

Yacht Devices

User Manual

NMEA 2000 Run Indicator YDRI-04N

Firmware version

1.06

2024

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Package Contents

Device	1 pc.
This Manual	1 pc.
Screws	2 pcs.
NMEA 2000 Cable	not supplied

Introduction

This Manual contains information on how to install, configure and operate the Yacht Devices NMEA 2000 Run Indicator YDRI-04 (hereinafter the Device). The Device is intended for use in NMEA 2000 marine electronics networks.

The Device is designed for visualizing and monitoring electrical current and voltage in up to four DC circuits connected to Device's terminals. Voltage and current data can be viewed on NMEA 2000 displays to check the state of manually or automatically switched loads (e.g. bilge pumps, navigation lights) and to monitor if target load is powered with correct voltage and consumes the right current.

You can set "DC type" (Battery, Solar Panel, Wind Generator, etc.), for outgoing PGN 127506 "DC Detailed Status" for each of the 4 DC channels. Device is well-suited to digitize the performance of solar panels and wind generators (up to 200 Watt per channel).

In addition to voltage and current data, the Device can also report the status of DC circuits via both the standard NMEA 2000 Digital Switching PGN 127501 «Binary Status Report» and the proprietary CZone extension.

Device can be set up to turn NMEA 2000 Digital Switching equipment ON or OFF via standard PGNs 127502 «Switch Bank Control» (Yacht Devices products) and «Write Fields» command for 127501 «Binary Status Report» (Maretron / Carling Tech products). For example, you can turn ON one of the relays on the Yacht Devices YDCC-04 unit to switch ON the generator when the battery voltage drops below the set threshold or trigger an alarm on the Yacht Devices YDAB-01 Alarm Button if the bilge pump runs continuously for more than 15 minutes indicating a leak or float switch failure (refer to Section III).

To configure the Device, PC software with NMEA 2000 gateway is required (from ActiSense, Maretron or Yacht Devices; refer to Section V). The firmware of Run Indicator can be updated with a gateway and software from Yacht Devices only.

The Device is equipped with a DeviceNet Micro Male connector. For NMEA 2000 networks with proprietary connectors (e.g. Raymarine SeaTalk NG, or Simrad SimNet), a cable adapter is required.

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, the sale 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 claim 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, nor include 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 or inaccuracies in 3rd party guides and instructions.
7. The Device requires no maintenance. The Device's case is non-dismountable.
8. In an 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 online: <http://www.yachtd.com/>.

I. Product Specification

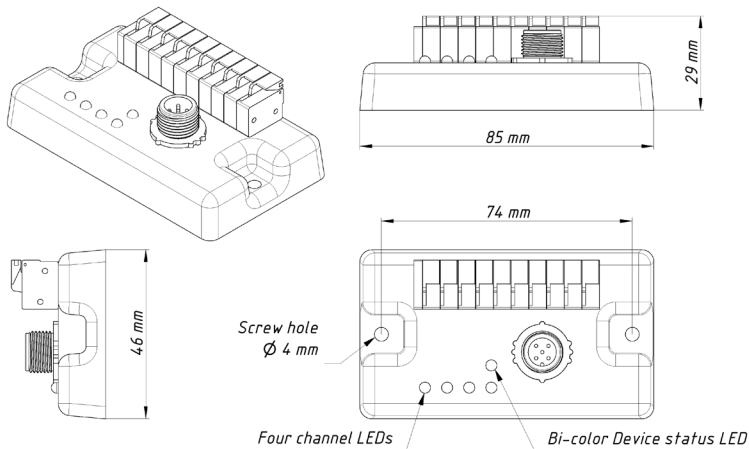


Figure 1. Drawing of YDRI-04

The Device is supplied with a NMEA 2000 Micro Male connector commonly used by a wide range of manufacturers.

Device parameter	Value	Unit
Supply voltage (from NMEA 2000 interface)	7..16	V
Consumption current (NMEA 2000 interface), average / peak	55/65	mA
Load Equivalency Number	2	LEN
Number of monitored DC circuits	4	—
Internal shunt resistance	0,005	Ohm
Maximum DC current on inputs (continuous / peak)	± 10 / 15	A
Current measurement accuracy (below 7A / above 7A)	± 50 / 100	mA
Maximum allowed DC voltage on inputs (in respect to GND input)	40	V
Voltage measurement accuracy	0,1	V
Breakdown voltage between NMEA 2000 network interface and inputs	5000	V _{RMS}
Analog input recommended pin / wire end lug diameter	1,5	mm
Analog input recommended pin / wire end lug length	18	mm
Device case dimensions (LxWxH)	85 x 46 x 29	mm
Weight	85	g
Operating temperature range	-20..+50	°C



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



Dispose of this product in compliance with the WEEE Directive or local regulations. Do not dispose of it with household or industrial waste.

II. Device Installation and Connection



All connections should be made with the power switched off at the circuit breaker. This will prevent accidental short circuits during installation.

The Device requires no maintenance. When deciding where to install the Device, choose a dry mounting location. Despite the fact that the Device's case is waterproof, its wire terminals are open, and seawater can cause corrosion or a short circuit. Do not place the Device where it can be flooded by water, get wet in rain or be sprayed by water.

The Device has two mount holes (see Section I), 4 mm in diameter. Use the supplied screws to fix the Device on a flat surface. The orientation is not important. However, with the wire terminal holes facing downwards, they are better protected from occasional water ingress. The locations of Device connectors, LEDs and terminals are shown in Appendix C.

1. Understanding the Basics

The Device has 4 physical inputs (channels A, B, C and D in and out) and a common ground (GND) to which you connect your boat's DC circuits: loads and/or voltage sources. Each input has two measurement channels: current (A, B, C, D), and voltage (VA, VB, VC, VD). As current and voltage measurements are different in nature, their wiring is also different (see Figure 2).

The primary use of the Device is to monitor DC current and voltage via connected MFDs, PCs or mobile devices. To make your system more flexible and scalable, we have added an expert option: management of NMEA 2000 Digital Switching equipment by user-defined rules.

Depending on the measurement results, the Device can switch ON or OFF any of the 28 «virtual» digital switches in its own bank (which can be read by other NMEA 2000 devices and software to check and display the status of the DC channel) and/or in other banks of Digital Switching devices, e.g. to trigger an audible alarm or switch other equipment ON or OFF (see Section III).

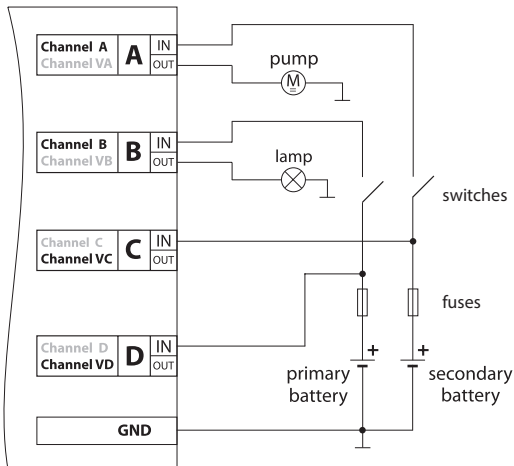


Figure 2. An example connection to DC current loads and voltage sources; note the common ground wire connected to GND input.

You can program rules to manage other equipment using a set of command strings (see Section V). Each of the eight measurement channels may contain up to 8 rules, each rule can be modified and set to be active or inactive.

The factory default rules set the Device to detect the flow of the current (above 0.2 A or below -0.2 A) in DC circuits connected to the Device's four input channels. The result is mapped to channels 1-4 of the Device's own Digital Switching bank, which can be read by other devices, and visualized by channel Status LEDs (see Section V.1).

2. Connecting to monitored DC circuits



Device inputs have no internal overcurrent protection. Each circuit should have a 15 A (max) rated slow-blow fuse (or circuit breaker). To keep the Device's measurement circuits from damage, please establish a reliable connection between a common ground wire and the GND terminal of the Device. A failed common ground connection can damage the Device.

Before connecting the Device to DC circuits, turn off their power supply.

Device has four input channels: A, B, C and D. Each channel has an input and output terminal. Each input channel has two measurement channels, one for current and one for voltage.

You must connect DC circuits to the clamp terminal block (see Appendix C). Crimp an end lug or pin onto the wire end before connecting. Choose a wire gauge according to the load current. Recommended pin/end lug diameter is 1.5 mm, length 18 mm or longer. Always use a marine grade power cable with proper voltage, current, temperature, and water/oil resistance ratings.

The Device measures current between the input and output terminals. Both positive and negative currents can be measured. Positive current values correspond to the current flow direction indicated by the arrows on the Device label (from IN to OUT, see Appendix C).

All monitored DC circuits must share a common ground, which must be connected to the Device's GND terminal. Each load should be connected between the Device's output terminal and the common ground.

Voltage is measured between the measurement channel's input and the common ground.

In the example given in Figure 2, channels A and B are measuring current in pump and lighting circuits, respectively. Channels C and D are wired for measuring voltage of primary and secondary batteries that are feeding both of the loads independently.

3. Connecting to NMEA 2000 Network

The Device should be connected to the NMEA 2000 network backbone with a NMEA 2000 drop cable (not supplied with the Device). The Device is equipped with a DeviceNet Micro Male connector. For NMEA 2000 networks with other connector types, you will need an appropriate adapter cable.

Before connecting the Device, turn off the bus power supply. If you have any questions regarding the use of connecting cables, terminators or connectors, please refer to the following documents:

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

After connecting the Device, close the NMEA 2000 connector lock to ensure its water resistance and reliability.

After you power on your NMEA 2000 network, the Device Status LED gives a short green blink confirming a successful initialization. Three further green flashes indicate a successful connection to the NMEA 2000 network. See the full list of Device's LEDs signals in Section VI.

NMEA devices						X	
Address	Name	Serial	Version	Frames	Rollcall	Pause display	
38	Engine Gate...	00030180	1.17 02/09/2...	1	YES	NMEA messages	
40	NMEA 2000 ...	00601035	1.26 03/04/2...	1	YES	Start recording	
43	Run Indicator...	01230001	1.00 DEV 31/...	405	YES	Save to:	
49	NMEA 2000 ...		1.25 06/02/2...	30	YES	SD 1	
4f	Voyage Rec	00020024	1.24 09/02/2...	1	YES		
bb	Tank Adapter...	00760026	1.04 23/05/2...	1	YES	Refresh	

Figure 3. NMEA devices list on a Raymarine Axiom MFD

The Device information will appear in the list of NMEA 2000 devices (SeaTalk NG, SimNet, Furuno CAN), or in the common list of external devices on your MFD (see picture above). In most models, you can access this list via the «Diagnostics», «External Interfaces», or «External devices» menu.

III. NMEA 2000 Digital Switching Support

The Run Indicator supports NMEA 2000 Digital Switching equipment (via Standard PGN 127501 and 127502). The Device can send commands to turn on/off electrical loads connected to external NMEA 2000 two-state devices (e.g. relay banks).

The Device also has its own internal «virtual» Digital Switching bank with 28 two-state channels. Their statuses are available to other NMEA 2000 devices, and may be used, for example, for indication purposes.

Products described in this Section may become a valuable addition to your Digital Switching system.

1. Yacht Devices NMEA 2000 Circuit Control YDCC-04

Circuit Control has one bank of four latching (bi-stable) relays capable of switching direct current (DC) and alternating current (AC) loads. Run Indicator can be used to monitor amperage in DC loads connected to the YDCC-04, and turn them ON and OFF depending on user rules. For example, you can set up the Run Indicator to switch the load OFF in case of over-current, or switch to a backup battery if the main battery voltage drops below the set threshold.

2. Yacht Devices Alarm Button YDAB-01

The Alarm Button is a universal alarm unit with a built-in 10 Watt sound amplifier that can be connected to a sound speaker and controlled via standard NEMA 2000 Digital Switching PGNs. The Run Indicator can turn ON any of 28 alarm sounds (or even voice messages uploaded by a user) of the Alarm Button. For example, you can activate an alarm when the bilge pump has been running for too long.

3. Yacht Devices NMEA 2000 Wi-Fi Gateway YDWG-02 or Wi-Fi Router YDNR-02

The Gateway or Router can establish its own Wi-Fi network, or connect to the boat's existing Wi-Fi to transfer marine data to mobile devices and laptops. Both have an internal web server with a special web page called «Web Gauges», which allows you to view vessel data from a standard web browser.



Figure 4. Web Gauges screenshot

Device's voltage and current data can be displayed with circular gauges or text databars used for batteries (see Figure 4), or as states of Digital Switching channels (upper bar is green – ON, lower bar is red – OFF). If you have external access to your boat's network, Web Gauges is an ideal solution for remote monitoring of your boat.

The Gateway or Router is also required to update the firmware of the Device (see Section VII), and can be used to configure it.

4. Third-party NMEA 2000 Digital Switching equipment

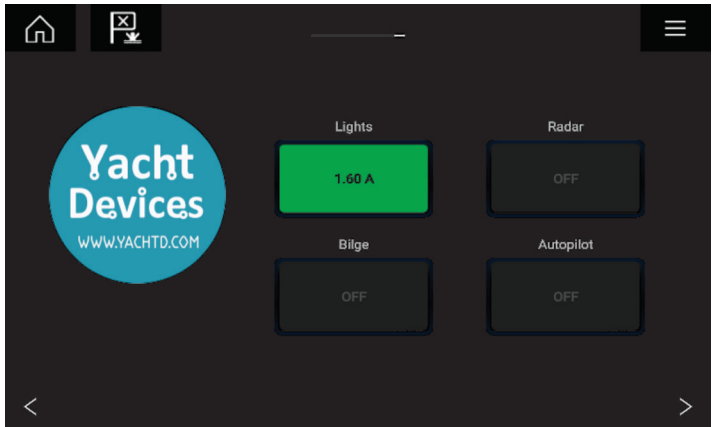
The Device can turn ON and OFF electrical loads connected to third-party NMEA 2000 Digital Switching equipment via standard NMEA 2000 PGNs 127501 and 127502. The Device is compatible with Oceanic Systems, Offshore Systems, Maretron and Carling Tech relay modules (enable via setting YD:MARETRON ON for Maretron and Carling Tech products, see Table 1 in Section V).

The Device cannot be used to control CZone or EmpirBus modules; they use proprietary protocols and cannot be managed with Standard NMEA 2000 messages. However, the Device can be set up to use CZone protocol to visualize electrical loads on MFDs (see IV.1).

IV. Typical Use Cases for the Device

The following examples do not represent a comprehensive list of potential applications for the Device. They are intended to provide an overview of the Device's capabilities in a number of real-life scenarios.

1. Monitor DC circuits on modern MFDs



*Figure 5. Device custom dashboard page on a Raymarine Axiom MFD.
Both current and channel state are transmitted via CZone extension.*

Section VIII describes how to generate a configuration file with your own labels and upload it to your MFD. Support for CZone protocol can be turned off with the YD:CZONE OFF command in Device's settings.

2. Monitor loads on legacy displays

For compatibility with legacy displays, the Device sends voltage and current data in PGN 127508 «Battery Status» which is supported by most NMEA 2000 displays on the market. In this case, loads are visualized as four «virtual» batteries. You can turn off the transmission of PGN 127508 in the Device's settings.

3. Monitor performance of solar panels and wind generators

In the Device's settings, the load type can be set to «Solar Panel» or «Wind Generator», or to any other type supported by NMEA 2000 Standard. In this case, PGN 127506 containing type data will be sent along with PGN 127508 «Battery Status» which contains voltage and current measurements data. In theory, it can lead to displaying of a load in a customized way on an MFD. For example, on a page called «Solar Panels» instead of on a page «Batteries».

However, at this moment we do not know of a chart plotter or display which behaves like this. All known models just ignore the type of DC source, and display solar panels and wind generators as ordinary «batteries».

4. Receive alerts on fresh water system leaks

If there is a leak in the fresh water system, the pump turns on periodically to restore the pressure in the system.

The following is an example command string which programs the Run Indicator to automatically detect current peaks over 0.5 A that happen at least once in each 10-minute interval over the course of an hour:

```
YD:RULE A 1 ON 0 1 >~0.5 3600 INTERVAL 6
```

By this command, rule #1 is set for measurement on channel A: if the current exceeds 0.5 A in absolute value (you need not worry that you mixed up the in and out Device terminals or wires) at least once during each 3600/6 second (i.e. 10 minutes) interval over a time period of 3600 seconds (i.e. 1 hour), turn on channel #1 at the Digital Switching bank #0 (see Section V.1 for details).

This rule may effectively detect large leaks but may accidentally trigger, say, during lunch, when water is actively used. It is better to use 7200 or 9000 second period with the same interval setting (it will be 20 or 25 minutes).

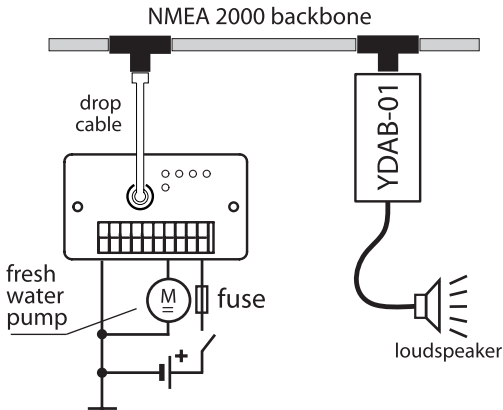


Figure 6. Basic Digital Switching system that provides alerts on fresh water leaks

If the vessel has a NMEA 2000 Alarm Button (see Section III) configured for bank #0 (see Figure 6), the rule will trigger an audio alert. The Alarm Button allows uploading of user sounds or voice messages.

5. Preventing malfunction of a shower pump

On most boats, sailors need to save water and do not to spend much time in the shower. Shower pumps are usually automatically activated, and drain the water in a few minutes. If the pump is on for too long, it can mean that there is a problem with intake or drain pipes, and it can lead to a malfunction.

Let's configure a rule that is triggered if the pump is continuously working for over 20 minutes:

```
YD:RULE B 1 OFF 0 2 >~1.0 1200.00
```

By this command, rule #1 is set for measurement channel B: if the current exceeds 1.0 A in absolute value for a time interval of 1200 seconds, turn OFF channel #2 on bank #0. If you have the Circuit Control (see Section III) configured to bank #0 with the shower pump connected to relay #2, the pump will be turned off by this rule.

```
YD:RULE B 2 ON 1 2 >~1.0 1200.00
```

And if you have an Alarm Button (configured to bank #1), the rule #2 (above) will trigger the sound alert the same time that the Circuit Control stops the pump.

6. Discover short cycling of a bilge pump

In normal conditions, a bilge pump is rarely seen in operation. An excessively short operating cycle may be a sign of hull leakage or other major problems. If your bilge pump switches on too frequently, a properly programmed Run Indicator can switch on an alarm.

The programing is similar to case 4, but the bilge pump may have no periodic intervals due to heeling and rolling through the waves:

```
YD:RULE A 1 ON 0 1 >~0.5 3600 COUNT 10
```

```
YD:RULE A 2 ON 0 1 >~0.5 600
```

Rules #1 and #2 above are triggered when the pump switches on at least 10 times within an hour (3600 seconds), or is continuously switched on for more than 10 minutes (600 seconds).

7. Get the status of ON/OFF switches and voltage-output sensors and transducers

Run Indicator can be used to get the status of the ON/OFF switches, such as jamb switches installed on boat's doors or portholes. You will need to connect one of the switch poles to the fused power source positive rail, the second switch pole to one of the Device's input terminals, and connect Device's GND terminal to the power source ground rail to close the circuit. Power source voltage can be as low as 3.3 Volts. Configure the corresponding Device's voltage measurement channel rules to trigger when the switch is closed (power source voltage is present on the input) or open (no voltage is present). It is recommended to set the voltage threshold approximately at half of the power source voltage level. For example, if +12 Volt power source is used for the door switch, the following rules:

```
YD:RULE VA 4 ON 1 2 >6 1.00
```

```
YD:RULE VA 4 OFF 1 2 <6 1.00
```

Will switch ON the channel 2 at bank 1 if voltage on channel VA is higher than 6 volts (when door switch is ON), and will switch OFF the same channel and bank if the voltage drops below 6V for 1 second (when door switch is OFF).

V. Device Configuration and Settings



Configuration of the Device should not be performed at sea.

NMEA 2000 «Installation Description» data fields are stored in the Device's non-volatile memory and are usually written by installers to specify the device location or to leave notes or contact information. They can be set with a PC software and a corresponding NMEA 2000 gateway hardware. Some models of NMEA 2000 display devices may also allow editing of «Installation Description» data fields. Please refer to your software or chart plotter documentation for details.

The screenshot shows a 'Device Properties' window with the following sections:

- Address Claim:** Address (67), HEX: 43, Unique number (1230001), Manufacturer code (717), Device instance (1), System instance (0), Class / function (35 / 170), Industry (4: Marine), Self-configurable (Yes). Includes an 'Update' button.
- Product Information:** Database version (2.100), Product code (25511), Model version (Run Indicator / YACHTD.COM), Model ID (YORI-04), Software version (1.00 DEV 07/11/2019), Serial (01230001), Certification (Not applicable), LEN (mA) (2 [100 mA]).
- Configuration Information:** Installation description 1, Installation description 2 (YD:DEV 1 DONE), Manufacturer information (Yacht Devices Ltd., www.yachtd.com). Includes an 'Update' button.
- Heartbeat:** CAN1 (checked), CAN2, Equipment (checked), Updated (16:30:57.262).

A 'Refresh' button is located at the bottom of the window.

Figure 7. Configuring the Device with CAN Log Viewer

To configure the Device, enter a special string starting with «YD:» to the «Installation description 2» data field in the Device properties. For example, «YD:DEV 1» (without quotes) will change the NMEA 2000 «Device Instance» of the Device to 1. If the command is accepted by the Device, it will add «DONE» to the entered text and «YD:DEV 1 DONE» will be displayed in return. If a command is entered without the last parameter, the Device replies with the current value of the parameter.

Figure 7 on the previous page shows the process of configuring the Device with free CAN Log Viewer software (to open this window, select the item «NMEA 2000 Devices» in the «View» menu, refresh the list of devices, select the Device and click «Properties» button). You can download this free program (runs on Microsoft Windows, Mac OS X and Linux) at <http://www.yachtd.com/downloads/>, Yacht Devices NMEA 2000 Wi-Fi Gateway, Yacht Devices NMEA 2000 Wi-Fi Router or Yacht Devices NMEA 2000 USB Gateway is required to connect the PC with a NMEA 2000 network.

Table 1 lists all supported commands, note that parameters in square brackets [] can be omitted to obtain the current setting value.

Table 1. List of supported «YD commands»

Syntax	Examples	Description
Device control strings		
YD:RESET	YD:RESET	Resets the Device to factory settings. This command also clears both installation description strings (no answer with «DONE»).
YD:DEV [0..255]	YD:DEV 1	Sets NMEA 2000 Device Instance (0–255). Factory setting: 0.
YD:SYS [0..15]	YD:SYS 2	Sets NMEA 2000 System Instance (0–15). Factory setting: 0.

Table 1 continued

YD:PGN <pgn> [OFF 0 100..60000]	YD:PGN 126993 60000 YD:PGN 127501 10000 YD:PGN 127506 1500 YD:PGN 127508 1500 YD:PGN 127751 1500	Sets the transmission interval for PGNs: 126993, 127501, 127506, 127508 and 127751 (see Appendix B). Values from 100 to 60 000 ms (1 minute) are allowed. Zero value or OFF disables periodic transmission of PGN. Factory settings are shown in the Examples column.
Channel control strings		
YD:DAT <A..D> [0..252 OFF]	YD:DAT A 0 YD:DAT B 1 YD:DAT C 2 YD:DAT D OFF	Sets «Battery Instance» value for outgoing PGN 127508 «Battery Status», «DC Instance» value for PGN 127506 «DC Detailed Status» and «Connection Number» for PGN 127751 «DC Voltage / Current» (0–252) for a specified Device channel (A–D). Factory settings are A=0, B=1, C=2, D=3. OFF value disables sending PGNs 127508, 127506 and 127751 for the selected channel.
YD:TYPE <A..D> [BATTERY ALTERNATOR CONVERTER SOLARCELL WINDGEN UNKNOWN]	YD:TYPE C WINDGEN YD:TYPE A UNKNOWN	Specifies DC Type for PGN 127506 «DC Detailed Status» message. Factory setting for all channels is «UNKNOWN».
Digital Switching related commands		
YD:BANK [0..252]	YD:BANK 0	Sets the Digital Switching bank number for the Device's own bank (0–252). Factory setting is 1. (See Note 1.)
YD:MARETRON [OFF ON]	YD:MARETRON OFF	Sets compatibility mode for Maretron and Carling Tech products. Factory setting is OFF.

Table 1 continued

YD:CZONE [OFF ON AUTO]	YD:CZONE AUTO	Activates CZone support. Factory setting is AUTO. See Section VIII.
YD:DIPSWITCH [DIPSWITCH]	YD:DIPSWITCH 01001110	Sets Device's CZone DIP switch value, binary number (LSB first), 8 characters. Default value is equal to the last two digits (decimal) of the Device's serial number + 1. Use if you got several CZone equipment with the same DIP switch values, choose free (not already used) value for the Device to resolve the DIP switch conflict. Of course, you need to edit CZone configuration (ZCF file) and set this new Device's DIP Switch as well.
YD:DOWNLOAD	YD:DOWNLOAD	Asks MFD to re-send CZone configuration stored on the MFD. Use if you got CZone «Configuration Conflict» error: first, de-configure CZone on all Yacht Devices' CZone-capable units via YD:CZONE AUTO command, then issue command YD:DOWNLOAD. Observe CZone MFD uploads configuration in response. To confirm success, query all Yacht Devices' CZone-capable units with YD:CZONE, should return value ON.
YD:RULE parameters	See V.1	Sets channel rules, see V.1 below
YD:ON parameters	See V.2	Quick command to set rules, see V.2 below

Note 1: If you set another bank for the Device, all rules that have been set for the old bank number are automatically changed to the new bank number.

1. Setting channel rules

YD:RULE command sets rules to turn Digital Switching channels ON and OFF. Each of the four Device input channels has two measurement channels: for current (A, B, C, D) and for voltage (VA, VB, VC, VD), see Figure 2.

Command string syntax is explained in Figure 8. In this example, rule #1 is set for measurement channel A: if amperage exceeds in absolute value 0.5 A (less than -0.5 A or above 0.5 A, current is present and flows in any direction) at least once in each 3600.00/6 second interval, turn ON channel #1 in bank #0.

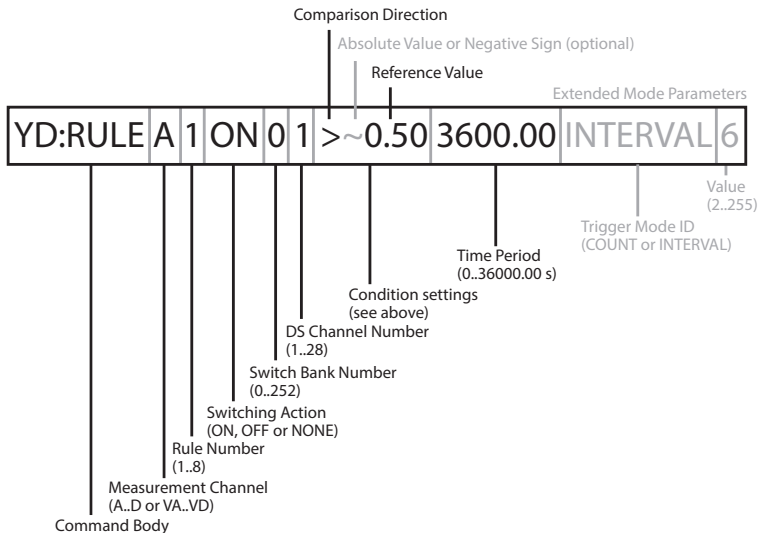


Figure 8. Syntax example of a command for setting channel rules;
non-obligatory parameters are greyed out.

The Device does not measure negative voltage values. Therefore, the absolute value sign (~) is ignored in any conditions related to voltage measurement (in rules for channels VA..VD).

In extended mode, two additional keywords with a numeric value are used:

- **INTERVAL** allows you to detect periodic fluctuations in amperage or voltage. The rule is triggered only if the condition occurs (at least) once within each segment of a specified time period. Duration of a segment is calculated as time period divided by the value (numeric parameter).
- **COUNT** parameter allows you to trigger an action if the condition occurs specified number of times within the specified time period.

For example, this rule:

```
YD:RULE VA 4 OFF 1 2 <5 5.00
```

switches OFF the channel 2 at bank 1 if voltage on channel VA drops below 5V for 5 seconds.

More examples are available in Sections IV.4–IV.6. To get the rule string stored on the Device, type the command with measurement channel name and rule number only. For the example above:

```
YD:RULE VA 4
```

In the factory settings, a pair of rules is set for each of the Device's measurement channels, allowing the Device to detect current or voltage in DC circuits connected to the input channels. Detection results for measurement channels A–D are indicated with channel Status LEDs.

Table 2. Default rules for Device's channels

Device input channel	Measurement channel	Default rules
A	A	YD:RULE A 1 ON 1 1 >~0.20 0.10 YD:RULE A 2 OFF 1 1 <~0.20 0.10
B	B	YD:RULE B 1 ON 1 2 >~0.20 0.10 YD:RULE B 2 OFF 1 2 <~0.20 0.10
C	C	YD:RULE C 1 ON 1 3 >~0.20 0.10 YD:RULE C 2 OFF 1 3 <~0.20 0.10
D	D	YD:RULE D 1 ON 1 4 >~0.20 0.10 YD:RULE D 2 OFF 1 4 <~0.20 0.10
A	VA	YD:RULE VA 1 ON 1 5 >~5.00 0.10 YD:RULE VA 2 OFF 1 5 <~4.00 0.10
B	VB	YD:RULE VB 1 ON 1 6 >~5.00 0.10 YD:RULE VB 2 OFF 1 6 <~4.00 0.10
C	VC	YD:RULE VC 1 ON 1 7 >~5.00 0.10 YD:RULE VC 2 OFF 1 7 <~4.00 0.10
D	VD	YD:RULE VD 1 ON 1 8 >~5.00 0.10 YD:RULE VD 2 OFF 1 8 <~4.00 0.10

Another format of the YD:RULE command allows you to reset or clear all rules for the specified measurement channel, or all channels at once:

```
YD:RULE [V]<A..D | ALL> <RESET | CLEAR>
```

Select a single measurement channel (A..D or VA.VD), or all channels (ALL), then specify RESET parameter to reset all rules to factory defaults, or CLEAR to delete all rules. In the second case, the status LED of the channel will always be unlit (see Section VI).

2. Quick commands

Quick command (see Figure 9 on the next page) sets a pair of rules (which can also be set or modified later with YD:RULE command) for a specified measurement channel: #1 for switching the channel ON, #2 for OFF. With this option, you can quickly set upper and lower current or voltage thresholds to turn on and off the target Digital Switching channel.

When executed, a quick command clears all existing rules (with numbers #2..#6, if they exist) for the specified measurement channel. For example, the command

```
YD:ON A 0 1 5 3 180 COUNT 4
```

clears rules 2-6 for channel A and sets the following rules:

```
YD:RULE A 1 ON 0 1 >~5.00 180.00 COUNT 4
```

```
YD:RULE A 2 OFF 0 1 <~3.00 180.00
```

This is how it works: when the current in the channel A exceeds 5A in absolute value (less than -5A or above 5A) four times within a 180-second interval, rule #1 switches on channel #1 at bank #0. If the current is below 3A in absolute value for a period of 180 seconds, rule #2 switches OFF the specified channel.

Another example command:

```
YD:ON A 6 2 5 4 1600
```

Resulting rules:

```
YD:RULE A 1 ON 6 2 >~5.00 1600.00
```

```
YD:RULE A 2 OFF 6 2 <~4.00 1600.00
```

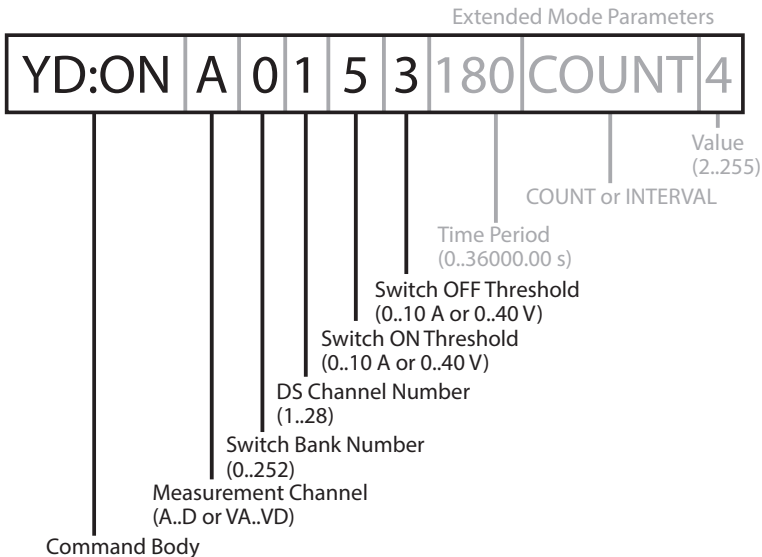


Figure 9. Syntax example of a quick command; non-obligatory parameters are greyed out

VI. LED Signals

The Device is equipped with a two-color red/green Status LED and four channel status LEDs. Their locations are pictured in Appendix C.

1. Signals during power-up

The Device produces one long (half second) flash on the Status LED after powering on. GREEN flash indicates that the Device is successfully initialized.

The Device also briefly turns on all Channel LEDs during the power-up.

After initialization, the Status LED produces three short (quarter of second) GREEN flashes indicating that it has successfully connected to the NMEA 2000 network.

2. Signals during normal operation

During the normal operation, the Device's Status LED emits a short GREEN flash upon a successful transmission of each PGN 127501 «Binary Status Report». The default transmission interval setting for this message is 10 seconds, it can be changed in the Device's settings (refer to Section V). Status LED RED flash indicates an issue with NMEA 2000 communication. Refer to Appendix A.

The Device's Channel LEDs indicate the state of the first four Digital Switching (DS) «virtual» switch statuses of the Device's own DS bank.

In the factory settings, the default channel rules toggle the «virtual» switches (and corresponding Channel LEDs) ON if electric current of more than 0.2A or less than -0.2A is detected in connected DC circuit, OFF otherwise. You can change the LEDs behaviour by modifying the corresponding channel rules (Refer to Section V.1).

3. Signals during firmware update

LED signals during firmware update procedure are described in Section VII.

VII. Firmware Updates

Firmware updates can be done with free CAN Log Viewer software (version 1.31 or later) running on Microsoft Windows, Mac OS X and Linux:

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

The program must be connected to an NMEA 2000 network with a Yacht Devices USB Gateway YDNU-02, or a Wi-Fi Gateway YDWG-02, or an Ethernet Gateway YDEN-02, or a Wi-Fi Router YDNR-02.

You can download the latest firmware version for the Run Indicator from our website:

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

Open the downloaded .ZIP archive with the update and copy the YDRIO4.BIN file to the disk. The README.TXT file inside the archive can contain important information regarding the update.

1. Click the «NMEA 2000 Devices» item in the «View» menu.
2. Click the «Refresh» button (see Figure 10 at the next page) in the opened window and wait for the Device to appear in the list.
3. Select the Device and click the «Firmware Update» button.
4. Locate and select the YDRIO4.BIN update file on the disk.
5. Wait while the firmware is uploading.

If in doubt, see the video with the update procedure on our web site. During the firmware upload, the Device's Status LED flashes RED very fast, with an occasional GREEN flash indicating that the firmware page was received correctly. When the firmware is updated, the Device status LED emits five RED half-second signals and then reboots. CAN Log Viewer also informs you that the update is successfully done.

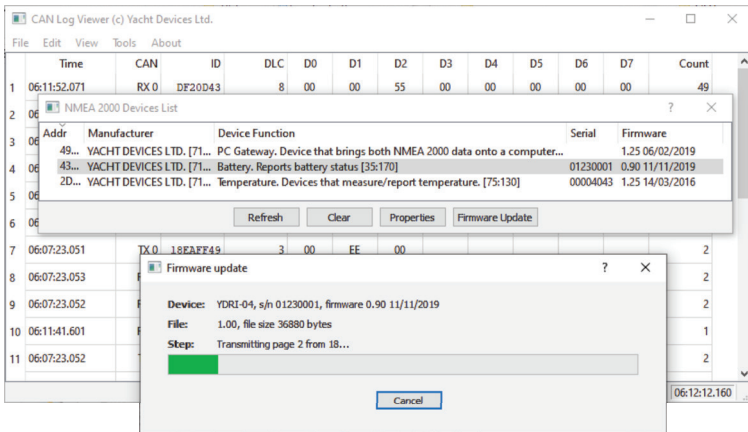


Figure 10. Firmware update with CAN Log Viewer

VIII. Configuring CZone

Most modern NMEA 2000 MFDs / chartplotters still do not support standard Digital Switching PGNs and implement CZone extension instead. On such display devices, you can monitor Device's «virtual» Digital Switching channels statuses via CZone interface. Refer your display device documentation and confirm it supports CZone. If so, you need to enable CZone support on MFD and configure it with CZone configuration file (ZCF file).

On our site we have an online ZCF file generator, visit the Device's product page and follow the link to the generator. B&G, Simrad, Lowrance, Furuno, Garmin, Raymarine Axiom, Axiom Pro, eS and gS series are supported, select your MFD in the list and get the file suitable for your MFD.

Enter all Yacht Devices Digital Switching equipment serial numbers, name the switches and download the file. For most of the MFDs you need only one ZCF file, but for Raymarine Axiom you will also get a «Custom Dashboard» GUI page bundle as well (zip archive, with ZCF file in CZone folder).

If you already have a working CZone system, edit its current configuration (ZCF file) and add our Devices to it using CZone Configuration Tool — carefully add all entries from the generated file «as is».



*Back up your «known good configuration» ZCF files
to avoid irrecoverable configuration loss!*

Our CAN Log Viewer software also can download the current configuration via NMEA 2000 and save it to ZCF file (menu Tools -> Download ZCF file). Double-check your new CZone configuration and make sure you got no DIP Switch conflict (each CZone device should have its unique DIP switch value), change DIP Switches on target devices via ZCF file or manually if necessary.

When ready, check if all CZone-capable units and displays are online and visible in the NEMA 2000 Devices List. Then confirm that all Yacht Devices units are ready to be configured, query each with YD:CZONE command, they should return AUTO. If not, set YD:CZONE AUTO on each.

Upload ZCF file onto the NEMA 2000 bus, either via MFD MicroSD card slot (B&G, Simrad, Lowrance, Garmin, Raymarine) or using CAN Log Viewer, menu Tools -> Upload ZCF file (Furuno MFDs can not upload ZCF files via card slot).

CZone Configuration Tool with a compatible gateway also can be used.

Appendix A. Troubleshooting

Issue	Possible causes and solutions
No LED indication after the NMEA 2000 network is powered on.	<p>1. No power supply on the bus. Check if the bus power is supplied (NMEA 2000 network requires a separate power connection and cannot be powered by a chart 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 NMEA 2000 connector.</p>
No three green blinks on powering on, the Status LED flashes red. Device does not appear in the list of external devices on the plotter. No data comes from the Device.	<p>1. Connectivity issue in the NMEA 2000 network. The network segment is not connected to the chart plotter or there are missing terminators in the network. Plug another device into the selected connector and make sure it appears in the list of devices on the chart plotter.</p> <p>2. There is a NMEA 2000 network connection issue. Loose connection in the data circuit. Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another NMEA 2000 connector.</p>
Missing, unstable or inaccurate current/voltage readings.	<p>1. Loose connection in the monitored circuit. Check the connections, apply contact cleaner spray where necessary.</p> <p>2. Improper wiring. Double check connected circuits, particularly for having a common ground wire connected to the Device's GND terminal. Refer to Section II.</p>
Digital Switching rules do not work as expected	<p>1. Wrong bank number. Check and match bank numbers across connected devices.</p> <p>2. Incorrect settings or rules. Check Device settings and active rules with Can Log Viewer (see Section V.1).</p>

Appendix B. NMEA 2000 Messages

Message name	PGN #	Receive	Transmit	Transmission interval, sec	Note
Acknowledge	59392	Yes	Yes	—	
ISO Request	59904	Yes	Yes	—	
ISO Transport Protocol (DT)	60160	Yes	—	—	
ISO Transport Protocol (CM)	60416	Yes	—	—	
ISO Address Claim	60928	Yes	Yes	—	
ISO Commanded Address	65240	Yes	—	—	
NMEA Group Function	126208	Yes	Yes	—	
PGN List	126464	—	Yes	—	
Heartbeat	126993	—	Yes	60	1
Product Information	126996	—	Yes	—	
Configuration Information	126998	—	Yes	—	
Binary Status Report	127501	Yes	Yes	10	1
Switch Bank Control	127502	Yes	Yes	—	
DC Detailed Status	127506	—	Yes	(1.5)	1, 4
Battery Status	127508	—	Yes	1.5	1, 2
DC Voltage / Current	127751	—	Yes	(1.5)	1, 3

Note 1: You can set the transmission interval for this message (see Section V).

Note 2: Supports complex request messages by Battery Instance.

Note 3: Disabled by default, set non-zero interval with YD:PGN to enable.

Note 4: Transmitted only for channels with the type (YD:TYPE) other than UNKNOWN.

Appendix C. LEDs, Connectors and Terminals

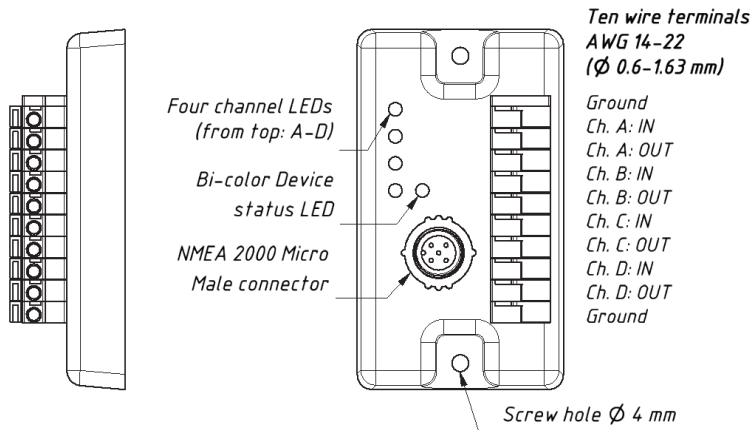


Figure 11. Diagram of the Run Indicator YDRI-04

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

