

To build a wind rose

Voyage Recorder is an affordable, miniature “black box” for a yacht. A Digital Voyage data recorder (VDR) connected to the NMEA 2000 network on your boat serves to record and store boat data. It collects GPS data, wind, depth, temperature, AIS and all other data which flow through the network backbone.

Data collected with the Voyage Recorder can be used to analyze your travels including, for example, the weather conditions throughout the trip. We will use data collected to analyze the wind conditions around the port of Baltiysk, city in the Kaliningrad Region of Russia. More specifically, we will determine the predominant wind direction for this area by building a wind rose.

Using the YDVRCONV program, we can use the data collected in this example to create a CVS file which will in turn be put into Microsoft Excel to make a wind rose. The program from Yacht Devices is available on this page: <http://www.yachtd.com/downloads/> — “PC Software for Voyage Recorder”. (see Figure 1 below).

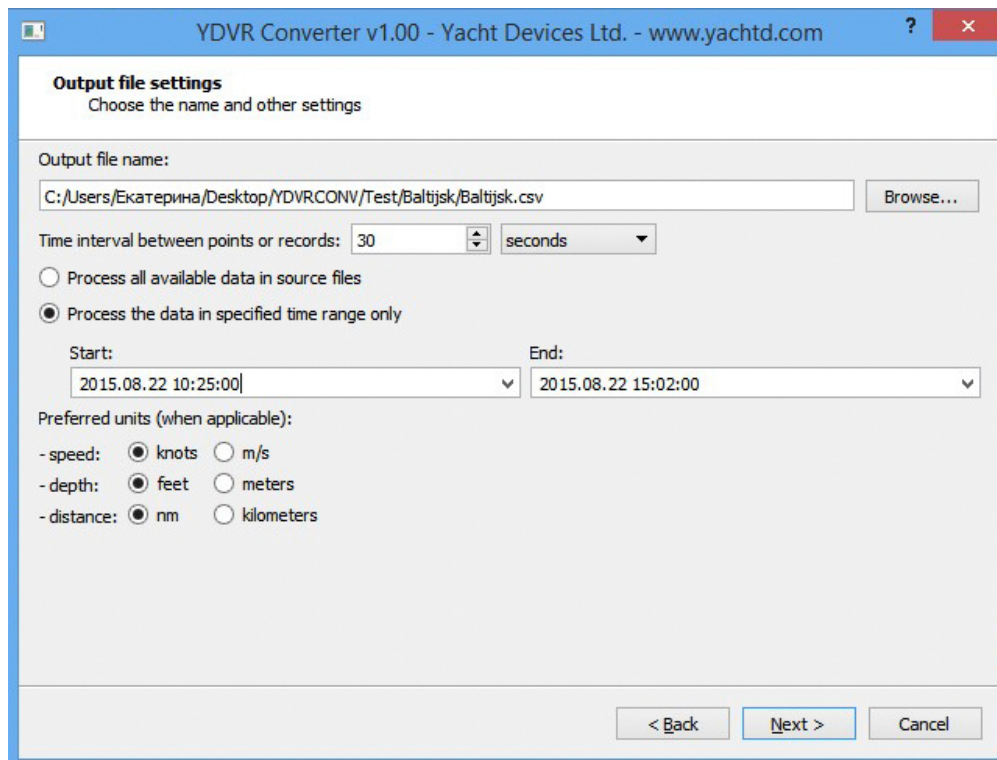


Figure 1

Since the transmitter of the anemometer sends data 10 times per second, to avoid incidental values, we take a measurement interval of 30 seconds (“Time interval between points or record” = 30 seconds).

When the test file is generated, we take data starting at 10:25:00, so that we do not use data taken when the yacht was moving under engine power.

Open the resulting file in Microsoft Excel. On a new sheet in the test file, create a table for 16 wind directions (see Figure 2 below):

	A	B	C	D	E	F
1	From	Direction	To	Total (%)	Total	22,5
2	348,75	N	11,25	0	0	
3	11,25	NNE	33,75	11,44578	57	
4	33,75	NE	56,25	5,62249	28	
5	56,25	ENE	78,75	0,200803	1	
6	78,75	E	101,25	1,807229	9	
7	101,25	ESE	123,75	7,228916	36	
8	123,75	SE	146,25	7,028112	35	
9	146,25	SSE	168,75	1,004016	5	
10	168,75	S	191,25	7,228916	36	
11	191,25	SSW	213,75	27,30924	136	
12	213,75	SW	236,25	16,86747	84	
13	236,25	WSW	258,75	1,204819	6	
14	258,75	W	281,25	0	0	
15	281,25	WNW	303,75	0	0	
16	303,75	NW	326,25	13,05221	65	
17	326,25	NNW	348,75	0	0	
18						

Figure 2. Auxiliary table

First we define an interval for each direction. Each direction will have a sector of $360/16 = 22.5$ degrees. We put that value in cell F1.

Next we calculate the interval for the first direction (N=0). Thus we get the following interval for North:

In the "From" column: **=360-F1/2**

In the "To" column: **= 0+\$F\$1/2**

From the interval now designated as N, we now can fill out the rest of the table in this way:

- the "To" column is populated by adding the size of one direction's sector (22.5°) to the previous value in the column **C3 = C2+\$F\$1;**
- the "From" column is then populated with the value from the previous "To" value, so in our example: **A3=C2;**

and so on, for each direction.

To build the wind rose from the file generated, we use the data from the column TWA (med) — the true wind angle (median). In the auxiliary table, we create two columns: “Total”, and “Total (%)”.

In the “Total” column, we have a count of the number of readings from the source file that occur in each direction. For each direction, the following formula is used:

= COUNTIFS(Baltiysk!\$M:\$M;<>=>&A2;Baltiysk!\$M:\$M;<<<&C2) — this counts the number of cells in the column N = TWA(med) from the Baltiysk sheet, where the values of columns A and C fulfill the conditions described in the auxiliary table for each of the 16 wind directions.

The Total(%) column for each wind direction is a calculated result as a percentage using the formula: **=E2*100/SUM(\$E\$2:\$E\$17)**.

To build a wind rose, we select **Insert/Charts/Radar Chart** at the main menu of Excel, where the data from the “Total%” column is used as the legend, and the axes labels are taken from the “Directions” column (see Figure 3 at the next page).

The result is the following wind rose (see diagram at the next page).

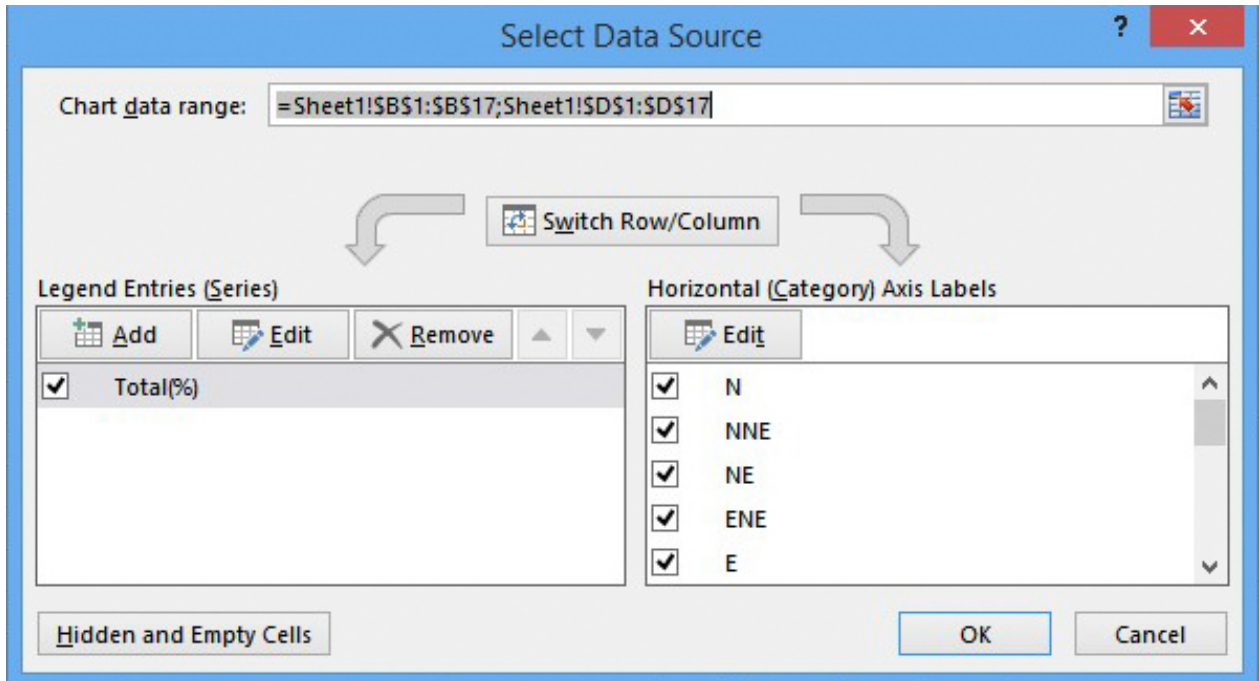


Figure 3. Select Data Source

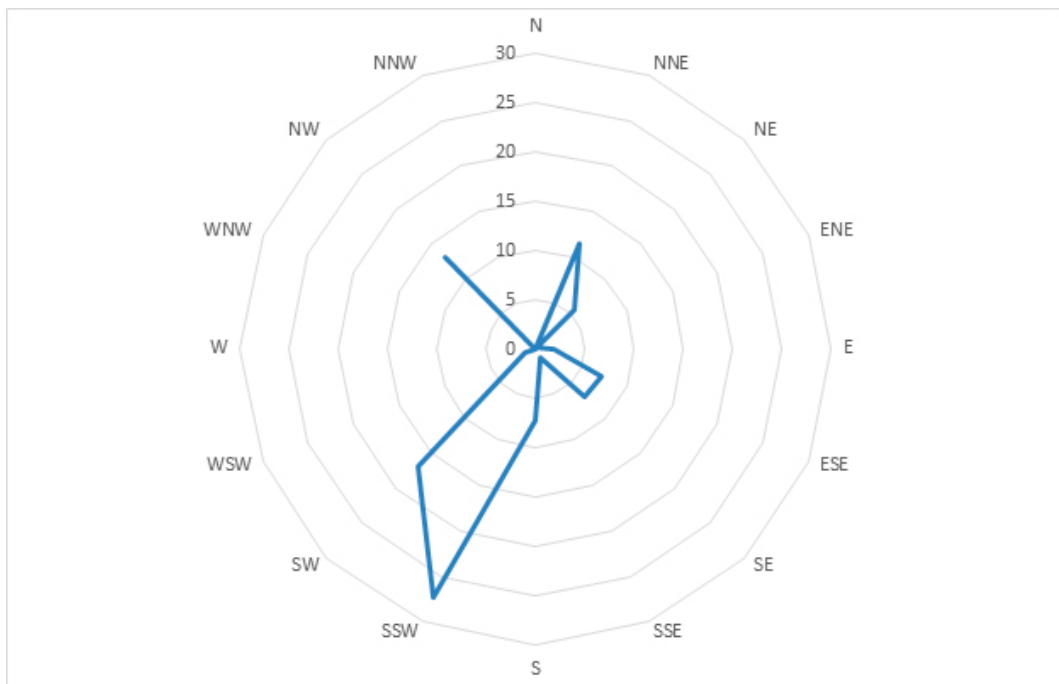


Diagram 1. Wind rose



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 10, 16-32 GB	—
Compatibility of MicroSD card	Unlimited	—
Estimated recording capacity for 16 GB	100..200	days
Automatic overwrite of old data	Yes, by default	—
Recording of data from bus, not less than	99.5	%

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.