Multiparameter *All-In-One* Weather Sensors

User manual

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1 About the manual

This manual gives detailed purpose, function and operation method of the product. Before using the product, please carefully read and understand the contents of this manual to ensure correct use of the product, and to ensure the safety of the patient and operator.

The manual introduces the product in the most complete configuration and therefore, part of the contents may be not applicable to the product you purchase. If you have any concerns, please contact the company.

The manual applies only to the use and reading by professionally trained clinical staff, and the operator shall have a wealth of expertise and years of clinical experience.
All illustrations provided in the manual are for reference purpose only, as the setting or data in the illustration may not entirely consistent with the actual display you see in the product.

Symbols in the Manual:

⚠ **Caution**	Caution warns you of a potential hazard. If you not read and follow instructions carefully at this point, the product could be damage or important data could be lost.
⚠ **Warning**	Indicates a danger; prompting potentially dangerous or unsafe operation. Failure to comply with the requirements of this manual may result in death or serious personal injury and property damage.
⚠ **Note**	Prompting potentially dangerous or unsafe operation. Failure to comply with the requirements of this manual may result in minor personal injury and property damage. Suggesting important information about the operation and use.

2 Introduction

This manual covers the LSI LASTEM *Multiparameter All-In-One Weather Sensors* for meteorological applications, which can provide 2D wind speed and direction, temperature, humidity, atmospheric pressure, precipitation, solar radiation, dew point (starting from sensors with SN later than 21251100) and other meteorological parameters measurements.

Compact serie				
P/N (with RS485 output)	**DNB200**	**DNB201**	**DNB202**	**DNB205**
P/N (with RS232 output)	**DNB200.2**	**DNB201.2**	**DNB202.2**	**DNB205.2**
P/N (with heater and RS485 output)				**DNB205.1**
P/N (with RS485 output, LM type)	**DNB200.LM**	**DNB201.LM**		**DNB205.LM**
P/N (with heater, RS485 output, LM type)				**DNB205.1.LM**
P/N (with heater, RS485 output, LM type)				**DNB205.1.RK**
				
Wind speed	X	X	X	X
Wind direction	X	X	X	X
Air Temperature	X	X	X	
Relative Humidity	X	X	X	
Pressure	X	X	X	
Solar radiation			X	
Rain		X		
Dew point	X	X	X	
Material	Luran			
Power consumption mA@12 V DC	12	30	18	11
Heating (P/Ns with heater)	Sensor & Shell			
Size (mm)	170x126	195x126	228x126	110x126
Weight (kg)	0.7	0.75	0.95	0.5
Mounting	Support to poles Ø 38 ÷ 52 mm (included)			

Tab. 1 – AIO compact series specifications.

Standard serie					
P/N (with RS485 output)	**DNB300**	**DNB301**	**DNB302**	**DNB305**	**DNB304**
P/N (with RS232 output)	**DNB300.2**	**DNB301.2**	**DNB302.2**	**DNB305.2**	**DNB304.2**
P/N (with heater and RS485 output)	**DNB300.1**	**DNB301.1**	**DNB302.1**	**DNB305.1**	**DNB304.1**
P/N (with RS485 output, LM type)				**DNB305.LM**	
P/N (with heater, RS485 output, LM type)				**DNB305.HLM**	
					
Wind speed	X	X	X	X	
Wind direction	X	X	X	X	
Air Temperature	X	X	X		
Relative Humidity	X	X	X		
Pressure	X	X	X		
Solar radiation			X		
Rain		X			X
Dew point	X	X	X		
Material	Aluminium				
Power consumption mA@12 V DC	12	30	18	11	25
Heating (P/Ns with heater)	Sensor & Shell				Not supported
Size (mm)	234x160	240x160	290x160	180x160	132x160
Weight (kg)	1.5	1.5	1.65	1.5	1.05
Mounting	Support to poles Ø 50 mm (DYA040.4 not included)				

Tab. 2 – Specification of the standard series AIO with digital output.

Standard serie	
P/N (with 4÷20 mA output)	**DNB306**
P/N (with heater and 4÷20 mA output)	**DNB306.1**
	
Wind speed	X
Wind direction	X
Air Temperature	
Relative Humidity	
Pressure	
Solar radiation	
Rain	
Material	Aluminium
Power consumption mA@12 V DC	11
Heating (P/Ns with heater)	Sensor & Shell
Size (mm)	180x160
Weight (kg)	1
Mounting	Support to poles Ø 50 mm (DYA040.4 not included)

Tab. 3 – Specification of the standard series AIO with current output.

Compact serie							
P/N	WS + WD	T + RH + Press + Dew point*	Rad	Rain	Heater	Output	
						RS232	RS485
DNB200	X	X					X
DNB200.2	X	X				X	
DNB200.LM	X	X					X
DNB201	X	X		X			X
DNB201.2	X	X		X		X	
DNB201.LM	X	X		X			X
DNB202	X	X	X				X
DNB202.2	X	X	X			X	
DNB205	X						X
DNB205.1	X				X		X
DNB205.2	X					X	
DNB205.LM	X						X
DNB205.1.LM	X						X
DNB205.1.RK	X						X

Tab. 4 – AIO compact series.

Standard serie								
P/N	WS + WD	T + RH + Press + Dew point*	Rad	Rain	Heater	Output		
						RS232	RS485	4÷20 mA
DNB300	X	X					X	
DNB300.1	X	X			X		X	
DNB300.2	X	X				X		
DNB301	X	X		X			X	
DNB301.1	X	X		X	X		X	
DNB301.2	X	X		X		X		
DNB302	X	X	X				X	
DNB302.1	X	X	X		X		X	
DNB302.2	X	X	X		X	X		
DNB304				X			X	
DNB304.2				X		X		
DNB305	X						X	
DNB305.1	X				X		X	
DNB305.2	X					X		
DNB305.LM	X						X	
DNB305.HLM	X				X		X	
DNB306	X							X
DNB306.1	X				X			X

Tab. 5 – AIO standard series.

*Starting from sensors with SN later than 21251100.

3 Installation

3.1 Before installation

⚠ **Warning**

To protect the people (and the device), a lightning rod should be installed with the tip at least one meter above weather sensor. The rod must be properly grounded, compliant with all applicable local safety regulations.

⚠ **Note**

Installations on top of high buildings or masts and in sites on opening grounds are vulnerable to lightning strikes. A nearby lightning strike may induce a high-voltage surge not tolerable by the internal surge suppressors of the instrument.
Additional protection is needed in regions with frequent, severe thunderstorms, especially when long line cables (> 30m) are used.

Positioning

Finding a right place for AIO sensors is important for getting representative ambient measurements. Select a place that represents the general area of interest. Follow the WMO Guide to Meteorological Instruments and Methods of Observation WMO No. 8.
It is important to take into account the geography and surrounding area to achieve optimum performance. Trees, buildings, or other objects situated near AIO sensors disturb free airflow and thus affect the accuracy of the measurement results.
Ideally, wind sensors should be higher than any other object within a horizontal radius of 10 time the difference between the sensor highness and the highness of any surrounding higher object.

3.2 Mounting Kit

Depending on the different AIO sensor type, a variety of mounting options are available. Users can be flexible selecting according to actual needs, but must ensure that the instrument is placed vertically, fixed firmly.

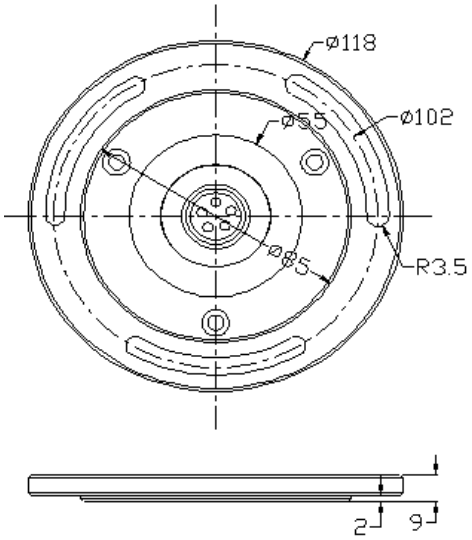
Compact series

	Compact series sensors come with its own flange for pole Ø 38 ÷ 52 mm

Standard series

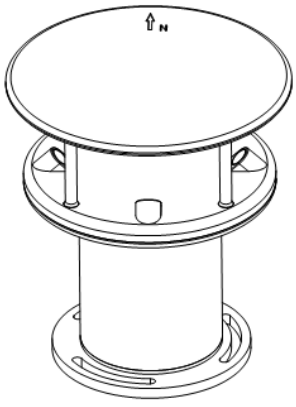
	Standard series sensors can be fixed to pole Ø 38 ÷ 52 mm using the flange. It is possible to fix the sensor on a customize plate, see the Mounting flange dimensions
	Flange

3.3 Mounting flange dimensions



3.4 Wind direction alignment

Before fixing the instrument, weather sensor should be aligned to the geographic North.
Rotate the sensor to point the arrow to the true north.



3.5 Cables

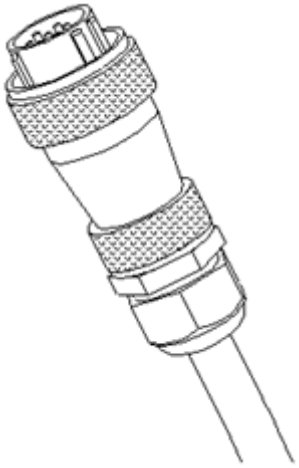
DWA054	Cable/L=5m/DNB20x-DNB30x
DWA104	Cable/L=10m/DNB20x-DNB30x
DWA254	Cable/L=25m/DNB20x-DNB30x
DWA056	Cable/L=5m/DNB20x.1-DNB30x.1
DWA106	Cable/L=10m/DNB20x.1-DNB30x.1
DWA256	Cable/L=25m/DNB20x.1-DNB30x.1
DWA058	Cable/L=5m/DNB306-DNB306.1
DWA108	Cable/L=10m/DNB306-DNB306.1
DWA258	Cable/L=25m/DNB306-DNB306.1
DWA831.1	Cable/L=5m/DNB20x-30x/RS485/Dual-Head
DWA832.1	Cable/L=10m/DNB20x-30x/RS485/Dual-Head
DWA833.1	Cable/L=25m/DNB20x-30x/RS485/Dual-Head

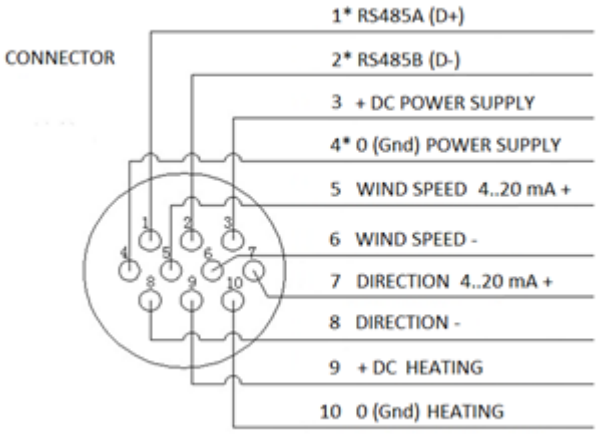
Dual-head cable is required to connect, on the same bus, two sensors with RS485 digital output (e. g. DNB302 + DNB304). Distance between two sensors is L.3 m. The sensors must have a unique device address.

3.5.1 10-Pin cable

Cable No.	*Signal Definition*	*Remarks*
Power		
3	+DC Power supply	12 ÷ 30 V DC Note: if the sensor has the RS232 output, pin 4 is RS232 Gnd
4	0 (Gnd) Power supply / RS232 Gnd	
9	+DC Heating	24 V DC @ 10 A
10	0 (Gnd) Heating	
Analog Output (wind sensors with analogue output only)		
5	Wind Speed+	Analog voltage or current or pulse signal output(optional)
6	Wind Speed-	
7	Wind Direction+	Analog voltage or current or pulse signal output(optional)
8	Wind Direction-	
Digital Output		
1	RS485A (D+) / RS232 Tx	According to the sensor output type. It is used to connect DCS, D/A converter module and other terminals
2	RS485B (D-) / RS232 Rx	

Connection Diagram





* If the sensor has the RS232 output, the pins are:
1 – RS232 Tx, 2 – RS232 Rx, 4 – RS232 Gnd

4 Communication Protocol

Weather sensors support the following communication protocols:

- ASCII
- MODBUS RTU (DEFAULT: sensors are supplied using the Modbus RTU protocol)

The protocol has been preconfigured at the factory according to the requirements specified when ordering weather sensors.

4.1 ASCII

Text-based communication with devices is possible using ASCII protocol.
ASCII protocol is network-compatible and serves exclusively for online data requests. The device will not respond to incomprehensible ASCII commands.
Use the ASCII protocol to change sensor parameter such as communication speed and device address, via a PC and serial communication software, such as RealTerm.

> ⚠ **Note**
>
> **To prevent accidental modification of system parameters, the configuration settings of the sensors are protected by default. For details, please see the chapter 4.1.2.**

4.1.1 Factory Settings

The default values for weather sensors are:

- Interface: RS232 or RS485, according to P/N (see Tab. 4 and Tab. 5)
- Speed: 9600 bps
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None
- Device address: 01 hex (33 hex for DNB304 = 51 dec)

4.1.2 Locking/unlocking the configuration

To prevent accidental modification of system parameters, the configuration settings of the sensors are locked by default.

Before making any configuration changes, you must first unlock the configuration by sending the following command:

```
$01wr 23456\r\n
```

Once the configuration has been unlocked, you can send the desired configuration command. For example, to set the baud rate to 19200 bps:

```
$01Z 19200\r\n
```

After all configuration changes have been completed successfully, it is recommended to lock the configuration again to prevent unintended modifications:

```
$01wr 0\r\n
```

If the sensor is not unlocked, these changes will not be retained after a power cycle.

> ⚠ **Note**
>
> **If the sensor is not unlocked, these changes will not be retained after a power cycle.**

4.1.3 Command Details (excluding DNB304)

Command	*Description*	*Response*	*Example*
$AAN<CR><LF>	Device S/N reading. AA = the device address.	>S/N<CR><LF>	Send: $01N<CR><LF> Response: >180121<CR><LF> Device S/N: 180121
$AAM<CR><LF>	Device type reading. AA = the device address.	>type<CR><LF>	Send: $01M<CR><LF> Response: >AR200<CR><LF> Device ID: AR200
%AANN<CR><LF>	Change the device address. AA = the old address. NN = the new address. Default Address: 01 hex.	!NN<CR><LF>	Send: %0109<CR><LF> Response: >!09<CR><LF> 01: Old address 09: New address
%FF01<CR><LF>	Reset the device address to 01.	!01<CR><LF>	Send: %FF01<CR><LF> Response: !01
$AAZ BR<CR><LF>	Baud rate setting. AA = the device address. BR = baud rate (default is 9600).	Nothing happens	Send: $01Z 19200<CR><LF> Response:
$AAZ<CR><LF>	Baud rate reading. AA = the device address. To use after baud rate setting.	>BR<CR><LF>	Send: $01Z<CR><LF> Response: >19200<CR><LF> Baud rate:19200
#AA0<CR><LF>	Wind speed value reading. AA = the device address.	>Value<CR><LF>	Send: #010<CR><LF> Response: >0.1<CR><LF> Unit: m/s
#AA1<CR><LF>	Wind direction value reading. AA = the device address.	>Value<CR><LF>	Send: #011<CR><LF> Response: >20.3<CR><LF> Unit: degrees
#AA2<CR><LF>	Relative Humidity value reading. AA = the device address.	>Value <CR><LF>	Send: #012<CR><LF> Response: >61.2 <CR><LF> Unit: %

#AA3<CR><LF>	Air Temperature value reading. AA = the device address.	>Value<CR><LF>	Send: #013<CR><LF> Response: >27.6<CR><LF> Unit: °C
#AA4<CR><LF>	Barometric Pressure value reading. AA = the device address.	>Value<CR><LF>	Send: #014<CR><LF> Response: >997.2<CR><LF> Unit: hPa
#AA<CR><LF>	All parameters reading. AA = the device address.	>Value1,Value2,Value3,…<CR><LF> Value1: wind speed Value2: wind direction Value3: air humidity Value4: air temperature Value5: barometric pressure Value6: minute rainfall Value7: hour rainfall Value8: day rainfall Value9: total rainfall Value10: solar radiation Value 11 ÷Value19: reserved Value 20: dew point Value >= 21: reserved	Send: #01<CR><LF> Response: >0.70,9.16,44.08,22.66,1001.44,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00 ,0.00,0.00,0.00,0.00,9.81,0.00,0.00,0.00,0.00<CR><LF> Unit: m/s,degree,%,℃,hPa,mm,mm,mm,mm,W/m^2,-,-,-,-,-,-,-,-,℃,-,…
#AAAC<CR><LF>	Measured values reading. AA = the device address.	>Value1,Value2,Value3,Value4,Value5,Value6,Value7,Value8,Value9,Value10,Value11<CR><LF> Value1: wind speed Value2: wind direction Value3: air humidity Value4: air temperature Value5: barometric pressure Value6: minute rainfall Value7: hour rainfall Value8: day rainfall Value9: total rainfall Value10: solar radiation Value11: dew point	Send: #01AC<CR><LF> Response: >4.1,97.0,78.5,29.4,994.3,0,0,0,0,99<CR><LF> Unit: m/s,degree,%,℃,hPa,mm,mm,mm,mm,W/m^2

<CR> is Carriage Return.

<LF> is Line Feed.

After the changes, switch off the device and switch it on again after one minute.
If the sensor address and/or baud rate are changed, it is recommended to identify the sensor with the new values.

4.1.1 Command Details for DNB304

Command	*Description*	*Response*	*Example*
$AAN<CR><LF>	Device S/N reading. AA = the device address.	>S/N<CR><LF>	Send: $33N<CR><LF> Response: >180123<CR><LF> Device ID: 180123
$AAM<CR><LF>	Device type reading. AA = the device address.	>type<CR><LF>	Send: $33M<CR><LF> Response: >MPR100<CR><LF> Device type: MPR100
%AANN<CR><LF>	Change the device address. AA = the old address. NN = the new address. Default Address: 33 hex.	>NN<CR><LF>	Send: %3302<CR><LF> Response: >02<CR><LF> 33: Old address 02: New address
%FF01<CR><LF>	Reset the device address to 01.	!01<CR><LF>	Send: %FF01<CR><LF> Response: !01
$AAZ BR<CR><LF>	Baud rate setting. AA = the device address. Default baud rate = 9600.	Nothing happens.	Send: $33Z 19200<CR><LF> Response:
$AAZ<CR><LF>	Baud rate reading. AA = the device address. To use after baud rate setting.	>BR<CR><LF>	Send: $33Z<CR><LF> Response: >19200<CR><LF> Baud rate: 19200
#AA0<CR><LF>	Minute rainfall reading. AA = the device address.	>value<CR><LF>	Send: #330<CR><LF> Response: >0.21<CR><LF> Minute rainfall: 0.21 mm
#AA1<CR><LF>	Hour rainfall reading. AA = the device address.	>value<CR><LF>	Send: #331<CR><LF> Response: >0.21<CR><LF> Hour rainfall: 0.21mm
#AA2<CR><LF>	24 Hour rainfall reading. AA = the device address.	>value<CR><LF>	Send: #332<CR><LF> Response: >0.21<CR><LF> 24 Hour rainfall: 0.21 mm

#AA3<CR><LF>	Total rainfall reading. AA = the device address.	>value<CR><LF>	Send: #333<CR><LF> Response: >0.21<CR><LF> Total rainfall: 0.21 mm
#AAA<CR><LF>	All rainfall reading. AA = the device address.	>value1,value2,value3,value 4<CR><LF>	Send: #33A<CR><LF> Response: >0.21,0.24,0.56,0.58<CR><LF> Minute rainfall: 0.21 mm Hour rainfall: 0.24 mm 24 Hour rainfall: 0.56 mm Total rainfall: 0.58 mm

<CR> is Carriage Return.

<LF> is Line Feed.

After the changes, switch off the device and switch it on again after one minute.
If the sensor address and/or baud rate are changed, it is recommended to identify the sensor with the new values.

4.2 Modbus (factory default)

4.2.1 Factory Settings

The default values for sensors are:

- Interface: RS232 or RS485, according to P/N (see Tab. 4 and Tab. 5)
- Speed: 9600 bps (19200 bps for LM and HLM models)
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None
- Check Mode: CRC-16
- Device address: 01 hex (33 hex for DNB304 = 51 dec)

4.2.2 Transmission Format

-Read Data Message

Function Code: 0x03 (Read Holding Registers) or 0x04 (Read Input Registers)

Request Format:

Address	*Function Code*	*Register Start Address*	*Register Numbers*	*CRC-16*
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Return Format:

Address	*Function Code*	*Length of Data*	*Data*	*CRC-16*
1 byte	1 byte	1 byte	Numbers of Data	2 bytes

-Write Data Message

Function Code: 0x06.

Request Format:

Address	*Function Code*	*Register Start Address*	*Register Numbers*	*CRC-16*
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Return Format:

Address	*Function Code*	*Length of Data*	*Data*	*CRC-16*
1 byte	1 byte	2 bytes	2 bytes	2 bytes

4.2.3 Registers definition for standard sensor

# Register	*Register Address*	*Measure*	*Format value*	*Unit*
1	0-1	Wind Speed	32-bit floating point	m/s
3	2-3	Wind Angle	32-bit floating point	Degree
5	4-5	Temperature	32-bit floating point	℃
7	6-7	Relative Humidity	32-bit floating point	%
9	8-9	Pressure	32-bit floating point	hPa
11	10-11	Minute Precipitation	32-bit floating point	mm
13	12-13	Hour Precipitation	32-bit floating point	mm
15	14-15	Day Precipitation	32-bit floating point	mm
17	16-17	Total Precipitation	32-bit floating point	mm
19	18-19	Radiation Intensity	32-bit floating point	W/m^2
39	38-39	Dew Point	32-bit floating point	℃

Registers are read Most-Significant Byte (MSB) first. 32-bit floating-point values are encoded per IEEE Standard 754. For floating point format variables, each data point appears twice because two 16-bit addresses are required to hold a 32-bit float value. The 16 bit Most Significant Word (MSW) is in the lower address of the register pair, while the least Significant Word (LSW) is in the upper address.

The precipitation values refer to the total amount of rain calculated by the sensor at the time of the Modbus inquiry, considering the acquired values starting from the beginning of the periods for this calculation. For example, if the Modbus request is at 8:30 am, you will have the following data:

- "Minute precipitation": total rain from 8:29 to 8:30
- "Hour precipitation": total rain from 7:31 to 8:30
- "Day precipitation": total rain from 8:31 of the previous day to 8:30
- "Total precipitation": total rain since the starting time of the measurement

So, if you want to have the total daily rainfall (day precipitation), you have to make the Modbus request exactly at 0:00.

To produce accurate rain totals, it is recommended to use the "Total precipitation" value and calculate the difference between two measurements taken at the beginning, and at the end, of the period under interest. Example: to have 10 minutes total rain at 10.00, produce (by the external software) the difference value between the total precipitation at 10.00 and 9.50. Using LSI LASTEM data logger, this is not required.

4.2.4 Registers definition for LM and HLM sensors

The definition below applies to LM and HLM Modbus sensors (e. g. DNB305.LM).

# Register	*Register Address*	*Measure*	*Format / Scaling factor*	*Unit*
11	10	Relative Humidity (act.)	16-bit signed integer / 10	%
12	11	Relative Humidity (min.)	16-bit signed integer / 10	%
13	12	Relative Humidity (max.)	16-bit signed integer / 10	%
14	13	Relative Humidity (avg.)	16-bit signed integer / 10	%
15	14	Relative Air Pressure (act.)	16-bit signed integer / 10	hPa
16	15	Relative Air Pressure (min.)	16-bit signed integer / 10	hPa
17	16	Relative Air Pressure (max.)	16-bit signed integer / 10	hPa
18	17	Relative Air Pressure (avg.)	16-bit signed integer / 10	hPa
19	18	Wind Direction (act.)	16-bit signed integer / 10	Degree
20	19	Wind Direction (min.)	16-bit signed integer / 10	Degree
21	20	Wind Direction (max.)	16-bit signed integer / 10	Degree
22	21	Wind Direction (vct.)	16-bit signed integer / 10	Degree
23	22	Wind Direction fast	16-bit signed integer / 10	Degree

# Register	*Register Address*	*Measure*	*Format / Scaling factor*	*Unit*
28	27	Global Radiation (act.)	16-bit signed integer / 10	W/m^2
29	28	Global Radiation (min.)	16-bit signed integer / 10	W/m^2
30	29	Global Radiation (max.)	16-bit signed integer / 10	W/m^2
31	30	Global Radiation (avg.)	16-bit signed integer / 10	W/m^2
32	31	Air Temperature (act.)	16-bit signed integer / 10	'C
33	32	Air Temperature (min.)	16-bit signed integer / 10	'C
34	33	Air Temperature (max.)	16-bit signed integer / 10	'C
35	34	Air Temperature (avg.)	16-bit signed integer / 10	'C
36	35	Dew Point (act.)	16-bit signed integer / 10	'C
37	36	Dew Point (min.)	16-bit signed integer / 10	'C
38	37	Dew Point (max.)	16-bit signed integer / 10	'C
39	38	Dew Point (avg.)	16-bit signed integer / 10	'C

# Register	Register Address	Measure	Format / Scaling factor	Unit
43	42	Wind Speed (act.)	16-bit signed integer / 10	m/s
44	43	Wind Speed (min.)	16-bit signed integer / 10	m/s
45	44	Wind Speed (max.)	16-bit signed integer / 10	m/s
46	45	Wind Speed (avg.)	16-bit signed integer / 10	m/s
47	46	Wind Speed (vct.)	16-bit signed integer / 10	m/s
48	47	Wind Speed fast	16-bit signed integer / 10	m/s
49	48	Precipitation abs.	16-bit unsigned integer / 100	mm
50	49	Precipitation diff.	16-bit unsigned integer / 100	mm

# Register	Register Address	Measure	Format / Scaling factor	Unit
63	62	Wind Speed (act.)	16-bit signed integer / 10	mph
64	63	Wind Speed (min.)	16-bit signed integer / 10	mph
65	64	Wind Speed (max.)	16-bit signed integer / 10	mph
66	65	Wind Speed (avg.)	16-bit signed integer / 10	mph

# Register	Register Address	Measure	Format / Scaling factor	Unit
84	83	Wind Speed (act.)	16-bit signed integer / 10	km/h
85	84	Wind Speed (min.)	16-bit signed integer / 10	km/h
86	85	Wind Speed (max.)	16-bit signed integer / 10	km/h
87	86	Wind Speed (avg.)	16-bit signed integer / 10	km/h

The measurement values are mapped to the 16-bit registers using scaling factor. Those expressed in the "signed integer" format (-32768 ÷ 32767) must be divided by 10 while those expressed in the "unsigned integer" format (0 ÷ 65535) must be divided by 100.

Little Endian applies when transmitting word: first the LowByte (LSB) and then the HighByte (MSB).

Note

The "act", "min," max "and" avg "registers contain the last acquired value of the measurement.
The precipitation value is contained in register number 49. The value is a counter. When the sensor is switched on it is equal to zero and increases when a rain event is recognized. It returns to zero when the sensor is restarted or when it reaches the value 65535.

4.2.5 Registers definition for RK sensors

The definition below applies to RK Modbus sensors (e. g. DNB205.1.RK).
Below are the registers for reading the measurements.

# Register	Register Address	Measure	Data type	Data length (byte)	Scaling factor	Unit
82	81	Wind Direction	Unsigned integer	2	1	°
83	82	Wind Speed	Unsigned integer	2	100	m/s

The measurement values are mapped to the 16-bit registers using scaling factor. The *Wind direction* represents the real value (it should be divided by 1) while the *Wind speed* must be divided by 100.

Little Endian applies when transmitting word: first the LowByte (LSB) and then the HighByte (MSB).

Below are the registers for reading/writing some sensor parameters.

# Register	*Register Address*	*Parameter name*	*Data type*	*Data length (byte)*	*Remark*
65	64	Baud rate (bps)	Unsigned integer	1	0=1200 1=2400 2=4800 3=9600 4=14400 5=19200 6=28800
66	65	Serial port parameters (data bit, parity, stop bit)	Unsigned integer	1	0=8, None, 2 1=8, Odd, 1 2=8, Even, 1 3= 8, None, 1
67	66	Sensor address	Unsigned integer	1	1÷255

After a write operation, switch off the device and switch it on again after one minute.
If the sensor address and/or baud rate are changed, it is recommended to identify the sensor with the new values.

4.2.6 Testing Modbus communication definition

For testing Modbus communication, you can use *modpoll* utility. It is a free command line software.
Below the command for query the first 10 values of the DNB302 sensor connected to the PC Com1 and its answer:

modpoll.exe -a 1 -r 1 -c 10 -t 4:float -b 9600 -p none -l 1000 com1

```
modpoll 3.4 - FieldTalk(tm) Modbus(R) Master Simulator
Copyright (c) 2002-2013 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 = 10
Communication.....: com1, 9600, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 32-bit float, output (holding) register table

-- Polling slave... (Ctrl-C to stop)
[1]: 0.000000
[3]: 0.000000
[5]: 24.222656
[7]: 61.142670
[9]: 1001.200012
[11]: 0.000000
[13]: 0.000000
[15]: 0.000000
[17]: 0.025400
[19]: 0.025400
-- Polling slave... (Ctrl-C to stop)
[1]: 0.000000
[3]: 0.000000
[5]: 24.222656
[7]: 61.142670
[9]: 1001.200012
[11]: 0.000000
[13]: 0.000000
[15]: 0.000000
[17]: 0.025400
[19]: 0.025400
-- Polling slave... (Ctrl-C to stop)
…
```

Here the command for query DNB304 sensor:

modpoll.exe -a 51 -r 11 -c 4 -t 4:float -b 9600 -p none -l 1000 com1

```
modpoll 3.4 - FieldTalk(tm) Modbus(R) Master Simulator
Copyright (c) 2002-2013 proconX Pty Ltd
Visit http://www.modbusdriver.com for Modbus libraries and tools.

Protocol configuration: Modbus RTU
Slave configuration...: address = 51, start reference = 11, count = 4
Communication.....: com1, 9600, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 32-bit float, output (holding) register table

-- Polling slave... (Ctrl-C to stop)
[11]: 0.000000
[13]: 0.000000
[15]: 0.000000
[17]: 0.000000
-- Polling slave... (Ctrl-C to stop)
[11]: 0.000000
[13]: 0.000000
[15]: 0.000000
[17]: 0.025400
-- Polling slave... (Ctrl-C to stop)
…
```

Here the command for query the *Wind direction* of DNB205.LM sensor:

modpoll.exe -a 1 -r 19 -c 5 -t 4 -b 19200 -p none -l 1000 com1

```
Protocol configuration: Modbus RTU
Slave configuration...: address = 1, start reference = 19, count = 5
Communication.....: com1, 19200, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 16-bit register, output (holding) register table

-- Polling slave... (Ctrl-C to stop)
[19]: 3512
[20]: 3512
[21]: 3512
[22]: 3512
[23]: 3512
-- Polling slave... (Ctrl-C to stop)
[19]: 3512
[20]: 3512
[21]: 3512
[22]: 3512
[23]: 3512
-- Polling slave... (Ctrl-C to stop)
…
```

And the command for query the *Wind speed* of DNB205.LM sensor:

modpoll.exe -a 1 -r 43 -c 6 -t 4 -b 19200 -p none -l 1000 com1

```
Protocol configuration: Modbus RTU
Slave configuration...: address = 1, start reference = 43, count = 6
Communication.....: com1, 19200, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 16-bit register, output (holding) register table

-- Polling slave... (Ctrl-C to stop)
[43]: 14
[44]: 14
[45]: 14
[46]: 14
[47]: 14
[48]: 14
-- Polling slave... (Ctrl-C to stop)
[43]: 14
[44]: 14
[45]: 14
[46]: 14
[47]: 14
[48]: 14
-- Polling slave... (Ctrl-C to stop)
…
```

Here the command for query the *Wind direction* and the *Wind speed* of DNB205.1.RK sensor:

modpoll.exe -a 1 -r 82 -c 2 -t 3 -b 9600 -p none -l 1000 com1

```
Protocol configuration: Modbus RTU
Slave configuration...: address = 1, start reference = 82, count = 2
Communication.....: com1, 9600, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 16-bit register, input register table

-- Polling slave... (Ctrl-C to stop)
[82]: 99
[83]: 21
-- Polling slave... (Ctrl-C to stop)
[82]: 96
[83]: 28
-- Polling slave... (Ctrl-C to stop)
…
```

And finally, the commands for changing to 3 the *Sensor address* of DNB205.1.RK sensor:

modpoll -a 1 -r 67 -c 1 -t 4 -b 9600 -p none -1 com1 3

```
Protocol configuration: Modbus RTU
Slave configuration...: address = 1, start reference = 67, count = 1
Communication.....: com1, 9600, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 16-bit register, output (holding) register table

Written 1 reference.…
```

Pay attention! In modpoll the address parameter must be expressed in decimal.

5 Maintenance

In general, the sensors are maintenance-free. However, an annual functional test is recommended. The following points deserve attention:

- Visual inspection regarding soiling of the sensor
- Checking the condition of the cable
- Checking the sensor with a measured value

Regular cleaning of the glass dome is recommended for device with radiation and rainfall measurements. The cleaning interval depends on the local pollution conditions.

In addition, it is recommended the device be calibrated and inspected annually by the LSI LASTEM.

If the sensor is well accessible it can be checked while remaining installed. If not, or particular contamination is detected, the sensor should be removed. Mark the sensor orientation to the North before removing it.

5.1 Cleaning

Proceed according to the measurements generated by the sensor.

Wind speed and wind direction
Gently clean with a damp cloth the ultrasonic transducer section in order to remove accumulated dust. Transducer can be cleaned using cotton swab.

Air temperature and relative humidity
The thermohygrometer shield can be cleaned using various size of cotton swab. The harder dirty parts can be removed with the stick without the cotton.
It is not recommended to use compressed air so as not to push the dirt particles into the protective metal mesh.

Solar radiation / rain
Remove dirty from the dome on the top of the sensor using a damp cloth. Be care to do not scratching the dome.

5.2 Checking measured values

Measurement values can be checked using an equivalent portable instrument.

A precise check can be performed in the LSI LASTEM laboratories.

6 Handling

Avoid the introduction of electrostatic discharge (ESD). The product, or part of it, is fragile, avoid mechanical shocks, abrasions or scratches on the surface and dome (if present). Avoid to touch the transducers.

7 Storage, packaging, preservation, delivery, disposal

For storage, respect the humidity (5÷100% non-condensing) and temperature (-40÷70 °C) limits. Avoid direct sun exposure.
For delivery and storage, use the packaging supplied with the product.
For preservation, it is recommended to respect the environmental limits of humidity (15÷80% non-condensing) and temperature (-30÷60 °C).
Upon receipt of the material, visually check the package for signs of crushing or perforation; in the presence of these signs, check the integrity of the product inside.



This item is a highly electronic scientific device. In accordance with the standards of environmental protection and collection, LSI LASTEM advises to handle the product as waste of electrical and electronic equipment (WEEE). It is therefore not to be collected with any other kind of waste.

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of the product, safeguarding the rights of the consumer. Unauthorized disposal will be punished by the law. Dispose of the dead batteries according to the regulations in force.

Recycle or dispose of the packaging material according to local regulations.

8 Safety

For safety regulations please refer to manual INSTUM_05290.

9 Technical Specifications

9.1 AIO sensors (excluding models DNB205.x, DNB305.x and DNB306.x)

		Compact Series	Standard Series
Wind speed	Type	Ultrasonic	Ultrasonic
	Range	0 ÷ 60 m/s	0 ÷ 60 m/s
	Accuracy	±0.3 m/s 5% (0.02...35 m/s) 10% (>35 m/s)	±0.2 m/s 3% (0,02...35 m/s) 5% (>35 m/s)
	Resolution	0.1 m/s	0.1 m/s
Wind direction	Type	Ultrasonic	Ultrasonic
	Range	0 ÷ 360°	0 ÷ 360°
	Accuracy	±3° (>1 m/s)	±2° (>1 m/s)
	Threshold	0.02 m/s	0.01 m/s
	Resolution	0.1°	0.1°
Temperature	Type	Diode voltage	Diode voltage
	Range	-40 ÷ 80 °C	-40 ÷ 80 °C
	Accuracy	±0.5 °C	±0.5 °C
	Resolution	0.1 °C	0.1 °C

		Compact Series	Standard Series
RH%	Type	Capacitive	Capacitive
	Range	0 ÷ 100%	0 ÷ 100%
	Accuracy	3%	3%
	Resolution	0.1%	0.1%
Pressure	Type	Piezoresistor	Piezoresistor
	Range	600 ÷ 1100 hPa	600 ÷ 1100 hPa
	Accuracy	±0.5 hPa @ 25°C	±0.5 hPa @ 25°C
	Resolution	0.1 hPa	0.1 hPa
Solar Radiation	Type	Photodiode	Photodiode
	Spectral range	300 ÷ 3000 nm	300 ÷ 3000 nm
	Range	0 ÷ 2000 W/m^2	0 ÷ 2000 W/m^2
	Resolution	1 W/m^2	1 W/m^2
	Accuracy	5%	5%
	Temperature response	5%	5%
	Directional error 0<θ<80°	<±10 W/m^2 (@ 1000 W/m^2)	<±10 W/m^2 (@ 1000 W/m^2)
	Non-linearity deviat.	Max 3% (0...1000 W/m^2)	Max 3% (0...1000 W/m^2)
Rain total	Type	Optical	Optical
	Measurement	Rain total: mm/min, mm/hr, mm/day, total	Rain total: mm/min, mm/hr, mm/day, total
	Range of measurement	0÷400 mm/hr	0÷400 mm/hr
	Accuracy	0.3 mm or 3%	0.3 mm or 3%
	Resolution	0.02 mm/hr	0.02 mm/hr

Common features		
Output	Digital	RS-232, RS-485
	Protocols	Modbus RTU (factory default), ASCII
Power supply	Power supply	12 ÷ 30 V DC
	Heating	24 V DC @ 5 A (24 V DC @ 1.4 A for DNB205.1 and DNB205.1.LM)
Warm-up	Time	10 seconds
Polling rate	Digital output	> 250 ms
	Analog output	> 500 ms
Cable	Connector	10 pin aerospace type
	Cable	Not included
Protection	Housing protection	IP66 (with mounting kit attached)
Operative conditions	Temperature	-40 ÷ 70 °C
	Humidity	5 ÷ 100% RH

9.2 DNB205.x, DNB305.x and DNB306.x sensors

		DNB205.x	DNB305.x / DNB306.x
Wind speed	Type	Sonic 2-Axis (U-V)	Sonic 2-Axis (U-V)
	Range	0 ÷ 60 m/s	0 ÷ 60 m/s
	Accuracy	±0.3 m/s or 5% (0.02...35 m/s)	± 0.2 m/s or 3% (0.02...35 m/s)
	Resolution	0.1 m/s	0.1 m/s
Wind direction	Type	Sonic 2-Axis (U-V)	Sonic 2-Axis (U-V)
	Range	0 ÷ 360°	0 ÷ 360°
	Accuracy	±3° (>1 m/s)	±2° (>1 m/s)
	Threshold	0.2 m/s	0.2 m/s
	Resolution	1°	0.1°

Common features		
Output	Digital	RS-485 (DNB205, DNB305, DNB305.1) RS-232 (DNB205.2, DNB305.2)
	Protocols	Modbus RTU (factory default), ASCII
Power supply	Power supply	12 ÷ 30 V DC
	Heating	24 V DC @ 5 A
Warm-up	Time	10 seconds
Polling rate	Digital output	> 250 ms
	Analog output	> 500 ms
Cable	Connector	10 pin aerospace type
	Cable	Not included
Protection	Housing protection	IP66 (with mounting kit attached)
Operative conditions	Temperature	-40 ÷ 70 °C
	Humidity	5 ÷ 100% RH

10 Declaration of conformity

Oggetto / *Subject*

Codice prodotto / Product code: DNB200, DNB200.2, DNB201, DNB201.2, DNB202, DNB202.2, DNB205, DNB205.2, DNB205.LM, DNB300, DNB300.1, DNB300.2, DNB301, DNB301.1, DNB301.2, DNB302, DNB302.1, DNB302.2, DNB304, DNB305, DNB305.1, DNB305.2, DNB305.LM, DNB305.HLM, DNB306, DNB306.1

Descrizione / *Description*

Serie di anemometri a ultrasuoni / *Series of ultrasonic anemometer*

Fabbricante / *Manufacturer*

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Dichiarazione / *Declaration*

Dichiariamo che i prodotti oggetto di questo documento sono stati progettati in accordo e compatibilmente alle seguenti Direttive Europee e norme armonizzate / *We declare that the products covered by this document have been designed in compliance with the following European Directives and harmonized standards:*

2014/30/EU – Direttiva sulla compatibilità elettromagnetica EMC / *EMC electromagnetic compatibility directive*

2011/65/EU – Direttiva sulla restrizione dell'uso di determinate sostanze pericolose nelle apparecchiature elettriche ed elettroniche / *The Restriction of Hazardous Substances Directive*

EN 61326-1:2013 – Apparecchi elettrici di misura, controllo e laboratorio – Prescrizioni di compatibilità elettromagnetica – Parte 1: Prescrizioni generali / *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements*

EN 61000-3-2:2014 – Compatibilità elettromagnetica (EMC) - Parte 3-2: Limiti - Limiti per le emissioni di corrente armonica per apparecchiature con corrente di ingresso <= 16 A per fase / *Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions for equipment with rated current ≤ 16 A per phase*

EN 61000-3-3:2013 – Compatibilità elettromagnetica (EMC) – Parte 3: Limiti delle fluttuazioni di tensione e oscillazioni in bassa tensione di sistemi di alimentazione per apparecchiature con corrente in ingresso <= 16A / *Electromagnetic compatibility (EMC) - Part 3: Limits - Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤ 16 A*

Il Legale Rappresentante / *Legal Representative*

Andrea Certo

15/01/2021

LSI LASTEM SRL