Ultrasonic anemometer
DNB105.2

User manual

Updated 04/05/2021

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1 Description

1.1 Main features

DNB105.2 is 2-axes ultrasonic anemometer for measuring wind speed and wind direction.

It is ideal for general meteorological applications requiring high wind speed range, no moving parts for low-maintenance or measurements with fast response even in very low-range wind speed conditions.

Sensor is equipped with compass and the Tilt angles detection system (inclination), to determine the spatial orientation of the anemometer at any time. This allows it to be installed even on mobile vehicles (boats, mobile environmental monitoring vehicles, etc.)

It has two 4÷20 mA analog outputs, one for wind speed and one for wind direction, and one RS485 serial output with Modbus-RTU protocol.

The anemometer can be connected to LSI LASTEM acquisition systems, or any other device using such kind of input.

1.2 Technical specifications

	DNB105.2	
Wind speed	Principle	Ultrasounds
	Measuring range	0÷85 m/s
	Resolution	0.01 m/s
	Accuracy	± 0.2 m/s or ± 2%, the greatest (0÷60 m/s), ± 3% (> 60 m/s)
Wind direction	Principle	Ultrasounds
	Measuring range	0÷359.9°
	Resolution	0.1°
	Accuracy	± 2° RMSE (wind speed > 2 m/s)
Compass And Tilt angle	Resolution	0.05°
	Accuracy	± 1°
General features	Power supply	12÷30 Vdc
	Power consumption	60 mA @ 24 Vdc
	Serial outputs	Isolated RS485
	Communication protocols	Modbus-RTU
	Analog outputs	2 (wind speed and direction) x 4÷20 mA (max. load 500 Ω)
	Electrical connection	19-pole M23 male connector
	Operating temperature	-40÷70 °C (without ice)
	Protection degree	IP 66
	Weight	640 g approx.
	Housing	ASA with aluminum and AISI 316 metal parts
	Mounting	Mast Ø 40 mm external and Ø 36 mm internal
	Data logger compatibility	M-Log (ELO008), R-Log (ELR515), E-Log, A-Log (with ALIEM)

2 Installation

For the installation choose a well-exposed spot for the anemometer. The WMO (World Meteorological Organization) suggests that the sensor should be assembled 10 m off the ground; in a place where the distance between the anemometer and surrounding obstacles which might disturb the measurements is at least 10 times the height of those objects from the ground. As such a position is difficult to find, the WMO suggests that the sensor should be assembled in a spot which is reasonably uninfluenced by local obstructions.

2.1 General safety rules

Please read the following general safety rules in order to avoid injuries to people and prevent damages to the product or to possible other products connected with it. In order to avoid any damages, use this product exclusively according to the instructions herein contained.

The installation and maintenance procedures must be carried-out only by authorized and skilled service personnel.

Power the instrument in a suitable manner. Pay attention and observe the power supplies like indicated for the model in your possession.

Carry-out all connections in a suitable manner. Pay strict attention to the connection diagrams supplied with the instrument.

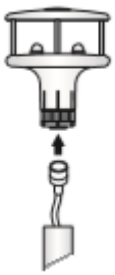
Do not use the product in case of suspected malfunctions. In case of suspected malfunction, do not power the instrument and contact authorized technical support immediately.

Before you carry-out any operation on electrical connections, power supply system, sensors and communication apparatus:

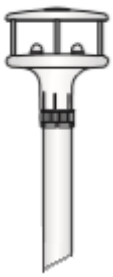
- Disconnect the power supply.
- Discharge the accumulated electrostatic discharges touching an earthed conductor or apparatus.

2.2 Mechanical installation

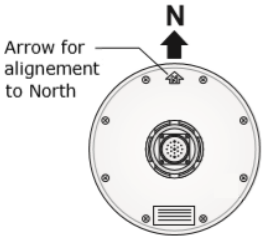
1. Pass the connection cable (DWA8xx.1) inside the support mast and connect the 19-pole M23 female connector of the cable to the 19-pole M23 male connector situated at the bottom of the anemometer. Ensure connection stability by tightening the connector external nut.



2. Mount the anemometer on the mast (Ø 40 mm external and Ø 36 mm internal). In case of mast Ø 50 mm external, the DNB191 adapter should be used.



3. The anemometer does not require positioning as the orientation is determined by the internal compass. However, if the sensor was requested with the compass disabled, it must be positioned with the arrow towards the North and installed in a perfectly vertical position.



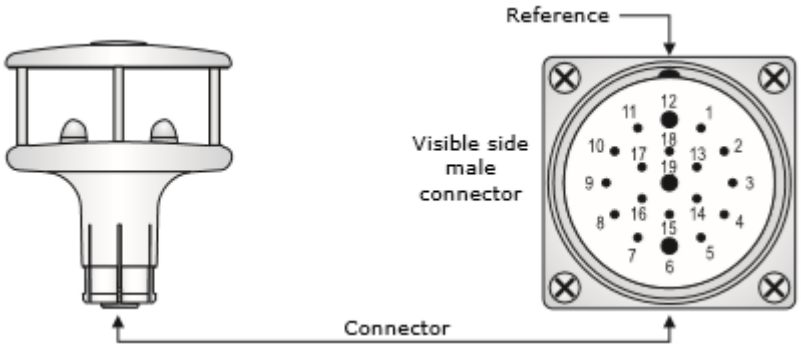
4. Fix it on the support mast by tightening the cable tie at the bottom of the anemometer.

Please note the following:

- The anemometer measures the provenience of the wind.
- The measure refers:
  - to magnetic North if the compass is active (default condition)
  - to geographical North (reference to the arrow) if the compass is disabled
- Geographical North differs from magnetic North indicated by the compass; the difference, called magnetic declination, depends on the area in which the sensor is installed; for example, in North America it is about 15° while in Europe it is less than 3°.

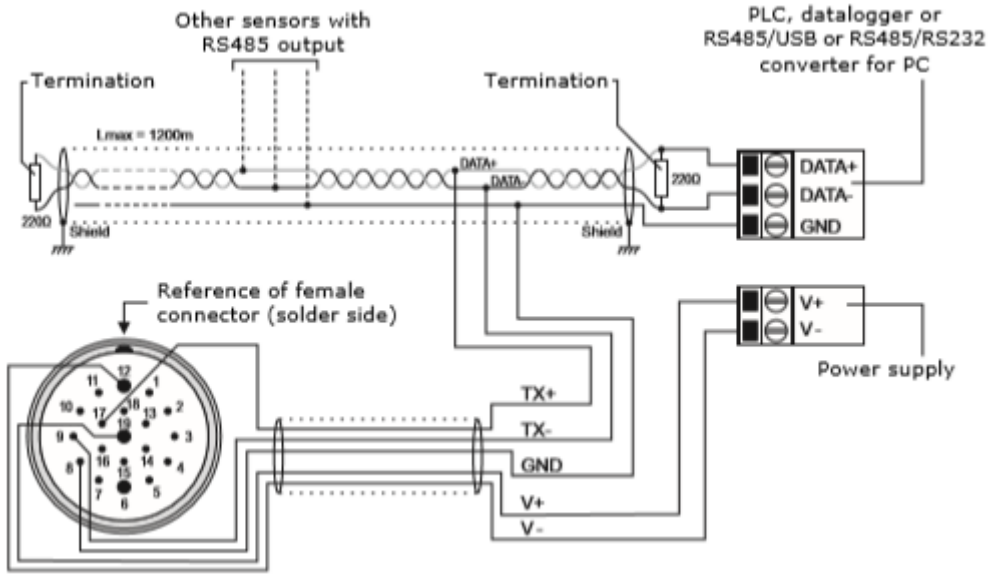
2.3 Electrical connections

All connections are performed through a 19-pole M23 male connector situated at the bottom of the anemometer. The figure and the table below show numbers and function of the connector contacts:



Pin connector	Symbol	Description
1		Not used
2		Not used
3	RX +	Serial receive (input) positive
4	HEAT -	Optional Heater power supply negative
5	HEAT +	Optional Heater power supply positive (24 Vdc)
6	HEAT -	Optional Heater power supply negative
7	HEAT +	Optional Heater power supply positive (24 Vdc)
8	GND	Serial ground (isolated from V –)
9	TX -	Serial transmission (output) negative “DATA –” main RS485 output
10	AUX_B	“DATA +” auxiliary RS485 output (D+)
11	AUX_A	“DATA –” auxiliary RS485 output (D-)
12	V -	Anemometer power supply negative
13	RX -	Serial receive (input) negative
14	OUT 1	Analog output 1 positive
15	GND	Analog ground (isolated from V –)
16	OUT 2	Analog output 2 positive
17	TX +	Serial transmission (output) positive “DATA +” main RS485 output
18		Not used
19	V +	Anemometer power supply positive (12÷30 Vdc)
--	SHIELD	Cable shield

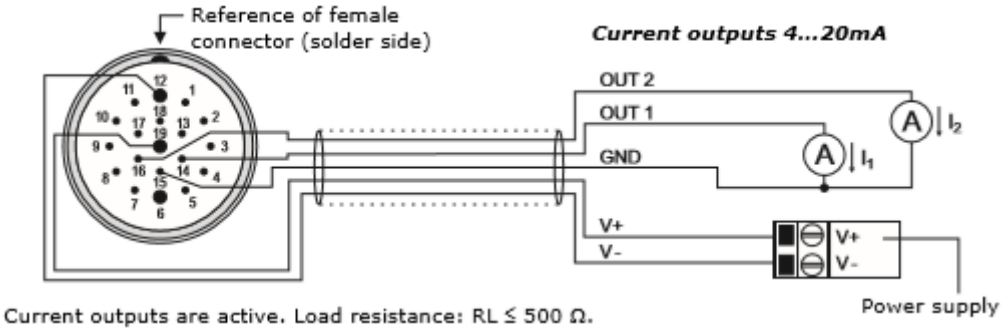
2.3.1 RS485 serial connection



For more information regarding RS485, consult the [EIA (Electronic Industries Association)].

2.3.2 Analog Output connection

OUT 1 and OUT 2 are associated to wind speed and wind direction respectively.



2.3.3 Connection to LSI LASTEM data logger

For the wiring connection see the DISACC210021 supplied with the anemometer.

3 Configuration

The anemometer supplied from LSI LASTEM is ready for working with its data loggers. The table below shows its configuration.

Section	Parameter	Value
General settings	Enabling magnetic compass	Enabled
	Wind speed thresholds	0.2 (m/s)
	Method for calculation of average of wind speed	Vector averaging
	Method for calculation of average of wind direction	0÷359°
	Time interval for the calculation of average	1 s
Measuring Units	Wind speed	m/s
Resolution (number of decimals)	Wind speed	2
Analog outputs	AN1 AN2	Wind speed Wind direction (0-359°)
	Offset and direction	4÷20 mA
	Full scale of wind speed analog output	85 m/s
Operation mode	Mode	Modbus-RTU
Modbus-RTU	Address	1
	Baud rate	19200
	Interface	RS485
	Parity and stop bits	8E1
	Waiting time after transmission	Wait 3.5 characters

For changing some operating parameter, contact LSI LASTEM.

4 Modbus-RTU

The Modbus function code 04h (Read Input Registers) allows reading the values measured by the anemometer. The following table lists the Input Registers available.

Register number	Quantity	Format
1	Instantaneous wind speed (x100)	unsigned 16 bits
2	Instantaneous wind direction in degrees (x10)	unsigned 16 bits
3	Sonic temperature measured by the transducers pair of the X axis (x10)	16 bits
4	Sonic temperature measured by the transducers pair of the Y axis (x10)	16 bits
5	Average of the two sonic temperatures measured by the two transducers pairs (x10)	16 bits
9	Compass angle in degrees (x10)	unsigned 16 bits
11	Average wind speed (x100)	unsigned 16 bits
12	Average wind direction in degrees (x10)	unsigned 16 bits
18	Status register bit0=1 ⇒ Speed measurement error bit1=1 ⇒ Not used bit2=1 ⇒ Not used bit3=1 ⇒ Not used bit4=1 ⇒ Pressure measurement error bit5=1 ⇒ Not used	unsigned 16 bits
19	Wind speed unit of measurement bit0=1 ⇒ m/s bit1=1 ⇒ cm/s bit2=1 ⇒ km/h bit3=1 ⇒ kn bit4=1 ⇒ mph	unsigned 16 bits
20	Temperature unit of measurement 0 ⇒ °C 1 ⇒ °F	unsigned 16 bits
25	Tilt_Y in degrees (x10)	16 bits
26	Tilt_X in degrees (x10)	16 bits

Note: for quantities with configurable measurement unit, the measurement value is expressed in the unit set in the anemometer.

For additional information regarding the protocol, visit the website www.modbus.org.

5 Maintenance

5.1 Testing

This type of testing is only required if the user wishes to verify the well functioning of each part of the anemometer. Please note that these tests are not intended to establish the operational limitations of the sensor.

Visual check

- body of the anemometer is in a level position
- there are no foreign objects in the transducer area

Operational check for 4÷20 output

To check the current output you need a multimeter and an air flow (you can use a hair dryer).

1. Set the multimeter to measure signals in direct current (DC) and 20 mA scale.
2. Referring to DISACC210021, connect the multimeter to the first output (wind speed) and power on the anemometer.
3. Place the sensor where there are not wind flows (0 m/s) and read 4 mA on the multimeter.
4. Subject the sensor to the air flow and read a value grater then 4 mA on the multimeter.
5. Connect the multimeter to the second output (wind direction).
6. Subject the sensor to the air flows with the angles 0, 90, 180 and 270° checking the corresponding current values as indicated in the following table:

Air flow provenience (°)	Output (mA)
0 (or 360)	4 (or 20)
90	8
180	12
270	16

Operational check for RS485 Modbus-RTU output

Verification of the digital output (RS485) can be done using a PC, equipped with a RS485 serial port (or a RS232/RS485 serial converter) and in which the third-party program *modpoll* (https://www.modbusdriver.com/modpoll.html) is installed. For the air flow you can use a hair dryer.

1. Connect the anemometer to the PC using RS485 and serial ground wires and power on the sensor.
2. Open a DOS Prompt window and type the following command (it is assumed that the transmission parameters are set as follows: *Baudrate: 19200 bps*, *Parity: Even* and that the PC serial port used is COM1):

   modpoll -a 1 -r 1 -c 2 -t 3 COM1 [Enter]

   For the list of available commands, type the command *modpoll /help*.
   [CTRL] + [C] to stop the program.

3. Subject the sensor to the air flows with the angles 0, 90, 180 and 270°. The program displays the values of *Wind speed* and *Wind direction*. The first value is in m/s and multiply by 100, the second in ° and multiply by 10. Here an example with a polling rate of 5 seconds:

```
modpoll 3.1 - FieldTalk(tm) Modbus(R) Master Simulator
Copyright (c) 2002-2011 proconX Pty Ltd
Visit http://www.modbusdriver.com for Modbus libraries and tools.

Protocol configuration: Modbus RTU
Slave configuration...: address = 1, start reference = 1, count = 2
Communication.....: COM1, 19200, 8, 1, even, t/o 1.00 s, poll rate 5000 ms
Data type.....: 16-bit register, input register table

-- Polling slave... (Ctrl-C to stop)
[1]: 8
[2]: 1291
-- Polling slave... (Ctrl-C to stop)
[1]: 463
[2]: 92
-- Polling slave... (Ctrl-C to stop)
[1]: 488
[2]: 791
-- Polling slave... (Ctrl-C to stop)
[1]: 576
[2]: 1764
-- Polling slave... (Ctrl-C to stop)
[1]: 484
[2]: 2668
-- Polling slave... (Ctrl-C to stop)
[1]: 454
[2]: 3459
```

4. Then type the following command:

modpoll -a 1 -r 18 -c 1 -t 3 COM1 [Enter]

5. To test the integrity of the wind speed measurement. The value 62 (binary 111110) indicates that the measurement of register 1 (§4) is correct.

5.2 Periodic maintenance

The absence of moving parts minimizes the sensor maintenance.

- Clean the anemometer paying attention at two pairs of transducers oriented along two orthogonal axes.

LSI LASTEM suggests to check the anemometer calibration every 2 years.

6 Accessories / Spare parts

Code	Description
DWA810.1	Cable L = 10 m
DWA825.1	Cable L = 25 m
DWA526.1	Cable L = 50 m
MDMMA1010.1	MSB – Modbus Sensor Box (Output RS485 Modbus-RTU, Power supply: 10÷30 Vac/dc)

7 Disposal

This product is a device with high electronic content. In accordance with the standards of environmental protection and collection, LSI LASTEM recommends handling the product as waste of electrical and electronic equipment (RAEE). For this reason, at the end of its life, the instrument must be kept apart from other wastes.

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of this product, safeguarding the rights of the consumer. Unauthorized disposal of this product will be punished by the law.

8 How to contact LSI LASTEM

In case of problem contact the technical support of LSI LASTEM sending an e-mail to support@lsi-lastem.com, or compiling the technical support request module at www.lsi-lastem.com.

For further information refer to addresses and numbers below:

- Phone number +39 02 95.414.1 (switchboard)
- Address: Via ex S.P. 161 – Dosso n. 9 - 20049 Settala Premenugo, Milano
- Web site: www.lsi-lastem.com
- Commercial service: info@lsi-lastem.com
- After-sales service: support@lsi-lastem.com, Repairs: riparazioni@lsi-lastem.com