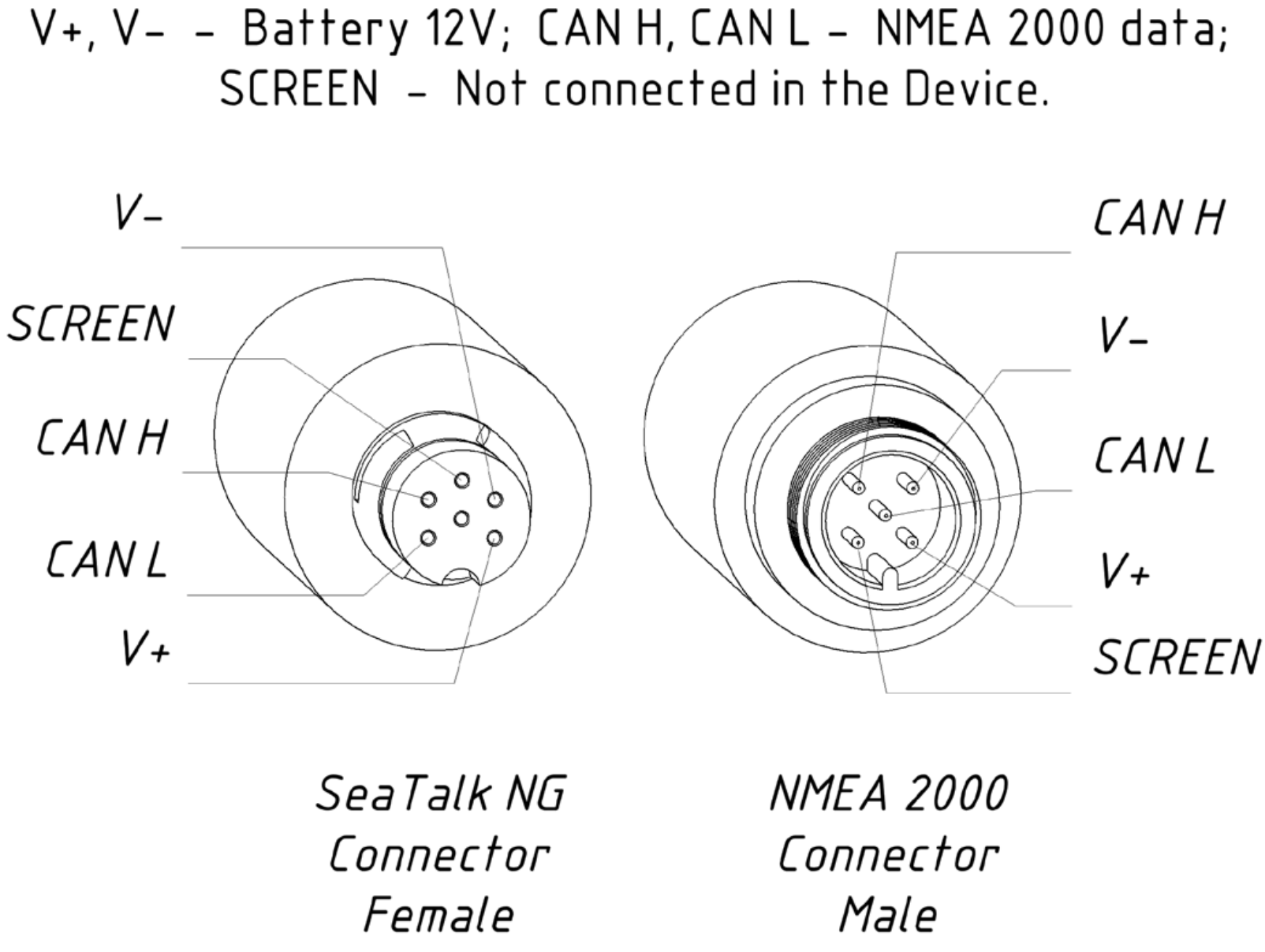


Figure 1. NMEA 2000 connectors of YDPG-01R (left) and YDPG-01N (right) models

The USB connector (type Mini-B female) and NMEA 0183 wires are shown in Figure 1 in the Section I.

NOTES