User manual

aeolog

(Software version 2.x)

compact wind monitoring system for site evaluation of small wind turbines and wind-solar hybrid systems

Content

ⓘ The technical features described in this manual are subject to change without notice.

ⓘ **Please read this manual completely before operating the data logger or installing the wind tower. Non-observance may cause injuries!**

1 Survey of data logger functions

The aeolog data logger was developed for the small wind power sector incorporating all functions required for cost effective wind and solar monitoring, site assessment and energy yield evaluation in a single device.

Before installing a wind turbine it is important to investigate the wind regime at the desired site. This is how the energy yield of a small wind turbine and its power distribution over time can be assessed for specific sites.

Stand-alone power systems based on wind and solar energy with battery storage are very sensitive especially regarding the availability of power over time. In these systems a strong negative correlation of wind and solar power can be valuable. To facilitate small wind and hybrid system design, aeolog records time series data which can be used in simulation software programs.

1.1 Recording of measured values

The wind speed is measured every 5 seconds. Using these values the aeolog data logger derives 10-minute averages and records them together with the maximum and the minimum value of the same period. The wind direction, temperature and

solar irradiation are measured once a minute to be shown on the aeolog display. The last value of a 10 minutes interval will be recorded on the SD-card.

Data is stored on the SD-card in 60-minute intervals. To check recorded data after commissioning, please wait for at least 60 minutes before removing the SD-card from the logger.

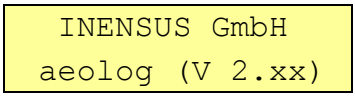
1.2 Control of data logger

The aeolog data logger is equipped with a button that can is used to set the clock when being commissioned, to activate the display and to click through the currently measured and evaluated data.

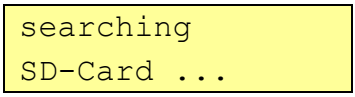
1.3 Display auto power off

To save battery power the display switches off automatically 60 seconds after the button was pressed last. Press the button again to reactivate the display.

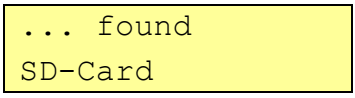
1.4 Starting screen



After connecting the ribbon cable inside the case, the logger checks the SD-storage card and searches for free space.



After some seconds the following screen indicates that the initialization of the storage card has been finished successfully.

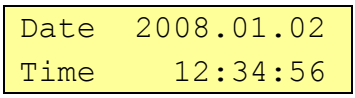


ⓘ **If you do not see this dialog please disconnect the ribbon cable in order to interrupt the power supply of the microcontroller, wait for 5 seconds before re-inserting the plug of the ribbon cable. This will reset the data logger. After the reset the dialog shown above should be displayed.**

2 Setup of data logger

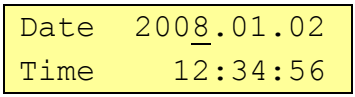
The aeolog data logger is already pre-configured for the sensors delivered and only a few inputs are needed after connection of the power supply.

2.1 Date and time



The date is displayed in a "`year.month.day`" format, the time is displayed in a 24h format "`hour:minute:second`".

Date and time can be set after pushing the button until an asterisk appears in the lower right corner of the display. The underlined digit can be incremented by pushing the button shortly. A minimum 2-seconds-push on the button makes the underline jump to the next digit which can be changed accordingly.



2.2 Configuration of sensors

Readily preconfigured sensor sets can be chosen from the menu. The display shows the sets as presented below

```
Sensor conf. [1]
1 anemometer
```

You can change the preconfigured sensor set for e.g. "`1 anemometer`" by pressing the button until an asterisk appears in the lower right corner of the display.

ⓘ The aeolog is usually shipped with the logger being preset for the sensor configuration it is supplied with.

Table 1: Overview of sensor configurations

#	Preset sensor configuration	Description
1	`1 anemometer`	Basic configuration with just one anemometer. All menus that do not apply are hidden (e.g. wind direction, second wind speed, temperature)
2	`1 anem.+brightn.`	One anemometer with integrated brightness sensor
3	`2 anemometer`	2 anemometers for measurements in different heights
4	`Meteocomp`	Recording of wind speed, wind direction and temperature
5	`Meteocomp+anem.`	Same as #4 + additional anemometer
6	`Mete.+anem.+bri.`	Same as #4 + additional anemometer with integrated brightness sensor

Depending on the sensors configuration chosen the display just shows the figures of the activated sensors.

3 Display

3.1 Survey of currently measured values

```
A1=11.3     D=123
A2=09.8    T=12.3
```

Depending on the sensor configuration chosen not all values are displayed. The wind speed is measured every 5 seconds and will be displayed accordingly. Wind direction and temperature are updated every 10 seconds.

The following abbreviations will be used:

Table 2: abbreviations

A1 (A2)	Data of anemometer 1 (2) in m/s
V1 (V2)	Wind velocity of anemometer 1 (2)
D	wind direction in °
T	Temperature in °C
c	current value
i	Average value of the recent 10-minutes interval
t	Average value since start of measurements (total average)
SR	Solar irradiation in W/m²

3.2 Display of wind speed

Measured values of anemometer 1 (A1) and anemometer 2 (A2) in meters per second (m/s) respectively.

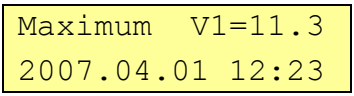
```
A1          c=11.3
   i=07.3 t=04.9
```

Display of

- current (c) wind speed
- the average value of the last 10-min-interval (i)
- average value since the beginning of total measurements (t).

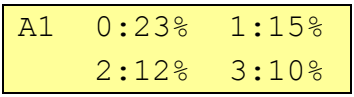
By pressing the button until an asterisk appears in the lower right corner of the display you will enter the detailed menu of this sensor as described in the following chapters.

3.2.1 Maximum wind speed



Maximum wind speed since start of measurements with time stamp of its occurrence.

3.2.2 Distribution of wind speeds using wind classes

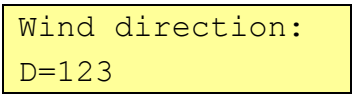


During measurement wind speeds are automatically assigned to wind classes e.g. from 0 to 1 m/s, from 1 to 2 m/s, etc. These wind classes usually serve as a basis for the evaluation of the energy yield of a wind turbine at the site of measurements. This data can be used to pre-design small wind turbine systems.

„1:15%“ means that 15 % of the measuring time the wind speed is between 1.00 and 1.99 m/s. The percentage values are rounded off. Therefore, the sum of the percentage values can differ from 100 % slightly. A closer analysis of wind-data can be conducted using the time series data recorded on the storage card.

All wind-speeds of v > 20 m/s are collected in the class „>20“.

3.3 Display of wind direction



This display option is just available if a wind-vane is installed. The “N” marked direction has to face north. The wind directions will be shown accordingly:

N : 0°

E : 90°

S : 180°

W : 270°

By pressing the button until an asterisk appears in the lower right corner of the display you will enter the detailed menu of this sensor as described in the following chapters.

3.3.1 Distribution of wind speed and frequency depending on the wind direction

These detailed evaluation results of wind data from the top anemometer is only available if a wind vane is installed.

```
N   09%05.6/13.7
NNE 03%03.4/11.2
```

For each of 16 sectors information about the frequency, average wind speed and maximum wind speed is displayed. In the second line of this example, the average wind speed is 3.4 m/s from north-north-eastern direction. Since every sector has an angle of 22.5°, NNE represents the sector from 11.25 to 33.75°. 3 % of the time since commencement of the measurement period the wind heads from this direction and 11.2 m/s is the maximum value recorded in this sector.

3.4 Display of external temperature

```
Temperature:
T=12.4
```

This display option is only available if a temperature sensor is installed.

The reading is in °C.

3.5 Display of brightness

```
Brightness:
B=123 (relative)
```

This display option is only available if a brightness sensor is installed and defined in the data logger menu.

The value displayed is proportional to the external signal of the photo diodes. The "B" value does not represent the absolute brightness value but should be considered as a relative value to be correlated with the wind speed time series.

3.6 Display of solar radiation

```
Solar radiation:
SR=123W/sqrm
```

This display option is only available if a photovoltaic-cell is integrated into the aeolog data logger housing. The value displayed is the power irradiated in a spectral distribution to be absorbed by a horizontal silicon solar cell (provided that the solar cell integrated into the data logger is horizontal during measurements). It is derived by measuring the short circuit current of the solar cell. Utilizing trigonometric calculation and multiplying the efficiency of the solar module used in the hybrid power system the power output of solar modules can be calculated. Alternatively, different software tools can be used.

3.7 Display of the storage capacity

```
Storage    017%
123 days & 12hrs
```

The percentage is relative to the 415 days of capacity in the data file while the time in full days and hours may differ since this is the time since inserting the battery. I.e. if a card with already 50 % of the capacity in the data file is inserted before inserting a new battery the reading will be "`50%`" and "`0 days`"

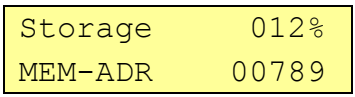
By pressing the button until an asterisk appears in the lower right corner of the display you will enter the detailed menu for this sensor as described in the following chapters.

3.7.1 Status of measuring campaign

```
Record no. 01234
123 days & 12hrs
```

„`Record no`" counts the successive number of the 10-min-intervals since insertion of the battery. Below, the time since installation of battery is displayed. Since data is stored to the SD-card in 60-minute intervals, the first data set is written on the SD card completely when this counter shows "7".

3.7.2 Memory address

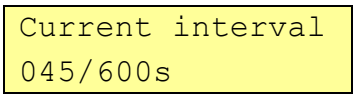


The first line displays the current storage capacity used on the SD-card. If you use a card which already contains data it will not start at 0% directly after commissioning.

"MEM-ADR" represents the currently used location on the memory card. This number will increment every 60 minutes.

The preconfigured range on the SD card delivered comprises the values 524 to 10524 which should be sufficient for 415 days.

3.7.3 Time within the interval



The reading shows the current time within the interval and the length of the interval (600 s = 10 minutes).

4 Preparation of wind tower set up

4.1 Choosing a wind site

The tower of the monitoring system should be placed exactly at the site where the wind turbine is expected to be installed. If this is impossible a site with similar wind conditions should be chosen.

As a rule of thumb there should be no building or vegetation higher than half the hub height of the turbine within a radius of 200 m around the wind site to gain a good energy yield. In other words, the hub height should be at least double the size of the highest building or plant within a 200 m radius for a good energy output. Wind monitoring campaigns should be conducted with the upper anemometer being close to the intended hub height of the wind turbine.

4.2 Base plate & ground anchors

The three ground anchors delivered with the main parcel have to be driven into the ground in a 4 m distance from the base plate using a hammer or stone. Please refer to the picture below. The ground anchor has to be tilted away from the base plate in

order not to be pulled out by the guy wire. The angle of the anchor points away from the base plate.

If the ground does not allow the usage of ground anchors of the delivered kind a different way of fixing the guy wires has to be chosen.

4.3 Preparation of the tower for erection

The tower has to be prepared for erection while lying on the ground. After accomplishing the preparation procedure the tower can be installed.

Pull out each of the segments of the aluminium mast till the red marked area of the segment becomes fully visible.

The 4th and the 5th segment counted from the top of the 15 m tower have to be pulled apart completely to slide the lower guy wire ring over the 5th segment. Rejoin the segments afterwards.

The upper guy wire ring has to be slid over the top segment of the tower.

Place the bottom of the tower on the base plate at the site where it is supposed to be erected when the tower is still lying on the ground.

4.3.1 Mounting of the bottom anemometer boom

The aluminium boom delivered must be fixed to the tower with a hose clamp. The hose clamp has to be unscrewed completely to be pushed through the holes in the boom. The boom shall be rectangular to the tower and rectangular to the estimated main wind direction.

The height of the bottom anemometer shall be 8 to 10 m above the ground depending on the surrounding vegetation. The hose clamp is applicable in different sizes to be attached to the mast at different heights.

4.3.2 Mounting of the bottom anemometer

The bottom anemometer has to be screwed to the boom at its end. The sensor cable shall be fixed to the bottom with cable ties.

Anemometers with brightness sensors can be identified by their transparent piece of plastic with three photo-diodes behind in the middle of the anemometer. Turn the boom and anemometer until the middle photo-diode faces the mid day sun.

4.3.3 Mounting of the top anemometer / the combined wind direction and speed sensor

At the top of the tower different sensors can be installed.

A single anemometer can be fixed to the side of the top of the tower with a hose clamp.

The combined wind direction and speed sensor shall be slid over the top end of the top segment of the tower and fixed with the screws. The mark signed “N” has to face north when the tower is erected. If there is an additional brightness sensor, check both, the direction of the brightness sensor and the direction of the wind vane. If necessary, correct the direction of the sensors towards each other.

After installation of the anemometers document the exact heights above ground in the prepared commissioning protocols at the end of this documentation.

4.3.4 Mounting of data logger

If the data logger integrates a solar cell the data logger should be facing the sun during mid day and should not be shaded by any objects surrounding the aeolog.

Protect the data logger from extreme weather conditions.

Ensure that the inside of the data logger is completely dry before closing the case.

The threaded cable connection must be at the bottom of the data logger.

4.3.5 Fixing of cables to the tower

The sensor cables are to be fixed tightly towards the tower using the black cable ties delivered with the tower. The distance between the cable ties shall be approx.

0.5 m. Directly below the sensors and at guy wire rings the sensor cable shall have a small slack as shown in the picture below.

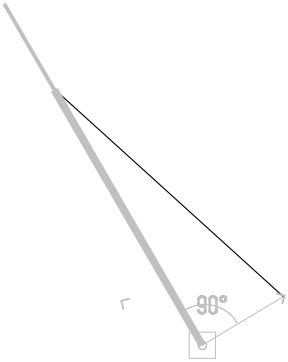
4.4 Tower tilt up

Before pulling up the tower please activate the data logger as described in the next chapter.

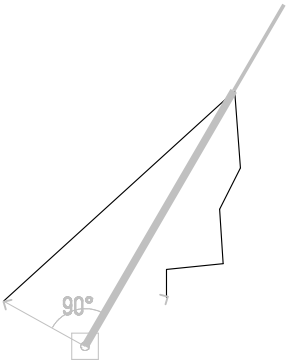
- ⓘ For tower tilt up at least two people are required.
- ⓘ Tower tilt up should be carried out at days with low wind speeds. When erecting the tower at stronger winds at least three people are required.
- ⓘ For safety reasons the guy wires shall not be pulled without wearing gloves.

The bottom part of the tower must be placed on the base plate which shall be situated on a horizontal plane and fixed in the ground in order not to move sideward.

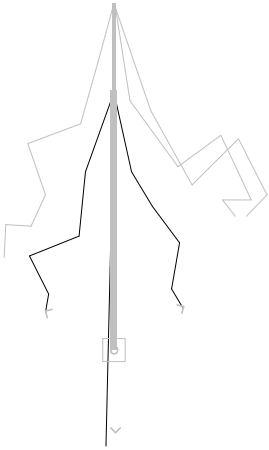
One guy wire with a guy wire ring at 9 m height shall be fixed to the ground anchor which is rectangular to the tower lying on the ground.



This is how also the second guy wire will be fixed to the ground anchor at the right length.



The tower is laid down to the ground in a way lying in the middle of the two guy wires already connected. The guy wires already connected lie on the ground loosely. However, as soon as the tower is tilted up these guy wires have the right length. With the 15 m tower the upper guy wires hang loosely without being connected anywhere at this stage.



Place two cable clamps next to each of the ground anchors or give them to the person who is in charge of pulling the guy wires and fixing them to the anchors. Make sure you have a spanner No. 7 (metric) with you.

Person 1 keeps the guy wire (guy wire ring of 9 m height) which is most parallel to the tower lying on the ground in his/her hand and keeps the bottom of the tower to the ground with his/her feet. Person 2 lifts the top of the tower above his/her head and walks slowly to the bottom of the tower. Person two makes sure that the guy wire fixed to the anchor is tight at all times. Person 1 pulls the guy wire in his/her hands and helps person 2 to tilt up the tower this way. Tilt up the tower carefully and slowly! The bottom of the tower has to be fitted onto the base plate.

Once the tower is in upright position the other two guy wires of the guy wire ring with 9 m height shall be fixed to the anchors by person 1. Person 2 holds the tower in its upright position. Person 1 adjusts the cable lengths until the tower is completely vertical.

If you have a 15 m tower now you can fix the upper guy wires to the ground anchors using cable clamps. Adjust the length of the guy wires till the tower is completely vertical.

The guy wires shall be pulled by hand. In its final position the guy wires must be tight enough to let the tower move maximal two times the diameter of the tower itself at the guy wire ring. On the other hand the guy wires must be slack enough for the tower to move a little bit.

5 Commissioning of the data logger

ⓘ To open the data logger casing a cross recess screw driver of the size PH2 is needed.

5.1 Alignment of the wind vane

The „N“-marked spot at the wind vane is supposed to face north once the tower is erected. If the „N“-mark and the mark at the wind vane cover each other the data logger should show a value between approx. 355 and 5°. 0° cannot be measured due to the technical design of the wind vane.

5.2 Connection of external sensors

The aeolog can record data of up to two anemometers, one wind vane and one external temperature and brightness sensor. Furthermore, if there is a solar cell integrated into the data logger housing the solar irradiation for photovoltaic applications will be measured.

To connect the sensor cables to the data logger please open the casing of the data logger carefully. Screw out the four cross recess screws at the front panel of the data logger until the front plate can be lifted. The data logger consists of two units being connected to each other via a flat ribbon cable. Please take care of the cable when opening the casing in order not to damage the plugs or the cable.

The sensor cables with 7 mm diameter maximum must be passed through the data logger casing and fixed with the threaded cable glands. External sensors can be connected via a shielded or a non-shielded cable with up to 0.25 mm^2 cross section. Flexible sensor cables have to be connected using wire end sleeves to guarantee good electrical contact between the wire and the clamp.

The clamp number and the abbreviation of the sensor are printed on the circuit board. The sensors being delivered with the data logger are readily configured and signed and can be connected to the clamps on the circuit board directly. The number of the wire corresponds to the number on the circuit board.

5.3 Preparation of the SD-card

The data saved on the SD-card can be read with a common SD-card reader. However, for utilization with aeolog a specifically prepared SD-card has to be applied. The SD-card of at least 32 MB must be formatted as FAT16. In a new folder a 5 MB ASCII-text file which just contains spaces characters has to be created. The file name and directory name should be chosen according to the site name where the data logger is installed. Storage cards with more than 2 GB capacity are not supported.

On this SD-card the 10 min averages are recorded once an hour.

To create this text file a usual text editor can be used. A short sequence of spaces can be copied and pasted until the required size of file is realized. Alternatively, the text file can be downloaded from the INENSUS website: http://www.inensus.com/en/products1.htm. The downloaded file has to be unzipped. The unzipped file has to be stored on the FAT 16 formatted SD-card.

The SD-card included in the delivery scope is already prepared and can be used directly.

5.4 Removing and inserting the storage card

Please remove and insert the SD-storage card only after disconnecting the power supply of the microcontroller by unplugging any of the plugs of the ribbon cable. Please insert the new empty storage card before connecting the battery.

5.5 Power supply

The aeolog data logger is supplied with a pv module to recharge the integrated nickel-metal hydride batteries. In case of weak batteries the data logger shows "`low battery`" in the display. At times of low battery, no data is recorded. Please allow some days of sunshine to recharge.

5.6 Closing the data logger casing

Please make sure that the plugs and clamps are connected and fixed properly before closing the data logger casing. The plugs can be used just in one direction. Furthermore, make sure that the packing seal is not dirty or broken.

When installing the data logger the threaded cable gland has to face down!

5.7 Setting the clock

After inserting the battery the data logger searches for a free space on the storage card (c.f. chapter 1.4 on page 6). After a few seconds the start-up screen appears and after pushing the button date and time should be set at the second screen (c.f. chapter 2.1 on page 6). The digit displayed can be increased by pressing the button shortly. To switch to the next value press the button for more than two seconds before releasing it.

The aeolog is equipped with a crystal controlled real-time-clock which can realize an accuracy with deviation of some minutes a year.

ⓘ The standard time (winter time) should be used all through the year to guarantee a consistency of the time series.

5.8 Test of function

Before erecting the tower the correct connection of the anemometers and the wind vane has to be checked.

Turn the wind vane until the two marked lines facing north are aligned and then check the display. To activate the display press the button of the data logger as often as necessary to show the figures as shown below (refer to chapter 3).

```
V1=00.0     D=123
V2=00.0    T=12.3
```

In this position the "D=000" or a similar small value representing the wind direction has to be shown on the display. Watching the wind vane from the top the values rise when turning right till the maximum value of 355° is reached. The wind direction is updated every 10 seconds and so is the display. Due to the design of the wind vane there are no values between 355° and 5°.

The top anemometer is turned slowly by hand for a test. One revolution per second relates to a wind speed of 0.9 m/s.

Repeat the test for the second anemometer if installed.

5.9 Documentation of tower set up

If the tower set up is documented properly, potential mistakes in the measured data can be explained and deleted. Documentation can be realized with photographs and drawings, or in writing. Please find attached to the user manual ten empty commissioning reports.

5.10 Evaluation of the measured data

The data measured is recorded on the storage card as unformatted ASCII text. The storage card will be retrieved as described in chapter 5.4 and can be read using a standard SD-card reader. On the SD-card in the folder "aeolog" you will find a file named "winddata.txt", which can be opened with any spreadsheet software. The columns are separated by tabulator. Decimal sign is the dot.

Table 3: Recorded date file

INENSUS aeolog (V2.50)										
www.inensus.com										
==========										
Date	Time	v1_avg	v1_min	v1_max	v2_avg	v2_min	v2_max	dir	temp	bright
==========										
2008.05.18	16:30:00	02.5	01.3	03.4	02.1	00.0	05.2	353	12.3	159
2008.05.18	16:40:00	02.3	01.3	06.0	01.6	00.8	02.6	347	13.2	135
2008.05.18	16:50:00	02.4	01.3	03.4	02.0	00.0	03.0	352	13.1	166
2008.05.18	17:00:00	01.5	00.8	02.6	01.4	00.8	02.1	357	12.7	167
2008.05.18	17:10:00	01.3	00.8	01.7	01.1	00.0	01.7	002	12.7	167
2008.05.18	17:20:00	00.9	00.0	01.7	00.8	00.0	01.7	003	12.5	159
2008.05.18	17:30:00	00.0	00.0	00.0	00.2	00.0	00.8	017	12.7	136

6 Appendix

6.1 Technical data

Table 4: Summary of technical data

Energy supply	Solar cell with 4 Nickel Metal Hydride accumulators or batteries.
Dimensions (WxHxD)	85x80x85 mm³
Data storage	10,000 hours = 416 days = 5 MB data file
External sensors (input channels protected against over voltage)	• 2 Anemometers (wind-speed) • 1 wind vane (Wind direction) • Temperature • Brightness of the environment
Display	• Current wind speed and wind direction • Average wind speed for every month and for the whole period of measurements since commissioning of data logger • wind speeds with classes of 1 m/s • Frequency and average wind speed in 16 direction sectors • Time & date

Table 5: Assignment of clamps to wires

aeolog clamp numbers	external sensor connection
8 GND	Common signal mass
7 A1	Pulse input for Anemometer 1 (reed-switch closure to GND)
6 Vane	Signal from the wind vane (1 k potentiometer)
5 +3V	3 V supply voltage for the wind vane and temperature sensor
4 Temp	Temperature sensor (10 k NTC)
3 Light	Brightness sensor (silicon diode)
2 GND	Common signal mass
1 A2	Pulse input for Anemometer 2 (reed-switch closure to GND)

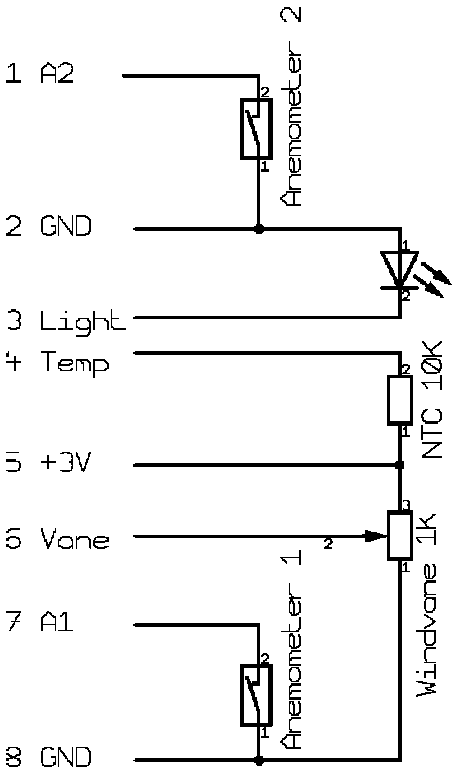


Figure 1: Schematic of external sensor configuration. Cable numbers from sensors supplied with the aeolog data logger have the same numbering as the clamp numbers printed on the circuit board. Colours and numbers in the data sheets supplied with the sensors may differ from the clamp numbers.

6.2 Permissible operation conditions

The aeolog data logger is applicable for outside installation without exposure to direct sunlight and temperatures of up to 35°C.

If the front panel is mounted correctly by the user and the sealing has the right fit casing of the data logger has protection class IP 44. This means that the data logger is protected against penetration of foreign bodies and splash-proof.

Protect the data logger from extreme weather conditions.

The cable entry must face the ground.

6.3 EG-conformity declaration

The signatory representing the manufacturer mentioned below

INENSUS GmbH
Am Stollen 19
38640 Goslar
Germany

herewith confirms that the product

aeolog data logger for small wind turbines and hybrid systems

is in accordance with the EG-guideline 89/336/EWG and obeys the following standards

- EN 55022:2006 Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- EN 55024:2002 Information technology equipment - Immunity characteristics - Limits and methods of measurement

as long as the following operation conditions are obeyed.

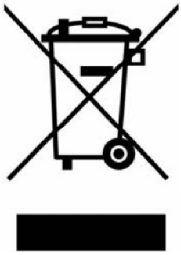
The area of applicability is the free field application outside of private or industrial buildings or plants. The data logger is equipped with different sensors that are connected to a metallic tower. The operator of the data logger has to make sure that the tower and the sensors are installed correctly and safely and that there is lightning protection available. The presence of strong electromagnetic fields in the vicinity of transformer station, overhead lines, transmitter masts or industrial plants may interfere with the function of the data logger and the sensors. The data logger and the sensors are not protected against direct lightning strikes.

The technical documentation may be viewed at the manufacturer's facilities.

Goslar, July 30th 2007

Dipl.-Ing. Holger Peters (Head of the INENUS R&D department and person in charge for EMC)

6.4 Disposal of the data logger



The aeolog data logger is registered in Germany with the number

WEEE-Reg.-Nr. DE 23444271

for free of charge disposal at local collecting points for electronic devices. The legal basis for this is the Electric devices law (ElektroG). Please do not put the data logger into your home garbage.

The data logger is manufactured RoHS conform regarding the EG-guideline 2002/95/EG *Restriction of the use of certain hazardous substances* of January 27th 2003.

6.5 Troubleshooting

If the data logger display does not respond after pushing the button, please check:

- Correct connection of the external sensor cables
- Correct connection of the 2 sections of the housing with the flat ribbon cable
- Regular exposure of the pv-module to direct sunlight
- Correct connection of the plug of the pv-module
- Correct connection of the 4 nickel-metal hydride batteries in the bottom of the housing. Please disconnect the sensor cables and unscrew the 4 screws in the corners of the circuit board with the clamps. Carefully remove the two circuit boards that the batteries are accessible.

6.6 Contact

Address: INENSUS GmbH
Am Stollen 19
38640 Goslar
Germany

URL: www.inensus.com
Email: info@inensus.com

Tel.: +49 (5321) 6855 101
Fax: +49 (5321) 6855 109

6.7 Documentation of tower set up

On the following pages you can find some empty forms for writing a commissioning protocol. You should use this form to document each change of the setting at the measuring site. This facilitates the data evaluation later on.

Please check the ground anchors and cable clamps regularly.

6.7.1 Commissioning protocol #1

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.2 Commissioning protocol #2

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.3 Commissioning protocol #3

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.4 Commissioning protocol #4

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.5 Commissioning protocol #5

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.6 Commissioning protocol #6

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.7 Commissioning protocol #7

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.8 Commissioning protocol #8

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.9 Commissioning protocol #9

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?

6.7.10 Commissioning protocol #10

Exact name and description of the monitoring site	
Commissioning carried out by	date & time
Height of the top anemometer	Height of the bottom anemometer
Deviation of wind vane from true north	Distance, height and direction of vegetation
Storage card marked with	Distance, height and direction of buildings
Date of battery replacement	Battery type
Problems during installation	
Sketch of the site and its surroundings	

- Anchors and wire clips are checked?
- Photographs of mast, sensors, and surroundings are made?