

# USER`S GUIDE

EOL ZENITH DATA LOGGER, EOL MANAGER, EOL CHARTING



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**KINTECH**  
ENGINEERING

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***Important note:***

***The information contained in this document will continuously be updated and completed step by step. Some features might refer to firmware or software versions different from the one you are using***

*Specifications are subject to change without notice*

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## 1. ASSISTANCE

For questions regarding Kintech products check the web page:

[www.Kintech-engineering.com](http://www.Kintech-engineering.com)

There has been a big evolution in the way measuring campaigns are performed in recent years. Anemometry has had a great evolution in parallel. Now, they use more and better technological resources:

- Higher masts equipped with higher amount of sensors.
- More accurate and more specific sensors.
- Use of different sensor types in the same met mast.
- Longer booms properly designed to avoid vibration.
- New communication technologies are applied allowing real time connections.
- The graphical tools and error detection algorithms have improved a lot.
- There is more information for met mast supervision and control.

Kintech Engineering knows that the sales efforts should not end after the systems are delivered to the client. That's the reason we have created an after sales department with a team of electronics engineers and wind engineers with collectively 30 years of experience. They answer questions from clients and installers in many languages.

We encourage installers to carefully read this manual. They should take special attention when reading the hardware and communication chapter. We also encourage the met mast management staff to read this manual with special attention to the software chapter.

### Questions

You can send your questions by e-mail. You can phone to our office for any questions you might have. You can view in our web page for the most up-to-date contact information of our offices in different countries. We will answer e-mails in the same day.

You can anyway contact the Kintech Engineering headquarters:

Email: [support@Kintech-engineering.com](mailto:support@Kintech-engineering.com)

Tel. +34 976 221 789

Fax. +34 976 158 079

Before contacting Kintech Engineering, have ready your name, company name, logger serial number, software and firmware version and logger telephone number. This information allows the technical support to connect to the logger to check it.

If you send downloaded data for analysis of anomalous behavior of data, you should also send the settings exported file (.sit), the raw data file (.log) and the report file (.txt). It is not necessary to send the wind data file (.wnd) so you can avoid heavy file attachments.

Thank you trusting Kintech products. We appreciate any suggestion you make.

### **“Zenith” service**

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The met mast complexity is increasing every day. To help dealing with such activities we offer to our clients the “Zenith” service. It allows tower management optimization, coordination with installer teams and tower management staff on client side. This subcontracted met mast supervision frees the client from specific tasks, allowing him to focus his activity on higher added value tasks.

To offer “Zenith” Service, Kintech Engineering benefit from a team of engineers specialized in wind, electronics and met masts

The service includes:

1. Create and upload settings to each logger according to client specifications
2. Site supervision after installation through a remote real time connection before the installation team leaves the site. A brief report is sent to the client.
3. Permanent technical support provided though phone calls or e-mails.
4. Fault detection in real time in contact with the installer on site or after analyzing output data files provided by the client.
5. Courses, seminars and technical training of met mast installers, maintenance staff or other groups designated by the client.
6. Setting everything ready for operation logistics. The data-logger is set up, SIM card is inserted and even contracted, and settings are checked and tested before shipment to installer.
7. Express delivery of loggers, sensors, replacement parts to the address designated by the client.
8. Logger firmware and software updates.
9. Advice about GSM and satellite questions.
10. Technical cooperation with client. Advice about sensor operation, new sensors, different tests.

### **“Download and Maintenance by telemetry” SERVICE**

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In addition to the previously described tasks, you may wish to receive monthly reports with all data from every data-logger. To do so, get the Download and Maintenance by Telemetry service. This service includes also (ask the monthly cost per month per logger):



1. Daily communication check out and automatic sensor fault detection
2. Weekly generation and analysis of charts by engineers
3. Monthly verification through sensor correlations to check plausibility
4. Monthly delivery of data to client including raw data, ASCII code output data and charts for all inputs
5. Sensor fault diagnosis, warning to maintenance team and reparation coordination if necessary

For environmental reasons, we inform you that at the end of the life of the equipment it should be disposed in a proper electronic waste facility. You can send it to Kintech for recycling.

Finally, we hope you enjoy this product for a long time. We wish you success in your wind energy projects. They will contribute to conserve the blue planet, to keep the sky the same color as the *Eol Zenith*® wind data logger.

See in the picture on the right side a common scene where wind energy is compatible with traditional farming.





## 2. INTRODUCTION

### Precautions

The voltage level inside *Eol Zenith*® is minimal and there isn't a special warning indicator when working with it. However there are internal capacitors inside the logger, so it should not be manipulated internally or dismantled by personnel unauthorized by Kintech. The capacitors could have an extra charge. Also, some electronic components are sensitive to electrostatic discharge. Furthermore, Kintech warranty will not apply to any product that has been subjected to modification, misuse or accidents of nature.

During a storm, there exists a risk of atmospheric high voltage electric discharge. Therefore, the logger should not be manipulated under storm conditions, and no field tasks should be done on the measuring tower. It is important to connect the ground to the correspondent terminal of the logger.



It is advisable to keep simple safety rules, in order to avoid personal and/or machine damage. These damages can be caused, for instance, due to the gas that is expelled from some accumulator if the terminals are short-circuited.

### Commissioning

The data-logger is supplied by default without an internal battery, but contains a built-in GSM modem (without a SIM card) and a built-in GPS, both manufactured by Kintech, and their respective antennas.

Additionally, if your communication system is not GSM, an external modem (Satellite, CDMA, etc) will be set on the data-logger case.

*Eol Zenith*® wind data-logger is tested by a strict quality control system throughout the production process, including all its' modules, such as the Communication and the Recording Module. The MMC memory card is delivered by default and is industrial grade, very robust and appropriate for the wind data-logger. The memory card has been tested and is blank (except otherwise specified by the client), it contains no saved information or any initial set up.

The logger is delivered in appropriate packaging for protecting it against eventual hits during transportation. After a visual inspection, to check that none of the logger parts has suffered damage during the shipment, you can proceed to an initial first test at the office. To start up, you have to remove the supply terminal, connect the supply (the battery or an external main) to this terminal, and finally plug the terminal in its logger socket again, as a switch.

The logger self checking (See *Logger Start: Reset*), will help you to check that the logger status is OK.

Afterwards, you can connect several sensors, and use the logger keyboard to navigate through the menu (See the chapter *KEYBOARD AND DISPLAY*).

If using the *Eol Zenith®* for the first time, it is advisable to play with the device to get familiar with it. Remember that all the staff involved in wind measurements should be skilled in using the measurement devices. *Think of the cost implied in a loss of data!*

It is recommendable that before the field installation you make a test at the office with the communication card, (SIM card, satellite modem or CDMA modem), since the operational success depends on the communication system you have chosen and on the telecommunication provider you have engaged the service with.

*Any unexpected issue can have a more expensive cost to fix on site than in the office!*

### Instruments installation in the measurement tower

Using high quality instruments, as *Eol Zenith®* or *Class 1* anemometers, it is not a full guarantee for success in a measuring campaign. Also, it is essential that the installations of the instruments be performed with the up most professionalism. Modern anemometers are very precise instruments, so it should not be hit during transportation or manipulated, because it could change its calibration.

Not only the parts of the whole measuring system but the performance of the instruments installation, should be executed with the best quality procedures, in order to diminish as much as possible the uncertainties in the measuring campaign.

In order to get it:

- The installation team should be properly trained and have enough field experience coupled with electronics skills.
- It is essential that all the workers meet the health and safety requirements established in the “prevention plan”.
- The structure should be optimized depending on the Wind Class on site and on the expected ice loads and it should have the safety factor required.
- The installation team should be aware that the task to install a measurement tower does not end when the structure has been raised. The installation of the electronics and instruments is a sensitive task and should take time.
- The booms and brackets should have the lengths recommended in the IEC61400-12 and others, to avoid tower wake effect and also the proper stiffness to avoid vibrations.
- The minimum distance between sensors should also meet the IEC61400-12 recommendations.
- Lightning protection and grounding should be properly performed.

- Boom orientation should meet IEC61400-12 (and other) recommendations, as a function of the local wind rose in order to minimize the tower wake effect.
- Wind vanes should be accurately orientated to some cardinal point.
- The wiring connections should be tidy and impeccably performed.
- The GSM or CDMA antenna should have a suitable gain depending on the signal intensity at site, and should be properly orientated, better if not too close to the structure or the metallic box.
- The cable of the antenna should be properly set, avoiding interferences with the sensor wires or the logger terminals, and never coiled up. The length should not be too long as to provoke attenuation of the signal.
- The solar panel should be properly orientated. The common criterion is to orientate with the direction of the ray of sunlight, at the moment of the solar midday on the day of the winter solstice or better if slightly more vertical to preserve the panel against the dust, hail or tower ice fall. However in tropical areas this criterion changes.
- The solar charge regulator should be of solid-state type, without automatic switch off when low battery, and with the terminals properly connected.
- The height over the ground of every sensor should be accurately written down.
- The sensors should be aligned with a precise vertical line.
- The enclosure should give the proper isolation, with drainage, and if possible to be accessible from the ground to get easier maintenance tasks.
- Sensor wires should have sufficient section. (Be aware of the attenuation for very high towers). They will also be shielded and the shields connected to the logger ground in order to be effective. For outdoor applications it is always advisable to work with good quality wires.
- All the data for the "Installation Form" should be diligently fulfilled.
- Since the meteorological conditions at site could be harsh, and outdoor work is not often easy, it is advisable that before the installation team lives the site, some specialized technician does a real time remote checking of the sensors. This task can be done comfortably from the office, to give the OK of the installation work.

It is interesting to say that some tubular tower models can enter in resonance under some particular wind (sometimes not very high). This fact provokes strong vibrations of the instruments, which can cause data errors, shortening of the life expectancy or even faults.

Finally, we can mention that Kintech advises the use of sensors calibrated in homologated laboratories, belonging to the MeasNet network and sensors of the best quality. Kintech advises the use of professional although expensive sensors rather than the use of a large number of cheap redundant sensors in one tower.

**Note:** Orientation and recommended length of the booms:

-Tubular Tower:

The best boom orientation is 45° from the main wind.

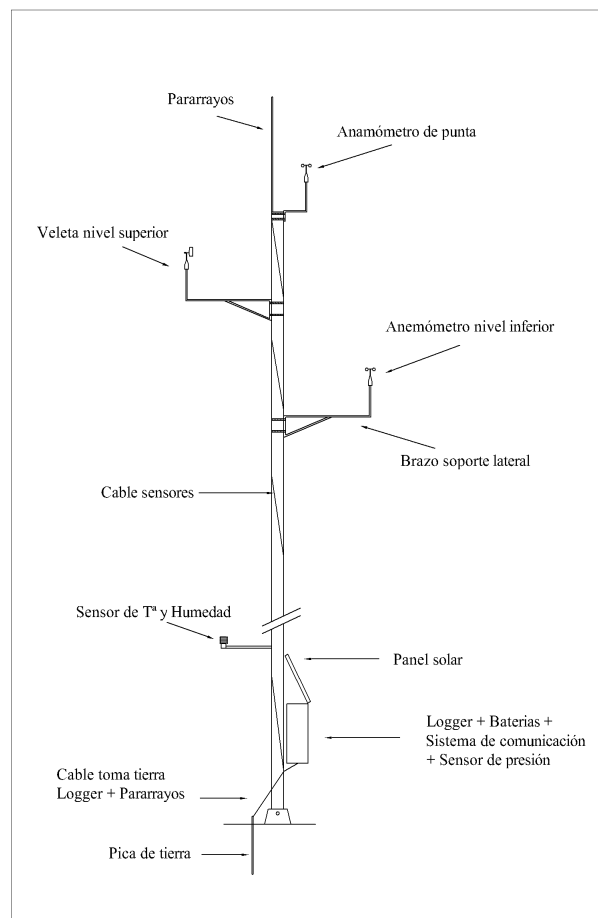
The recommended boom length is about 8.2 times the tower diameter.

-Lattice Towers:

The best boom orientation is 90° from the main wind, parallel to one of the tower sides.

The recommended boom length is about 5.7 times the tower diameter.

-Vertical distance between sensors: 1.5m.



### 3. PRODUCT DESCRIPTION

#### General Description

*Eol Zenith*® data-logger is a device designed specifically for the wind sector, and therefore it meets the measurement standards of the IEC 61400-12 and other recommendations described by public or private organizations as MeasNet, RISO or DEWI.

Kintech's design philosophy is to maximize data availability of your measurement stations by operating and communicating with them in the shortest possible time. It is emphasized to have a logger that is easy to operate but with a strong and reliable data acquisition system. Also, improved analysis tools by a practical interface and by an automatic operation of multiple processes.



*Eol Zenith*® data-logger has the capacity to connect 10 anemometers, calculating the true speed average every one second. The 2 wind vane specific channels and the 13 general-purpose analog channels, perform a physical capture of the polled value every one second in the same way as the two digital buses. Using these records, the logger finds out the standard deviation of the global data set, and the maximum and minimum record during the 10minute interval, and saves the data in its' non-volatile card (MMC card), in addition to the 10minute mean value and the time stamp, date and time of the instant when the 10minute interval has finished.

The logger works with its own operative system. The system set up, the 10minute data records, the asynchronous records of events, are saved into the MMC memory card. Some part of this information is also saved in parallel into an internal non volatile logger EEPROM memory as a backup. The operative system organizes and loads the configuration, operates the communication interface, the display and keyboard, and the recording process. The configuration changes will be saved into the non volatile memory when the present recording interval ends. When you download the data from the logger, you get the asynchronous recordings with information such as system alarm status, accesses to the logger, configuration changes, etc. The asynchronous recordings are stored in the non volatile memory at the end of the present 10minute interval also.

Since remote access to the towers has become an essential tool to be able to maximize the data availability by the quick fixing of faults, the present 3<sup>rd</sup> generation of loggers has always a built-in internal modem for the communication.



Although *Eol Zenith*® has a big display and keyboard for manual operation of the logger, Kintech's philosophy consists of minimizing the user interventions on site, letting operate all the functions remotely and in real time. Actually there are some configuration parameters that cannot be uploaded by the logger keyboard, only by the computer.

## New features

*Eol Zenith*® wind data-logger is the first logger of the 3rd generation, with modem and GPS built-in the logger, and incorporating all the advances of electronics, software and communications of the past years.

### *Traditional characteristics of the EOL family*

The new EOL Zenith ® system features both software and hardware designed with the same philosophy as its predecessor, the EOL 2020, with more than 2300 units sold worldwide. These standard features from the EOL 2020 wind data logger include:

1. Compatibility in hardware and software to connect sensors of different brands and models, simply by choosing the sensor type from a drop down menu. No more specific interface cards are required.
2. SLAVE-master system that involves control of all stations from a central office location, avoiding for example the risk of wrong configurations, or nonsense communications started by the logger or any incident out of the office control.
3. Ability to monitor and connect in real time and send SMS status messages.
4. Ease of use and simplicity of user interface in their formats and concepts.
5. Robustness of remote downloads even under poor GSM signal. This is accomplished through a sophisticated proprietary protocol and bidirectional communication between central station and the data logger.
6. Calculation of "IT30" which quickly and more accurately identifies the intensity of turbulence associated with wind turbine subclass in each location, as well as a more precise detection of true extreme turbulence.

### *Major improvements made in the Eol Zenith® data logger*

1. New flash memory technology. This allows for greater storage capacity (almost unlimited data capacity in practice). Compatibility with most of the existing models of memory cards.



2. Improving on the logger's internal protection against lightning or overvoltage.
3. Expanding the possibilities of remote download, now introducing communication via GPRS, with or without fixed IP, and real-time, independent of any hosting, and giving the possibility of sending 10minute data by an email with attached file.
4. New compact data encoding. This allows a saving of 40% in the volume of information, improving the success of the transmission in areas with low GSM signal as well as data transmission costs, especially for Satellite communications. (We estimate that user can enjoy from 200% to 400% of less time for the transmissions with respect to other data-loggers).
5. Possibility of remote configuration of the stations. The logger can be configured easily directly from the office after installation.
6. Larger logger display, which allows the manual operator to easily access a wide range of information in the language you select directly on site.
7. Possibility of remote firmware update of the logger (AFA), which allows an easy way to update of the logger program code.
8. Extension of calculations. The calculations of maximum, minimum and standard deviation can be activated in any digital or analog channel, wind vanes included.
9. Extension of the automatic detection of failures (e.g. sensor failures, low battery etc.), with user-configurable algorithms, introducing a new special notice of failure for wind vanes based on instantaneous data.
10. Adaptation to the new IEC 61400-12 standard that requires the data sampling rate in the logger to be equal to or less than 1 second (1 Hz).
11. Given the enormous growth of the sector there have been added redundant safety concepts to the *Eol Zenith*®: raw data encryption, file signature which guarantees no manipulation, control of both manual and/or remote access to the logger, digital signature of the logger position, reporting its coordinates, and the creation of an **Access Privilege** System with several levels to information access. As an example of the latter feature, it allows for an installer to connect to a data logger (and check that all sensors are connected correctly) but not to download data.
12. New power management, and recording of the battery voltage every ten minutes.
13. Satellite-update of both time and date, which ensures perfect synchronization at all times in all loggers installed worldwide.

14. At the request of the user, you can configure the auto-forwarding to the email address specified by the client of all the 10minute data previously downloaded.
15. Removable terminals that provide easier installation and sensor repair.
16. Extension of the number of channels up to 10 anemometers and 15 analog.

## Software

The software platform for the data logger has changed and is now presented as an entirely new concept:

### ***EOL Manager***®

The experience gained by companies with hundreds of weather stations, has led to the Kintech Engineering design of the software that goes beyond the mere concept of an interface with the logger. *EOL Manager*® represents a real manager of the wind assessment sites, with the clear intention of saving time in operating the stations.

All stations provide data to a database located on your PC, which acts as a central control system, and is updated automatically. At a glance you can recognize if there are any changes in the status of any wind assessment site, or if there is a problem in the data-logger itself, or with some of the sensors connected to the data logger.

Still maintaining its ease of use, we have amplified the number of options. For any set up, there are existing defaults, but you can create your own configuration and customize (e.g. output file formats etc.).

We have built a new advanced graphical interface for viewing the wind data; we call it the

### ***EOL Charting Tool***®

Time graphs can be generated in polar coordinates, XY charts, Weibull, graphs, correlations between sensors, analysis of tower shadowing, wind profiles, combined IT10-IT30 graphics, etc.

The *EOL Charting Tool*® allows the user to detect failures by manually zooming on the wind data, application of offset to graphics, color-coded according to date for not time based graphs, wind roses, as well as a long list of features designed for wind assessment engineering.

## Logger components

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The below picture of the logger shows several logger user interfaces. Some of the logger components are shown although they will be explained more in depth in the following chapters.

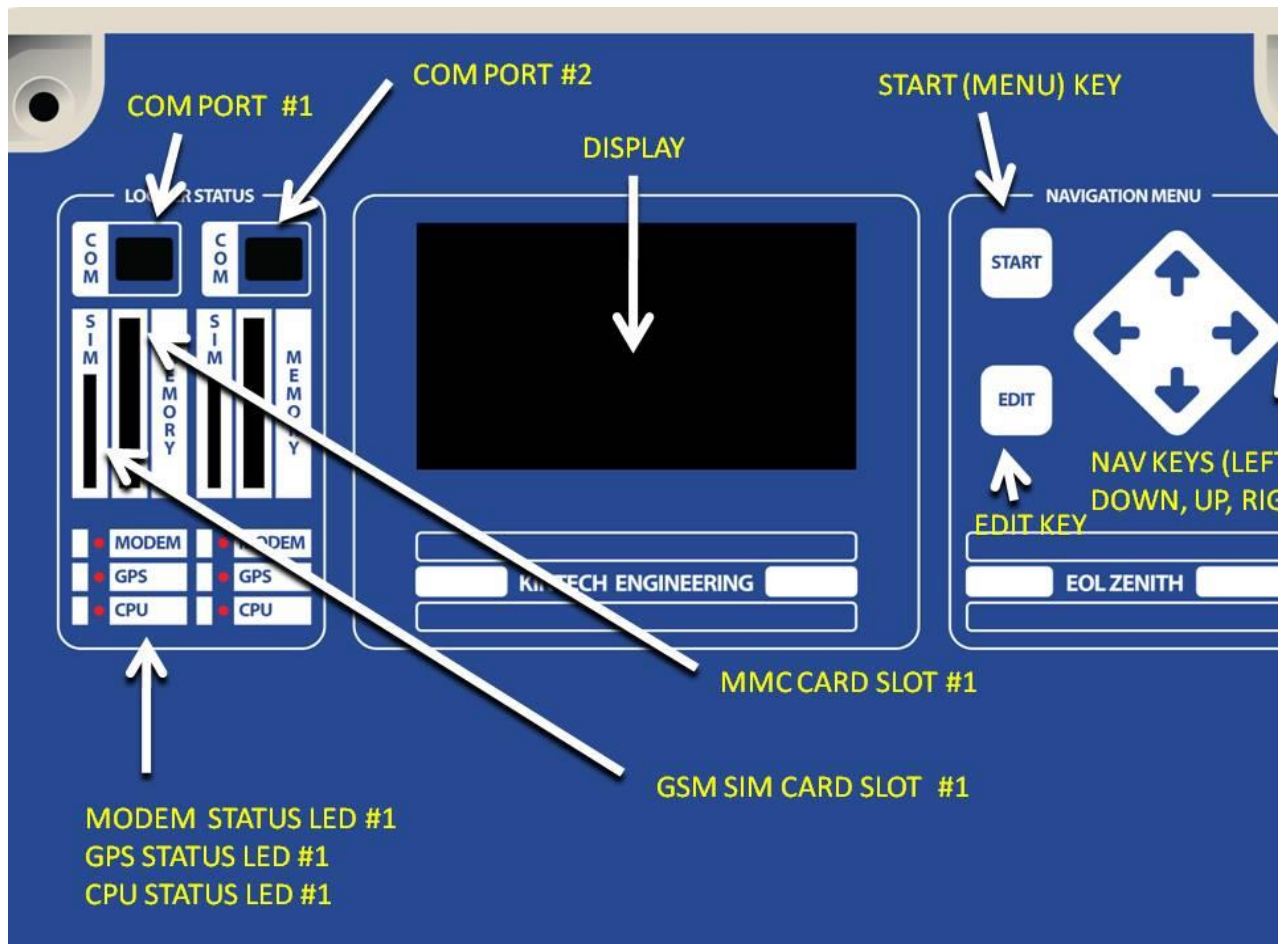
### *Display*

The user can access the information of the connected sensors, the time and date of the logger, the communication status, the coverage or signal intensity, or the system status, for example the supply voltage. Sometimes, the logger itself displays automatically a warning message with some interesting information about an event or process. In order to save energy, the display will automatically switch off after several minutes of the latest access to the any key. To switch on again, press the *Start* button.

### *Keyboard*

The keyboard is used to access the logger menus and to select or validate new configuration parameters.

There are also some key combinations that do specific tasks and are described in its correspondent chapter.



#### Led Indicator

##### GPS (blue LED):

- LED indicator is off: GPS has no power.
- LED indicator is steady on: GPS is on but there is no satellite signal.
- LED indicator is blinking: GPS is on and has satellite signal (even if the GPS just received the signal).

##### MODEM GSM (red LED):

- LED indicator is off: modem has no power.
- LED indicator is steady: Modem is on but is not able to register on the network due to wrong PIN, no signal or incorrect configuration.
- LED indicator is blinking slowly (every two seconds): the modem is correctly registered in the network and waiting for communication.
- LED indicator blinks fast: two times per second during a call.

##### CPU (green LED):

- LED blinks two times per second when high activity is present in the CPU.

### External Battery

The Eol Zenith works only with an external battery. We recommend using a flotation (back-up) sealed lead-acid battery (12VDC). This kind of battery has no maintenance and can be transported in any orientation.



There are different consumption requirements according to the station configuration, so there is no universal power supply system solution that fits every station. There are several factors affecting the station consumption: hardware, communication mode, sensors... I.e. satellite modems consumption is two times higher than GSM, sites with low signal need more transmission power during telemetry sessions, number of telemetry sessions a week, number and type of sensors... Other factors affecting electrical generation are latitude, solar radiation of the site, panel orientation. We recommend using batteries at least 24Ah having that way up to 1 month autonomy without be recharged (and the GSM modem on).

Solar regulator and battery should be inside the same weather proof enclosure that protects the logger. Solar regulator must be installed just next to the battery because its charge control function depends on the battery temperature: this means that the temperature of the regulators should be as close to the battery temperature as possible.

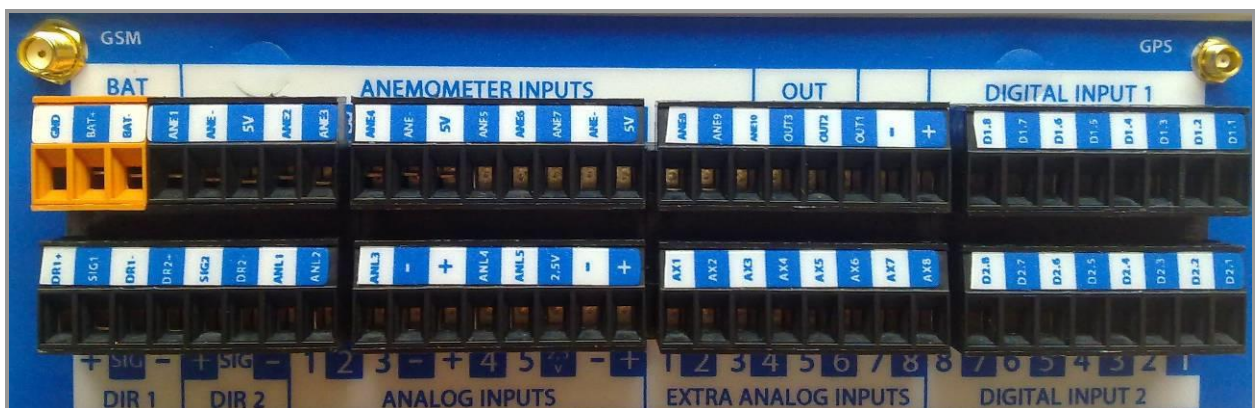
Disconnect the battery positive terminal on the data-logger prior to perform any maintenance on the battery first.

### Grounding terminal

The GND terminal is designed to be connected to a grounding cable. You must use a different grounding cable than the grounding wire coming from the Franklin spike. The wire must be made of copper and with an appropriate section; the grounding rod should have the minimal resistance to the earth. Depending on the soil resistance a special grounding installation (net) should be considered. As in most cases the grounding resistance to the soil have not been measured, it is advisable to install a grounding rod apart to the other dedicated to logger ground terminal.

### Modem

The Eol Zenith® logger has an internal quad-band GSM-GPRS modem that works worldwide. For CDMA or satellite communications an external modem is used, the modem is connected to the loggers' COM port. The GSM antenna must be connected to the antenna connector shown below:





### **GPS**

The Eol Zenith® has an internal GPS. The antenna must be connected on the right as shown above.

The logger updates its time and date using standard UTC time provided by the GPS. Every time update and coordinates is included in the reports (txt files after data downloads).

### **COM1 connector**

COM2 port is by default reserved for the GSM internal modem (and the physical connector should be free). That connector is just used when using a:

- CDMA or satellite modem
- Radio-modem or a optic-fiber converter for (Wind Farm module)
- Direct PC to logger connection

### **COM2 connector**

COM1 port is by default reserved for the GPS (and the physical connector should be free). This connector can also be used as an alternative COM1 under some specific conditions.

Special uses of COM1 can be i.e. the connection of an ultrasonic anemometer that requires RS232 bus (contact Kintech Engineering for additional information).

### **Logger Reset**

The Eol Zenith® has no reset button. To reset, just disconnect the battery power (the system keeps configuration and data in the internal memory).

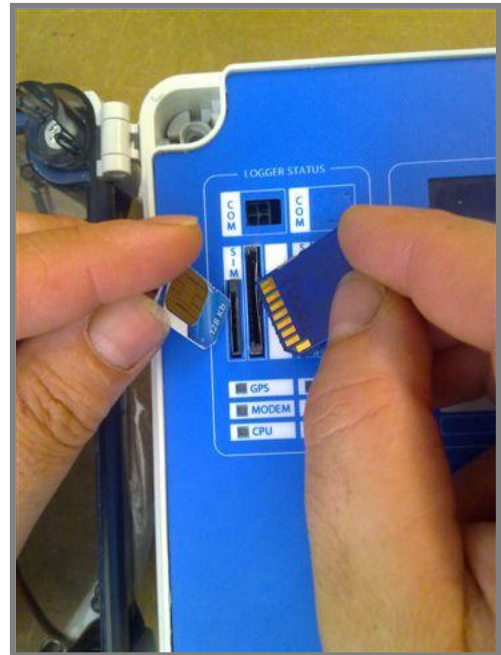
Just after the logger is turned on, the time and date of the recordings will be the present on the non-volatile memory when the unit was turned off; however that time and date will be updated as soon as the Eol Zenith's GPS syncs once again.



### MMC card slot

The logger works with an external standard SD/MMC memory. The MMC memory should be inserted in the slot "MEMORY" (left side of logger). Card should be inserted softly with metal contacts facing SIM card metal contacts and the trimmed corner first (down) till a click sound is produced (then the card moves backward). There is just one way to insert the MMC card; do not force it or damages can be produced.

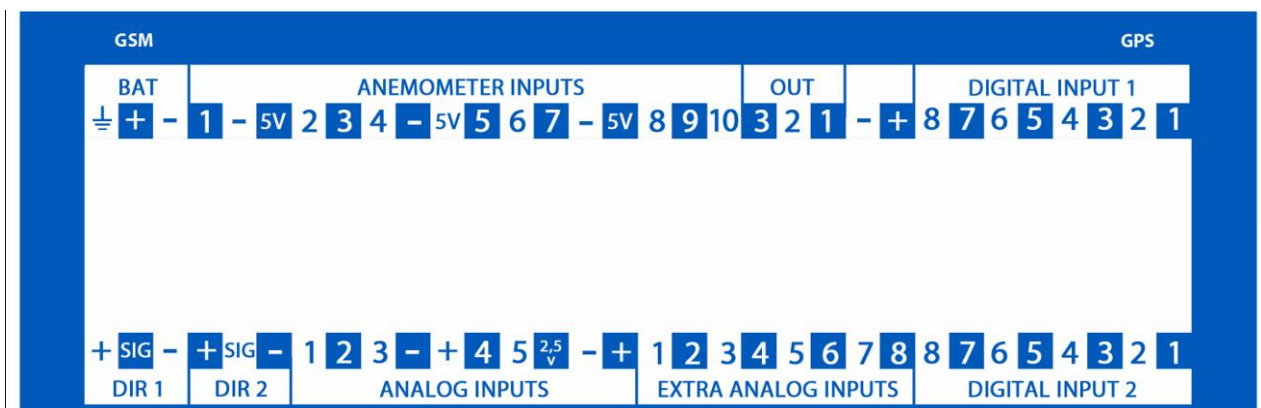
The memory is supplied together with the logger. Even though the logger is compatible with most SD/MMC memory cards up to 4GB memory capacity, we strongly recommend using the supplied memory.



### SIM card slot

The SIM card should be inserted in the slot "SIM" (left side of logger). Card should be inserted softly with metal contacts facing MEMORY card metal contacts and the trimmed corner first (down) till a click sound is produced (then the card moves backward). There is just one way to insert the SIM card; do not force it or damages can be produced.

### Logger terminal



The picture shows the 64 logger terminals:

- 10 anemometers terminals
- 2 wind vane terminals (with power terminals)
- 13 analog
- 1 earth GND terminal
- 2 battery terminals
- 16 terminals for 2 digital BUS
- 5 terminals with 5V discontinuous power: labeled with '+' symbol

- 3 terminals with 5V continuous power: labeled with '5V' symbol
- 1 terminal with 2,5V
- 3 terminals for digital outputs
- 6 terminals for signal reference connection ('-')

## Logger reliability and accuracy

### *Hardware reliability*

The Eol Zenith hardware reliability is reached with a hardware design that includes active filters for all inputs, Transzorb® diodes, lightning/ESD protection varistors and Schmitt trigger on inputs with hysteresis.

All loggers' components have the maximum quality available at the international semiconductor suppliers market. The components used are industrial grade designed for extreme temperatures and electromagnetic noise reduction.

### *Firmware reliability*

The Zenith firmware shares the same OS platform than EOL2020 and EOL2040 predecessor, this guarantees the same reliability reached in the last 10 years.

The Zenith has an auto-diagnosis system that detects failures like low battery special status.

There is immediate configuration values recovery after a reset event or power lost including time, date, sensor configuration. The system registers the reset event and also any possible change on the configuration.

Micro-processor task are supervised by intelligent watchdog.

### *Quality on manufacturing*

The data-logger is manufactured under traceable homologated procedures. All logger component providers are specialized and manufacture under quality control systems. 100% of loggers are tested in an automatic system including all features, functions and telemetry modules.

### *Calculation precision*

Average wind speeds for anemometers are calculated with 16 bit precision: this means that the precision in the results depends consequently on the sensor precision. Max and Min wind speeds have  $\pm 0.05$  meters / second accuracy. Standard deviation has 1% accuracy and 0,001m/s resolution.

Wind direction are calculated with 8 bits precision (0.4% resolution after conversion =  $1^\circ$ ).

For the rest of analog inputs precision is 12+1 bits, meaning 0,024%.

## Data security and anti-intrusion protection

The high value of the wind data causes that actions must be taken to provide enough protection:

1. Data must be protected from internal or external theft: protection against stolen cards and unauthorized connections must be taken.
2. Data must be original: must be protected against manipulation; wind auditors have plenty of ways to check if the data is real.
3. The origin (site location) of the data must be real; a protection must be taken against errors or third party interest when providing the origin of the data.

### Intrusion

Intrusion means unauthorized data download that can or cannot be noticed by the real data owner. Additionally in some data-loggers it is possible to deliberately modify wind files (even raw data files) to modify the results (so it is difficult to detect for wind auditors because they use those raw data files).

The Eol Zenith® data-logger always encrypts raw data recorded on the MMC card to avoid any unauthorized data use (no special actions from user are required due to the encryption).

The Eol Zenith® has a special feature allowing station owners to provide a special password for technicians that only allows them to real time monitoring of the station and not data downloading. This feature allows technicians to check sensors or doing any other check after maintenance is performed (protecting the data). The station owner can provide a special password that allows just instant time data access, so 10 minute averages are protected. Other higher level passwords are configurable for providing access to all system features or just to a specific list of employees (anyway the access and operation of the software requires introduction of the device serial number available on the logger's left side, right between the hinges).

After every download the user can check the download report (comes attached to the data file) all remote access, ID of incoming calls, license number of software that originated the communication and MMC card extraction.

### Manipulation

Data encryption avoids by itself any possible manipulation however there is a redundant security method consisting in a *hash code* SHA512 digital signature that informs of any manipulation in both \*.wnd and \*.log files.

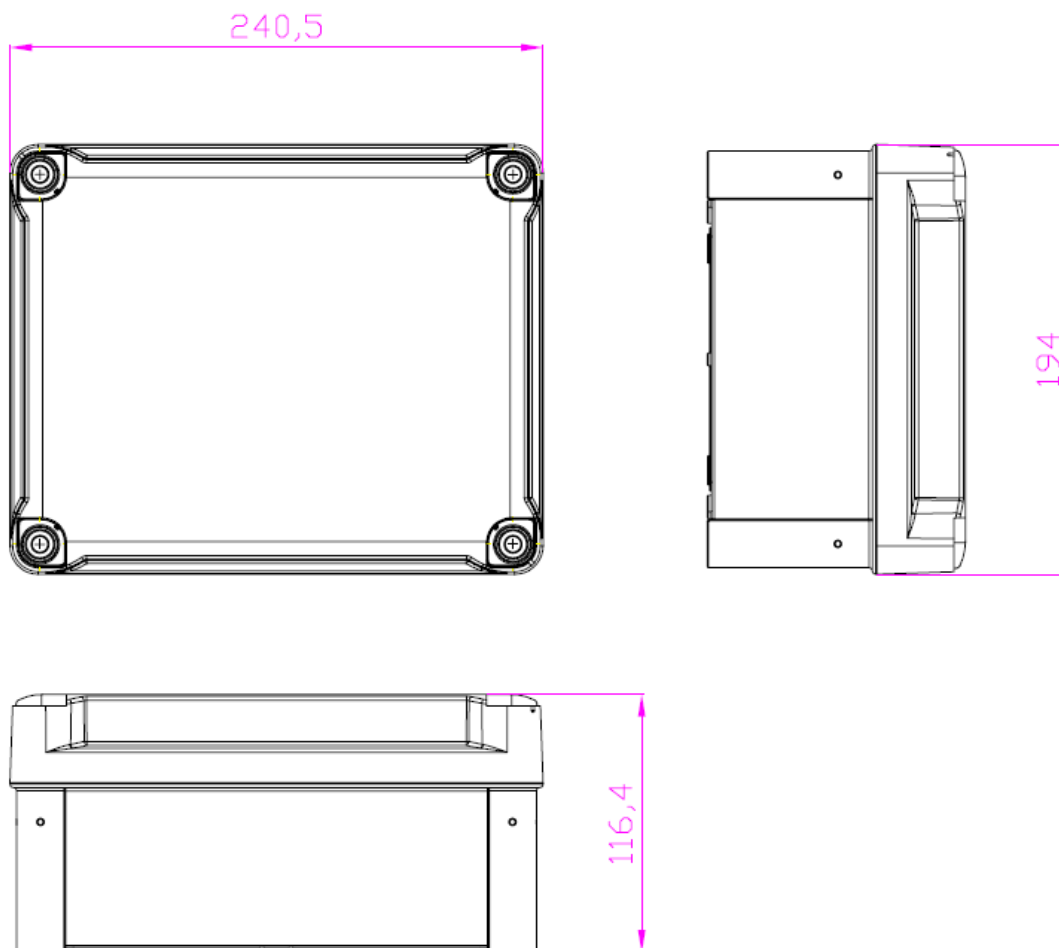
### Origin

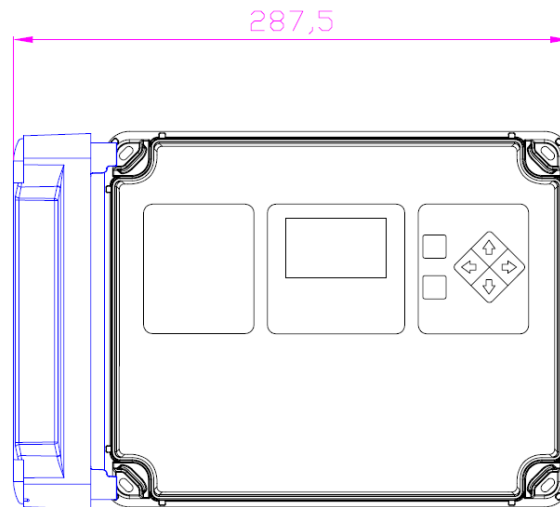
Installation crews would check the exact coordinates for met towers with handheld GPS devices. This procedure sometimes is the origin of significant errors. Also, the location of two different towers has been permuted (so the origin of data is false). To avoid either situations or deliberated modifications the Eol Zenith® has an internal GPS that informs about the exact location.

## Schematics and mechanical dimensions

Drafts below will help installers preparing the enclosure for logger and electronics. We also show the best way to install the logger box inside the enclosure.

### *Eol Zenith® dimensions (mm):*



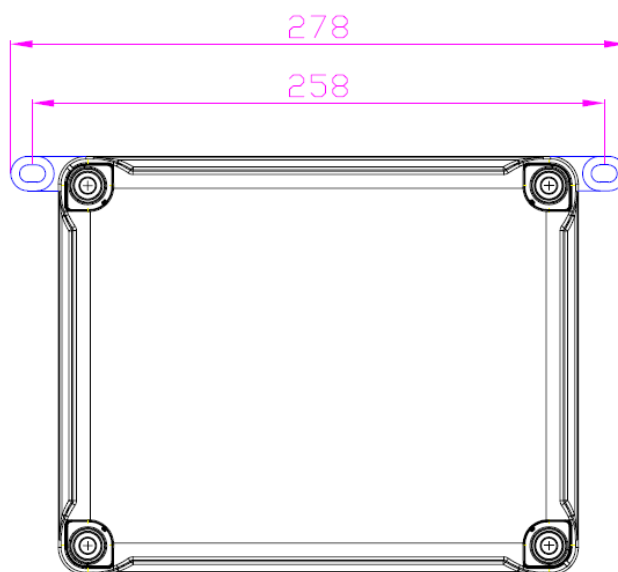
***Eol Zenith ® dimesions with the door open:******Mounting the Eol Zenith ® to the shelter box***

There are two mounting rings to fix the logger box on mounting screws: the rings can be installed vertically or horizontally by screwing on the logger drills. Distance needed between both mounting screws depends on how you installed the rings.

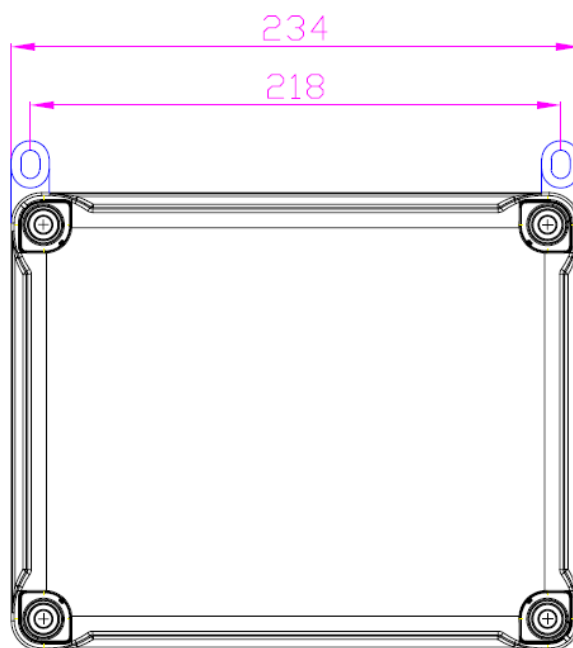


Below different drafts showing dimensions between screws for booth vertical and horizontal installation: keep this in mind before drilling holes for mounting screws. Internal ring diameter is 7 mm: buy screws according to this.

**Eol Zenith ® dimensions with mounting rings in horizontal position:**



**Eol Zenith ® dimensions with mounting rings in vertical position:**





## 4. BASIC PRINCIPLES OF ANEMOMETRY IN THE WIND SECTOR

### The data-logger in the measuring campaign

The specific data-logger model used in a measuring campaign can directly influence the results. Indeed, the quality of the logger improves the data-availability and even the quality of the data recorded.

The data availability can be improved by different ways. The logger should be robust, able to shield against lightening and the telemetry system should be efficient even in areas where the signal is poor, in order to be able to detect and fix eventual sensor faults as soon as possible. Also, the ease-of-use, the real time monitoring capability and all the features incorporated in the logger will always help or assist to improve data-availability.

Any data-logger works by means of its' microprocessor, which has implemented mathematical functions, (in the same way as a calculator), which cannot make any error in the digital calculations. But a data-logger is an isolated device, which suffers harsh conditions and works - stand alone, without an operator. Some issues could cause the logger to give false or biased information. For example, the interferences or even exceptionally a fault in a semiconductor could affect the measurements.

Despite all these problems, the most common source of trouble, are slips or mistakes of the technicians who work on the installation and maintenance of the stations. For example, a technician installs an erroneous configuration. It is very important the data acquisition system is developed to be resistant to any eventual human error that has negative consequences. The Eol Zenith® system has been designed, taking into account all the practical factors in everyday tasks. It is important that the entire network of data-loggers is designed with a Central Station acting as a Master from where all the Measure Stations are controlled. For example, all the telephone calls are made from the Central Station but not from the loggers, just to avoid confusion. For the same reason, the location coordinates are saved thanks to the built-in GPS of the Eol Zenith®.

Nevertheless, the quality of a measuring campaign places a large significance on the sensors. (The sensors are the transducers of the physical reality). Not only in the Eol Zenith® software, but also on the logger display there are available lists of branch and sensor models, which you can connect to the Eol Zenith®. This list includes the majority of commercial sensors in the wind sector. If you don't find a particular model, please do not hesitate to contact Kintech Technical Service.

Kintech has Wiring Diagrams available for all the sensor models included.

Please, refer to the chapter *Configuration* to get more information about the sensor models explicitly compatible with the logger.

Some basic principles about the most common sensors in the wind sector and its calculations are shown in the following pages.

## Anemometers. Basics of Anemometry

Eol Zenith® offers ten channels to connect anemometers with frequency output. We refer usually to the mechanical cup anemometers, which are the most common sensors in the wind sector. However, we will mention the propeller anemometers, which can be combined with a wind vane to get a self-orientated rotor. The precision of the propeller anemometer is lower than the precision of a Class 1 cup anemometer. However, the propeller anemometers have advantages, which can make them an interesting option for some applications, such as the RMYoung\_05103.

Some anemometers produce pulsed output signal with frequency proportional to the cup rotation speed. The transducer is a coil that generates a sinusoidal wave output signal whose amplitude and frequency are proportional to this speed. This kind of anemometers benefits from zero consumption, but they have the inconvenience of having low immunity to electromagnetic interferences, especially at low wind speeds, because the output signal under this condition is very weak. Some known models are the old MAX40, the Ornytion 107A, the anemometers manufactured by RM Young and some others. These anemometers have a signal output codified in two wires, without polarity, i.e. it is of no matter to connect any of the two wires to the positive or negative terminals of the logger wiring panel. The anemometer coil has a double pair of poles, so every rotor revolution generates two whole waves. If so, the proportion factor or transfer equation  $\text{Velocity (m/s)} / \text{Frequency (Hz)}$  use to be around 0.75 (=3/4).

Many anemometers give a pulsed output signal, typically by an electronic stage, which generates the waves whose amplitude does not depend on the anemometer speed, but whose frequency is directly proportional to the rotation speed. Examples of sensor models are *Ornytion 107H*, *Vector A100L(X)* and *Thies*. These anemometers have at least 3 wires, positive and negative for the supply plus the output signal wire. The positive pole has to be connected to the supply voltage specified by the sensor manufacturer. The output wave is generated by semiconductors with magnetic or optic effect. For example the optic type, the anemometer is directly coupled to a slotted disc chopper wheel. The chopper rotates and interrupts the light path of an optical link. The optic types usually produce an output signal with about ten times higher frequency than the coil anemometers mentioned above. This fact does not have any advantage when calculating 10 minutes average speed, but it can affect and improve the calculations related to instantaneous speed, such as the turbulence calculations. The optic type of anemometer should be chosen when used over areas where interferences are expected due to the proximity of antennas or electrical power lines.

**Note1:** The anemometers with analog output cannot be connected to any of the 10 channels, but to the analog channels only. There are some anemometer models, for example the *Vector A100L2*, which have both outputs, voltage and frequency output. All the recommendations say that the anemometers should have a frequency output, due to the fact that a digital system has always stronger immunity for interferences. However, there are still some devices with an analog encoding only, as the anemometer for measuring vertical wind *RMYoung Propeller*, which must distinguish between an upward or downward stream.

The ultrasonic anemometers, due to its design used to have an analog output as well. This type of ultrasonic anemometer, despite being more precise than the mechanical ones have not become very popular in wind prospecting perhaps due to its high consumption, high cost and the interferences

they can suffer. Although, they have a good time response (which is in favor of the turbulence calculations), it is considered that this type of anemometer does not give reliable and accurate average speed data and there are still some doubts about the influence of the anemometer structure on the wind flow, which can cause measurement errors.

Note2: Some anemometers still use a reed relay which is a series connection of 2 wires, with a contact switching on and off while rotor cups turn. For example, the Serial of the manufacturer *Vector A100R* has this relay. This is a simple but old fashion system, and can suffer hook up of signals, due to its high  $dV/dt$  and infinite impedance when the contact opens, for this reason this option should be rejected to avoid interferences.

Note3: The electronic stages of the common data-loggers in the Wind Sector are designed, either for coil anemometers or for square wave output anemometers only. So, it is necessary to acquire a specific interface card when using the type of anemometer not compatible by default with the logger. However, the data-logger Eol Zenith® does not need any interface card.

It is necessary to point out, the instantaneous speed found out with a coil anemometer, when this speed is low, should be calculated taking into account the instant when the pulse has come, and not only the number of pulses recorded in the 1 second period. Eol Zenith® makes this calculation by capturing this pulse.

### **TRANSFER EQUATION of a mechanical anemometer**

The anemometer frequency output is proportional to the cup rotation speed in pulses per second, measured in Hertz (Hz). Ideally the wind velocity  $V(m/s)$  is proportional to this frequency  $F(Hz)$ , with a proportionality constant  $K= V/F$ .

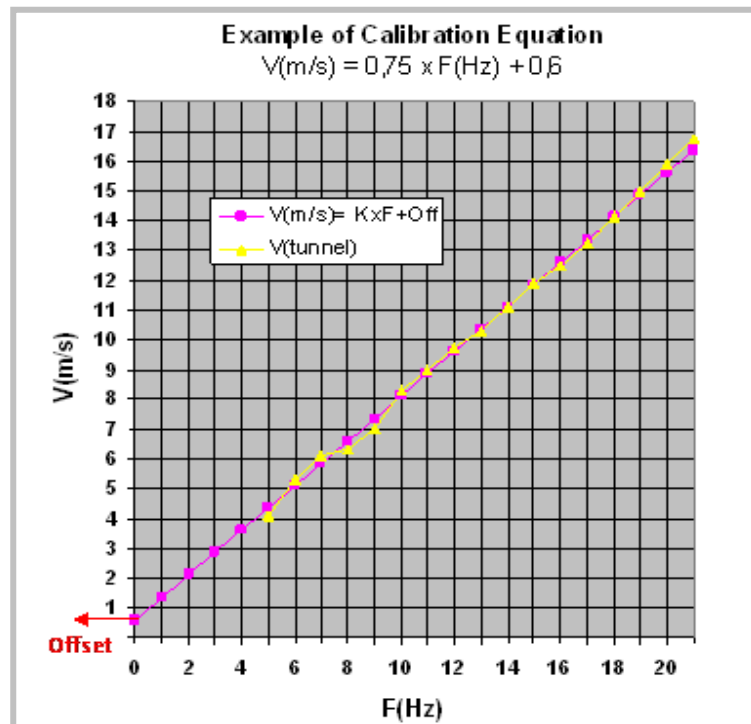
In practice, due to the anemometer friction, there is not an exact proportionality, but the transfer equation which better fits the sensor behavior, is the equation of a straight line, whose y-intercept we call offset.

$$V = K \times F + Off$$

The offset of the Class 1 anemometers is around 0.24 m/s. The lower the figure, the less friction of the anemometer, and the closer it is to the ideal one. But in practice, it is also an important fact that the figures should have a good repetitiveness. This means the transfer equation for the same model of anemometer should be always very similar to the pattern, and furthermore, should not vary with its age, the outdoor conditions, or the temperature.

This transfer equation usually is made empirically by determining pairs of  $F$ ,  $V$  in a wind tunnel, writing down the output frequency observed in the anemometer, for every known speed in the tunnel. Afterward, a regression line is calculated by the least square method.

Obviously, the more pairs of points are obtained in the calibration, the more accurate it will be. For example, 13 speed points are determined, in the range from 4 up to 16 m/s, in a MeasNet Calibration. This is the range where the wind produces the major part of the energy for a wind mill. Moreover, above 16 m/s the anemometer increases the non linearity behavior. Thus, the calibration line will fit better inside this discrete range than out of it, where the speeds are above or below these limits.



Actually, the very low speed, are not relevant statistically speaking, and has no weight in the resource studies, due to its low energy content. The calibration is performed taking speed points with increasing speed and then decreasing speed, to avoid hysteresis.

From all the reasons commented, it can be concluded that the calibration transfer equation, is nothing but an ideal model of the reality. If we see the equation, when the anemometer is stopped,  $F=0 \Rightarrow V=\text{off}$ ; Thus, the equation gives the paradox that (due to the offset), despite the anemometer is stopped, the speed is not zero. If we follow the calibration equation literally, we will never find calms, since the minimum speed  $V=\text{off}$ . Actually, the anemometers have a starting threshold, with a value specified by the manufacturer, usually lower than 1m/s, although higher than the anemometer offset.

Some data logger manufacturers use the calibration equation for the internal calculations of speed, but only from some particular lowest limit of frequency  $F_{min}$  (or speed  $V_{min}$  by using the calibration equation  $V_{min} = K \times F_{min} + \text{Off}$ ), whereas under this (conventionally invented) speed limit threshold  $V_{min}$ , they cut off the speed to zero. In this way, they still show calms in the 10minutes speed records. This fact causes a bias in low speed bins, in such a way that there is more data than the expected data from its Weibull distribution in the zero bin although less data in the following bin.

However, Kintech loggers use the same equation along the frequency spectrum to calculate all the 10minutes speed data,  $V = K \times F + Off$ , since the user himself can create his own criteria to distinguish calms, by knowing the average, minimum, maximum and standard deviation of every 10 minutes record. Nevertheless, Kintech still finds out maximum and minimum speed with the criteria: If  $F=0 \Rightarrow V=0$ , but only in this case the offset is not used.

**Important:**

It is very important to highlight that regardless of the criteria followed by the logger (Kintech criteria or any other), the results of a wind resource analysis are the same, due to the short statistic weight of low speed records, as mentioned below. Hence, the choice of the criteria, from a practical point of view, is irrelevant.

***Accuracy of the anemometers***

During the last years, several manufacturers have designed more precise anemometers and several technical documents about this matter have been released.

Some technicians thought years ago, that the uncertainties associated with a measuring campaign, masked the uncertainties of a cup anemometer. For this reason they did not attach importance to the quality of the anemometer. However, nowadays the majority of technicians are aware of the fact that a precise anemometer is required in order to not increment the uncertainty of the projects, which is very understandable if we take into account the huge amount of money involved in Wind Farm development.



**EXAMPLE OF OLD  
ANEMOMETER**

The improvements have been reached by using the proper bearings, a lighter rotor, using conical cups and a thinner anemometer body shape by an axis of the cylinder which makes up stator and rotor of the shortest possible diameter in order to avoid flow distortion. As a result of these improvements, we get a better aerodynamic response of the anemometer.

In the above picture an old anemometer is shown. A thick body, cups too close to the axis and not conical but spherical, can detail the old anemometer. On the other hand, the below picture displays a modern anemometer, Ornytion branch, model 107A, which represents all the features of the Class 1 anemometers, designed specifically for the wind sector.





MODERN ANEMOMETER FOR  
THE WIND SECTOR

The most important features to take into account are:

- The time of response, speed up and down as a response of a speed step. It must be the quickest possible. Its characteristic length should not be higher than 2 meters. Higher lengths will affect the calculations especially under turbulent environment.
- The cosine response or immunity against vertical streams, should not have influence in the horizontal speed records. This is naturally more usual in areas with strong slopes.
- The linearity in the response, which is included in the figure  $R^2$ , shown in the calibration certificate. It gives an idea about the sensor accuracy. It should be greater than 0.9995
- The repetitiveness of the series, which in modern anemometers is about 1/1000 for the values of K slope.

As it has been already explained in the section *Installation of instruments in a measurement tower*, it would be useless to set a high quality anemometer if it is not correctly installed. It is especially important that the booms have enough length and are well orientated.

Icing is one of the most common troubles in cold areas. Kintech has released several “*Application Notes*” about this issue. Do not hesitate to consult Kintech Technical Service for inquiries.

Finally, it is recommended the anemometers should be calibrated not only before but also after the measuring campaign.

### Wind Speed Data

The most important data used for wind calculations is the **10minute average** speed. This 10minute period, is a standard of the software packages for wind resource assessment, and comes from the WMO (World Meteorological Organization). *Eol Zenith*® data-logger captures, counts and records all the pulses generated by the anemometers for this period. The graph tool of the software *EOL Manager*® is an excellent help to perform wind studies.

The **gust** calculation of the *Eol Zenith*® lets the user know the maximum and minimum speed in the 10minute interval. The gusts evaluated, have a length multiple of one second, time which is user configurable. Every one second the logger renews the gust, by introducing the last one second speed value. (Think that the wind has inertia, reason why accelerations and decelerations take some time). In fact, the standard gust nowadays from the IEC61400-12 is 3 seconds, which is the default value taken by *Eol Zenith*®. The data is shown with one decimal place, with a precision of  $\pm 0.05$  m/s.



Gust calculation is also used for data filtering. The average of the maximum and minimum speed in a 10minute interval should be very close to the 10minute speed (the average of the instantaneous records along this period). If it is not so close, it could indicate a fault, mainly due to some erroneous instantaneous speed.

The **standard deviation** calculation  $\sigma$  has a precision for *Eol Zenith*® of about 1%, and a resolution of 0.001 m/s. The overflow limit is 6.4 m/s. If deviation records around 6 m/s are found, data should be revised, since it could be a false value, indicating a problem in the measuring tower, as for example interferences, lightening or a bad connection. Any wind data-logger should not have a resolution for  $\sigma$  worse than 2%. This is due to the fact that the bands which define the wind mill subclasses in the IEC 61400-12 are very narrow. The Turbulence Intensity *TI* is defined as the relationship between the 10minute standard deviation of the wind speed instantaneous records  $\sigma$ , and its respective 10 minutes average  $v$ .

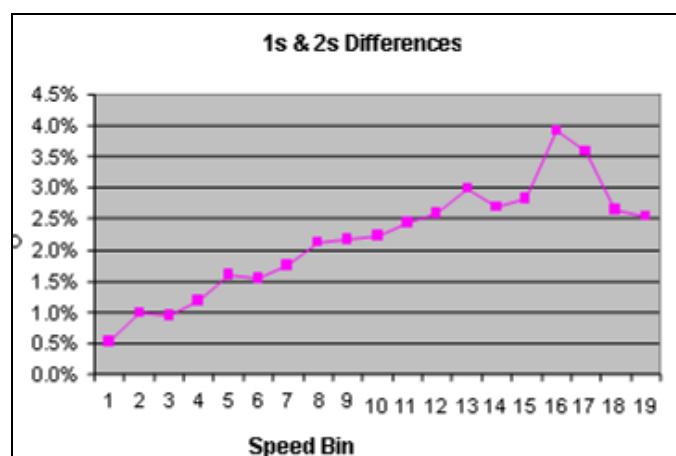
$$TI = \sigma / v$$

According to the International Standard IEC 61400-12, the values of Turbulence Intensity *-Iref-* which define the turbine Subclasses, A, B, C, are respectively 0.12, 0.14, and 0.16. For example, if we have a Site with  $TI = 0.13$ , it will change the Subclass up to C when  $TI$  raises 7% only.

Anemometers with slow response will give a lower  $\sigma$ . The International Standard calculations are based in the response of a cup anemometer. (A sonic anemometer can make a higher  $\sigma$ , up to approximately 4%, so it will reflect a more turbulent environment).

#### **Important:**

The international standard IEC61400-12, establishes that the time period for the speed calculation, referred as sampling time, should be 1 second, as *Eol Zenith*® calculates. However, there are still data-loggers which do not meet this international standard requirement, working in longer periods such as, for example, 2 seconds. The attached picture represents the difference in percentage of ten minutes standard deviation with 1 second and two seconds data collection. It was calculated from more than one million speed data recorded every one second from different sites.



### 30 sec. Turbulence Intensity calculation

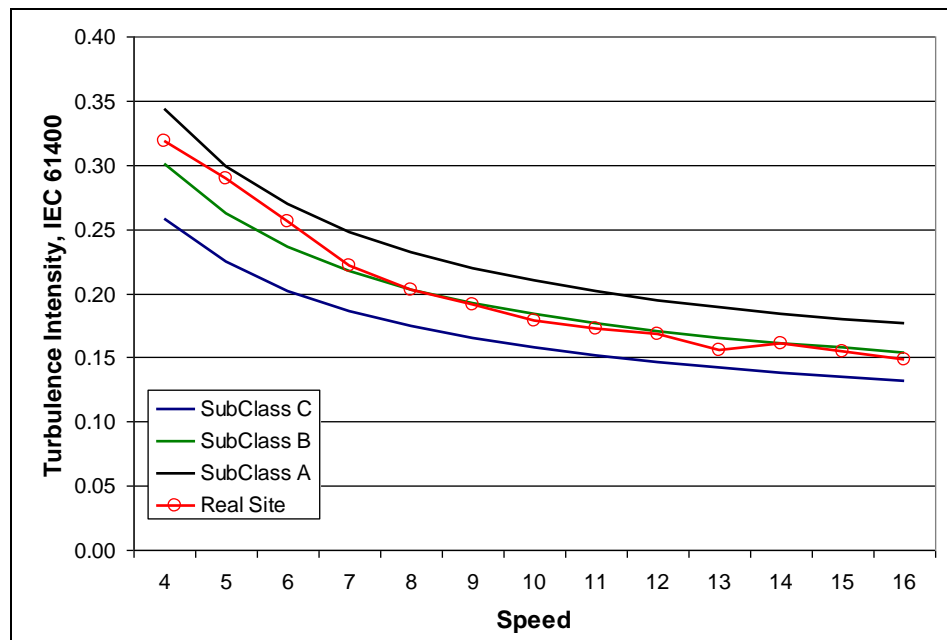
*Eol Zenith*®, in addition to the classic 10minute standard deviation, finds out the Turbulence Intensity every 30 seconds, (*TI30*), and saves every 10 minutes, the average of the twenty *TI30* records inside a 10minute interval. This calculation is made for the anemometer inputs 1 and 2 only. Furthermore, Kintech has created a new model of turbulence, which has been shown to several wind research institutes. This model defines the turbine subclasses with a new criterion. An *EOL Manager*® chart shows and compares the *TI30* of the classic and the new method for every speed bin.

Currently, the Turbulence Intensity, *TI*, is calculated based on the Standard Deviation, *SD*, of wind speed in 10minute periods, *SD\_10m*, as described in the Standard IEC61400. This *SD* is influenced by phenomenon that does not create loads on the turbines. For example, a change in the average speed trend, or low frequency wind. By the calculation of the wind speed *SD* of 30 second periods, *SD\_30s*, instead of 10 minutes, these influences are reduced. The calculation of *SD\_30s* reflects more realistically the actual loads, getting a different wind characterization.

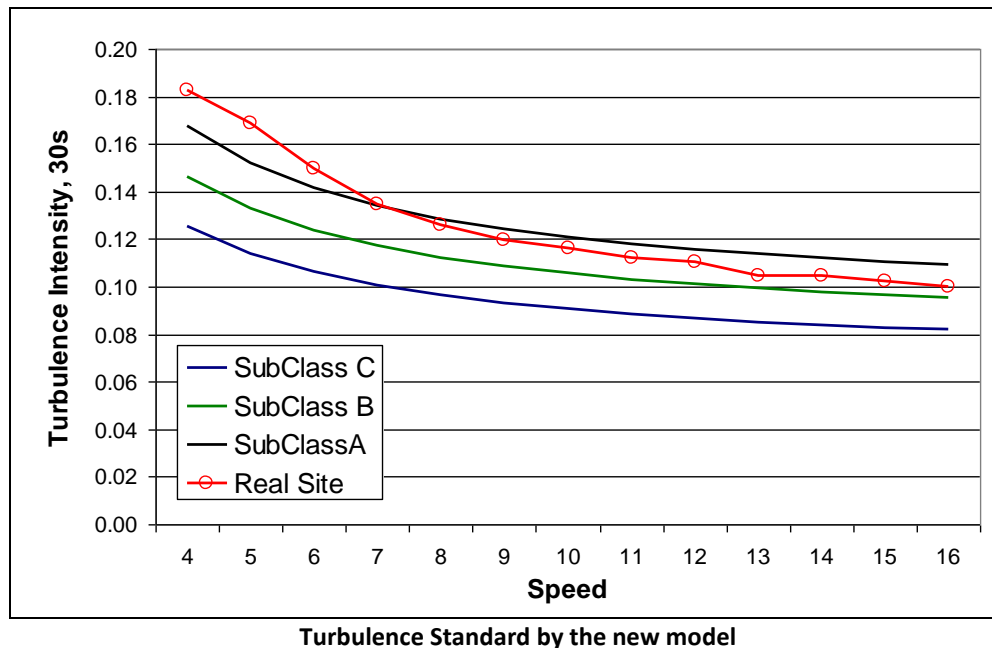
Calculations based on *SD\_10m* and *SD\_30s* lead to different results in about 25% of the sites, which could have an erroneous Subclass definition by using the present model. The application of this new method does not modify significantly the total amount of sites in each Turbine Subclass A, B, C. Therefore it does not increase or decrease systematically the turbulence on the sites, compared to the present model. It just makes a different assessment.

The topic is of prime economic importance because the Turbine Subclass A, B, C calculated for a wind farm, has a substantial impact both in wind farm yield and availability.

It can be checked in the below charts a Site where both Criteria give different results



Turbulence Intensity by the classic Standard 61400-12.



Also, this new model redefines the criteria of “**Extreme Turbulence**”, which causes, when applying the classic model used by wind farm controllers, often forces unnecessary preventive stops of the wind mills, causing an unnecessary loss of profit.

### *Anemometer for measuring vertical flow*

A cup anemometer only informs about the horizontal projection of the wind speed vector, which is the input used to interpolate the power curve of a wind mill, the horizontal speed. However, vertical streams are important regarding turbulence and they generate fatigue and vibrations in the wind mills. These streams go usually upward.

When planning to measure vertical streams, it is necessary either using a sonic anemometer, or (as the most common option) using a propeller anemometer. The propeller measures the wind speed in one direction, in this case vertical wind if the anemometer axis is vertically orientated.



The most popular one is the model “Propeller” manufactured by RMYoung shown in the picture. Given that the stream can go upward or downward, this anemometer gives an analog output, in such a way that you can distinguish the direction of rotation depending on the sensor output voltage. Since it is an analog signal it must be connected to the analog logger channels.

The propeller response is disturbed by the wind components parallel to the propeller plane, and also by the boom, which is in the same line as the wind. Because of the reasons stated, the propeller does not have high precision and there is not much worth in making a complete calibration of the anemometer.

It is advisable to find out the standard deviation of the vertical wind speed, since the International Standard says that this value must be composed with the standard deviation of the horizontal wind.

## Wind vanes

Wind vanes are very important in wind studies due to the fact that:

- The wake effect depends on the wind direction and therefore the wind rose determines the “micrositing” to optimize the location of the turbines along the wind farm.
- The wind direction is an “input” to solve the equations of the fluid field by some of the available software packages.

*Eol Zenith®* has 2 channels for wind vanes and 5 analog channels user-configurable for example to connect additional wind vanes.

The main issue of mistakes in the wind direction data is not the wind vane hardware, but its installation. Getting a proper orientation of the wind vane is not as simple as one can think, and often this task is performed without the required precision. It is common that in spite of the fact that the North reference is taken correctly, the mechanical procedure to install the wind vane causes an error. Because of this, it is advisable to always install one [Geovane](#) per met mast. Take into account that perfectly aligned wind vanes with zero offset between them in no way means either of the wind vanes is correctly aligned towards True North. What's more, despite the common misconception, adding more wind vanes does NOT resolve this issue.

The upper wind vane must be set at the same height (or very similar) than the upper anemometer, in order to properly characterize the wind.

It could also happen that in addition to the mechanical orientation error of the wind vane, the reference North point could also have an erroneous offset. It is important to be aware of:

- The orientation by a compass, could be interfered by the tower structure itself.
- Obviously when working with a magnetic North, you have to take into account the magnetic declination with respect to the geographic North, which varies along the planet considerably. In this case setting 2 wind vanes would be useless because both would give an erroneous direction.
- Kintech Engineering has developed the Geovane for the suppression of the wind vane true north offset. Visit [www.geovane360.com](http://www.geovane360.com) for more information.



Another common problem occurs when some of the 3 wires of the analog wind vane are exchanged by a careless mistake. If you exchange negative and positive poles, data can be restored at later stage,

since the measured angle is the supplementary of the real one ( $\alpha' = 360 - \alpha$ ); When any of the terminals are exchanged by mistake with the output signal wire, then it is possible to restore some of the quadrants only. A Kintech *Application Note* is available to explain the transfer functions to proceed to restore data.

Wind vanes have usually a notch in the sensor's body, to orientate it to the North. Please, take care to centre the wind vane's notch with the tooth on the sensor body's rotating cone. By practical reasons, the orientation to North is probably the best choice, to avoid a mess in the installation records. However there are installers that, by technical reasons, prefer to orientate the wind vanes to a different cardinal point. In this case, they should write down precisely the "orientation offset". This is the angle that you have to **ADD** to the angle captured by the wind vane, to get the real angle.

### **Analog Wind Vanes**

Wind vanes can be classified in two kinds, depending on how they codify the information, in an analog or digital way. The most popular ones are the analog, which have a potentiometer of circular shape.

A potentiometer is a variable resistor with 3 connecting wires. Depending on the position of the brush, the resistance varies from 0 to its total resistance. This full-scale value is, depending on the manufacturer from 1K $\Omega$  to 10 K $\Omega$ . The lower limit of the potentiometer is connected to the ground and the top limit is connected to the supply  $U_v$ .

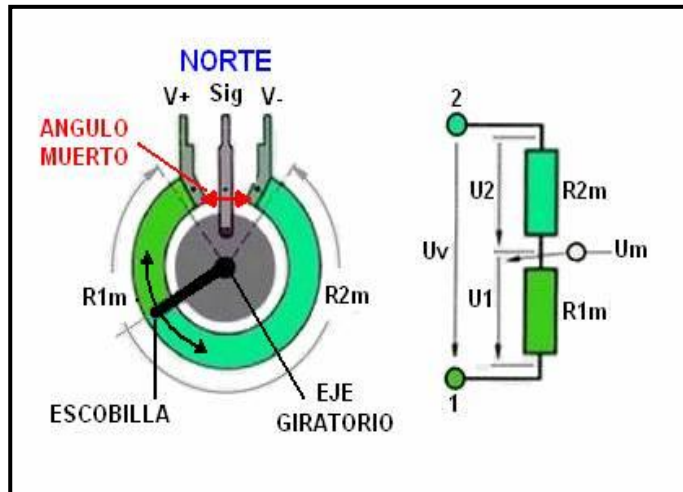
The terminals 1 & 2 ( $V+$  y  $V-$ ) of the potentiometer are almost in contact, in the north of the wind vane. This gap is called dead band,  $A_m$ , the range of directions for which the output signal is undefined. So, when the potentiometer brush is within this arch, it not possible to know exactly where inside this arch is pointing the wind vane. The North should be at the center of the dead band. On the right of the dead band, at the bottom end of the potentiometer, the logger ground is connected,  $V-$ , reason why the electrical angle will be 0 and the mechanical angle will be  $A_m/2$ . On the left side of the dead band is the upper end of the potentiometer where the supply  $V+$  is connected, so the electrical angle will be  $V=U_v$  and the mechanical angle will be  $360 - A_m/2$ . In a general location, the voltage  $U_m$  measured by the brush will give the particular angle. By processing this voltage with a digital to analog converter of the logger, you will get the direction pointed by the wind vane. The analog wind vanes enjoy an infinite resolution. The analog to digital converter of the *Eol Zenith*® is 12 bits, so its resolution is 1/4096x2 much higher than the requirements for this application.

#### Dead Band

The manufacturer indicates the dead band value  $A_m$ . It used to be from 5° to 8°, although in practice can be lower than the value specified in the data sheet. The dead band is designed to avoid that the brush causes a short circuit of the terminals.



Some manufacturers like Thies, reduce the dead band almost down to 0. This is an advantage since the angle where the wind vane does not measure with precision, is also reduced. However, it has the disadvantage that a short circuit will be generated any time the wind vane passes around the North 0. To solve this problem, Thies provides in some models an internal protection against short circuit. Some other Thies models do not provide it, so in this case it is necessary that the logger provides this protection.



*Eol Zenith*® provides built-in short circuit protection in all its supply terminals, not only in the analog channels -labeled with a '+'- but in the supply of the anemometer channels, -labeled with a '+5V'-. Otherwise, although the impedance to the signal wire is infinite (not 0) when the wind vane is in the dead band, the logger should give always a 0 angle along this band.

The dead band (when the electrical to mechanical angle has been properly corrected), does not cause a big error in the direction data, although it can diminish the accuracy. This is because during 10 minutes, even with north wind, the wind vane will be turning, entering and leaving the dead band, in such a way that the average will be partially affected. Sometimes, when the brush is on the dead band, if just the edge of the brush touches the potentiometer limit, the vane could see a random impedance, which represents another source of inaccuracy. Furthermore, since the dead band is small, the difference between electrical and mechanical angle is not big. Nevertheless, given the wind vane model connected to its terminal, *Eol Zenith*® logger makes the conversion between both angles. Be aware that some loggers do not make this conversion. If the data logger doesn't make it, then some data in the range of north wind will be biased to the North, in a quantity of almost half the value of the dead band.

### Digital wind vanes

Digital wind vanes codify the absolute direction by a tower system which determines the rotor angle, usually in Gray code. One-increment binary code, on the changeover of one value to the next one only one single data bit modifies each to the previous and the next value respectively. The Gray-code is used for the digital determination of distances, for example, for the wind direction of a wind vane. The code can be set up by means of any number of digits. It depends only on the required accuracy of resolution. 8-bit wind direction Gray-code the wind direction (0...360°) is converted into an 8 bit Gray code. Some manufacturers have a particular kind of Gray code. For example for Thies wind vanes, the resolution is 2.5°, 144 increments per revolution. Increment 0=0°=North and corresponds to the sector 0...2.5° Increment 143 = 357.5° corresponds to the sector 357.5...0°. Theoretically, a 7 bit Gray code has  $2^7 = 128$  positions, so the resolution is  $360/128 = 2.8^\circ$ , and for 8 bits would be  $1.4^\circ$ . Vaisala and Thies are examples of manufacturers of digital wind vanes.



Digital wind vanes enjoy the advantage of not having a dead band and not having a brush. The brush, due to the friction, can get in trouble since it has a limited life expectancy. On the other hand, these wind vanes used to be more expensive than the analog ones, and not all the loggers have inputs for these devices. *Eol Zenith*® provides two channels to connect two buses of digital wind vanes up to 8 bits each.

### *Mechanical features of a wind vane*

Wind Direction is very important in meteorology, even for soft breeze, when the wind speed is low. However, for wind energy applications, wind direction becomes relevant when the speed is high enough, the reason why, in addition to the Frequency Rose (frequency of direction within each sector), they find out the Energy Rose, (percentage of wind energy in each sector). For wind energy applications, the speed threshold of a wind vane (minimum speed from where the wind vane begins to get oriented starting from the direction perpendicular to the wind), is not as important as in meteorology.

The wind vane rotor is made with a tail to get the orientation pointing to the wind and the head to counterweight the tail. Both elements should be designed to avoid the wind vane turning round. This means that when the wind changes the direction, the wind vane should not over-damp before reaching the balanced point. This performance characteristic is called "Damping Ratio".

### *Most common troubles of the wind vanes*

In spite of the fact that it was stated above that some of the most common troubles in the wind vanes are due to a wrong installation, it is also true that the wind vane quality is important in practice. The cost of a wind vane has obviously a direct relationship with its performance and life.

Some analog wind vanes, can give wrong measurements after some years of work. Since the potentiometers have a limited life expectancy, to avoid problems the wind vanes should be replaced or fixed some years after the installation.



**NOT ALWAYS CAN BE MET THE PRESCRIPTIONS!**  
**Measuring Station over a water tank**  
**Comboniana Mission. Nariokotome. KENYA.**

One of the typical problems is that, because of the potentiometer wearing, the brush sometimes does not contact properly, giving a false 0° angle. This fact causes biased 10minute average data. The further from the North we are, the more biased are the data generated. Depending on the wind direction, this trouble can appear as a kind of variable offset which varies with the wind direction. This problem and some others, which cannot be easily detected by the revision of the 10minute data, however become visible when looking at the instantaneous data, either the logger display at site, or comfortably in your office by a real time remote transmission.

Lightening and strikes usually damage the upper wind vane of the tower, and this is perhaps the main source of faults in the meteorological towers. We know from the experience that some wind vane models are more sensitive to lightening than others, because of the design of its metallic parts.

It is also remarkable that icing is a frequent problem in some regions. Users often do not know that some anemometers models get frozen much easily than others.

The wind vane booms should not be shared with the anemometer booms, and can be slightly shorter. Obviously the boom orientation should avoid the tower shadowing.

### **Wind direction data**

The data used in wind energy calculations, is the average of the directions every 10 minutes. As mentioned before, when the wind is low, these data make less sense and sometimes the wind average direction even has no physical sense. This is the case when it blows soft breeze with variable direction and the wind vane does not point to any fix orientation.

Additionally, the user can work with some other information as the maximum, minimum and the Standard Deviation of the set of directions recorded every 1 second for 10 minutes. These values can be interesting for wind characterization, but they are also a good tool to detect eventual failures of the wind vanes. Data-loggers do not give the possibility to calculate the maximum and minimum direction during the 10 minutes period, but *Eol Zenith*® does. With these data, we will know the arch generated by the wind vane during a 10 minutes period. The length of this arch depends on the site and the wind speed, but it used to be from 10° up to 50°. If this angle were too long, it could indicate a wind vane fault. Similarly, some too short angle could indicate either a fault or an icing trouble. In the same way, a standard deviation higher than 25°, could indicate some wind vane trouble. Anyway the assessment about these figures will stay in the hands of a skilled technician in charge of data revision.

## **Analog probes: Thermometers, hygrometers and barometers**

### **Pressure and Temperature calculations**

The maximum amount of analog probes which can be connected to the data-logger *Eol Zenith*® is 5+8= 13 units. Temperature, relative humidity, and pressure are some scalar physic magnitudes, that although are less relevant than the wind vector for wind calculations, they can help to identify the wind resource with better accuracy. These magnitudes vary much slower than the wind speed, so it is not relevant to program in the logger the calculation of maximum or minimum value during a 10minute interval, since this information is not useful.

The air density, from the well known ideal gas law, is proportional to the atmospheric pressure, and reversely proportional to the absolute temperature. (1°K = 1°C +273.15). Moreover the output power of a wind mill is directly proportional to the density of the air crossing its rotor. (Actually, due to several reasons, that proportionality is not always exact).

$$\rho_0(\text{Kg/m}^3) / \rho_1(\text{Kg/m}^3) = (P_0 / P_1) \times T_1(^{\circ}\text{C}+273) / T_0(^{\circ}\text{C}+273)$$

The atmospheric pressure at sea level is 1013mbar, and the ISO reference temperature is 15°C. The standard Power Curve of a wind mill is given by default under these ISO conditions, which assume an air density of 1.225 kg/m<sup>3</sup>

If pressure data recorded at site are not available, you can work with the average pressure at turbine hub height, by knowing the altitude above sea level. This simplified procedure generates negligible errors in the final results of the calculations. The atmospheric pressure as a function of the altitude, in millibar is:

$$P_{at} \text{ (mb)} = 1013 - 11.8 \times H \text{ (m)} / 100 \text{ mb}$$

So, the atmospheric pressure diminishes with altitude 11.8mb every 100m. This means that at 1500m, the air density will be 177mb or 17.4% lower, and consequently lower the energy of the wind for a particular speed. Given the pressure variations with anticyclones and depressions use to be lower than 40mb, the error attributable to work with the average hub height pressure instead of the 10minute pressure records, is very small.

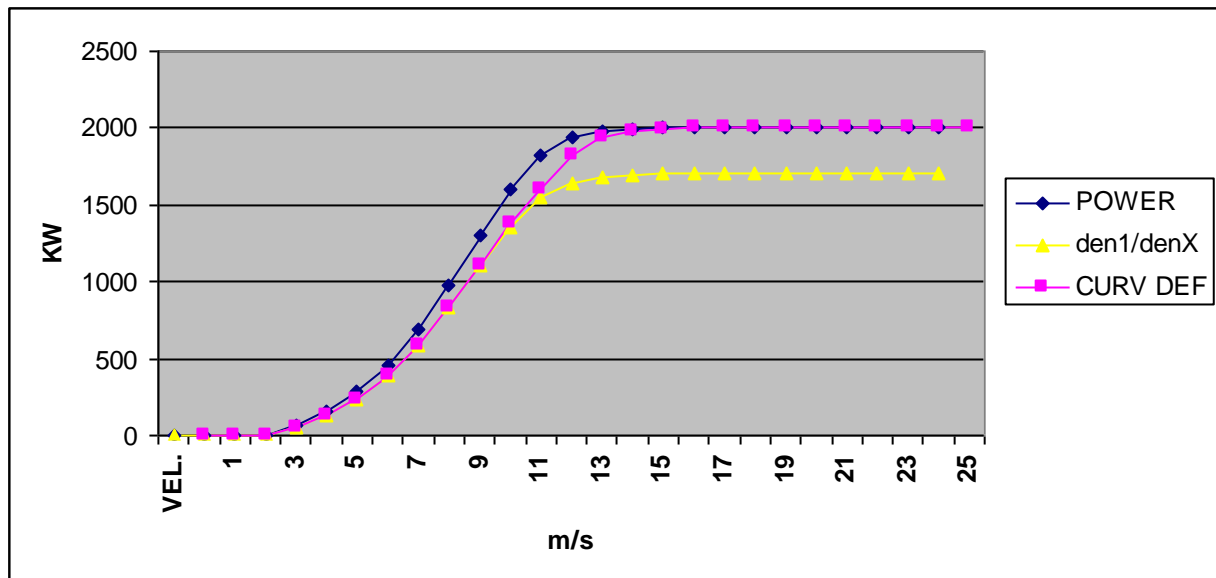
Note:

*Eol Zenith*® pressure is given in Hectopascals (*hPa*) = millibar (*mb*); 1 Pa= 1 N/m<sup>2</sup>

In the same way, if **temperature** data recorded at site are not available, you can work with the average temperature at site indirectly, by extrapolating some information related to it. The temperature has a greater variability than the pressure, and depends on the location in the Planet, the distance to the sea, the season, the latitude and the altitude. Consequently, to know precisely the average temperature without measurements is not as easy as to know the average pressure. In the standard atmosphere, the temperature falls 0.65°C every 100m of higher altitude. So, a place located at 1500m has approximately an average temperature about 10°C lower than some other located at sea level. This fact implies a heavier air density of about 5% at the higher location. (See that this data compensates partially the pressure fall with altitude). So, if we knew precisely the average temperature at hub height, in the same way than with the pressure, the error attributable to work with the average hub height temperature instead of the 10minute temperature records is very small.

The **relative humidity** has an even lower influence on the air density. It is actually negligible in wind resource assessment. The International Standard IEC 61400-12 recommends measuring humidity for Power Curve evaluation in warm climates, since when the humidity rises from 0% to 100% (very unlikely), the air density lower 1.2% at 20°C, 2% at 30°C, and up to 4% at 40°C.

The pressure variations have a greater influence than the temperature, in the air density variation from one location to the other. However, temperature is much more difficult to estimate accurately without measurements, reason why it is more frequent measuring temperature than measuring pressure in the wind resource assessment towers, as mentioned above, the pressure only depends on the altitude. Some technicians think that both magnitudes should be measured, and some others do not measure any of them.



Given the location or even better the temperature and pressure records at site, the turbine manufacturer delivers a particular power curve for this site. This power curve can be divided into two different sections. The first one ends when the wind speed reaches the rated speed for the rated power output. Along this section, the variations in air density are proportional to the power output, and after this rate speed is reached, the density variations do not affect the output power because the turbine control tries to always keep the rated power setpoint. (This explanation is a simplified version of the reality).

A more sophisticated application for the temperature data is performed by measuring at the bottom and at the top of the tower. The small differences of the temperature at both points are related to the "Atmospheric Stability". This term of physics is related to turbulence, vertical flow, stratification of the atmosphere and the length of the atmospheric boundary layer.

Naturally, the towers for Power Performance Curve (as the towers for Wind Farm SCADA connection) should have a thermometer and a barometer, because just what we are looking for is to compare the real electrical output of the turbine with the theoretical one, by knowing the wind speed and the air density at any time. The sensors should be set for these applications at hub height in the tower, following the IEC 61400-12 recommendations.

### Barometers

There are several barometer manufacturers available in the market. The most known ones are Setra and Vaisala. The pressure gauge is set inside the box, for the applications of wind resource assessment. Afterwards, the user can apply the correction to get the equivalent pressure at hub height. Given the site altitude, the user should check that the average pressure is the same than the theoretical expected pressure at this altitude.

Due to its design, a barometer resolution is lower when the measuring range specified in the pressure gauge data-sheet is higher. So, the higher maximum altitude the sensor is capable to measure the lower its accuracy. Because of that, it is advisable to specify in the order, an extended range gauge when working at high altitudes, depending on the model, over about 1500m.



Although laboratory range barometers are available, in practice is enough that the barometer we use has a precision of about 0.25%, i.e.  $\pm 0.75\text{mb}$  (equivalent to  $\pm 7.5\text{m}$ . of air column). The uncertainty associated to the pressure calculation from the IEC 61400-12 is about  $\pm 3\text{mb}$ .

The barometer consumption is not negligible; it is advisable that the supply connected to the gauge is a pulsed one, being connected to the sensor a short time before the logger reads the output. For Power Performance Curve applications, this capture has to be done at least once per minute. The output "out1" of Zenith is an ideal pulsed supply to connect barometers at 12v.

### Thermohygrometers

The thermo-hygrometer must be covered by the radiation shield to minimize the effect of the solar radiation. For wind resource assessment applications, they are usually set at 3 m. above the ground level. In the north hemisphere it is advisable to set the logger on the north side of the tower and reciprocally in the south.

As it was already mentioned, the main task of the thermo-hygrometer is to evaluate the air density at site. In addition, these sensors can help to detect and filter icing conditions. Also, the temperature and climate can determine the design of some elements of the turbine, as the refrigeration and lubrication systems. It is interesting to mention, especially for fix pitch turbines, when the temperature drops, the power output does not increment in the expected factor because of the air density increase, but it has actually a higher increment. This is probably due to the air viscosity, which depends critically on the temperature, and modifies the aerodynamic behavior of the turbine.

The thermometers work usually based on the principle of a variable resistor which depends on the temperature. Thanks to a Wheatstone bridge, the temperature value is known. As usual for analog sensors, the manufacturer designs a built-in electronics, to get that the sensor output is in volts, varying linearly with the scalar physic magnitude to be measured.

$$\text{Physic Magnitude} = \text{Slope} \times V (\text{volt}) + \text{Offset}$$

The thermometer accuracy depends on its class. From the IEC 61400-12, there is an uncertainty associated to the temperature probe of about  $\pm 0.5^\circ\text{C}$ . The sensor location also adds uncertainty,



**THERMOHYGROMETER AND ITS RADIATION SHIELD IN A TOWER FOR WIND RESOURCE ASSESSMENT IN PANAMA**

about 1/3 °C to move down 10m from the hub height. But the most interesting issue of the International Standard is the fact that due to the radiation shield, (probably it is also related to the thermometer location itself), is  $\pm 2^{\circ}\text{C}$ . This value indicates that neither in barometers nor in thermometers is worth to work laboratory precision instruments if we take into account the extra cost of these instruments.

## Pyranometers

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Although *Eol Zenith*® is a wind data-logger and the main purpose of the logger is the wind resource assessment, this logger and some others manufactured by Kintech have been used also for solar resource assessment, to find not only the global radiation but the direct and diffuse also.

Depending on the technology used, a pyranometer can be classified in thermoelectric effect (thermo resistors) and thermopiles. Thermo-resistors are cheaper but measure in a narrower radiation spectrum. It is possible to connect a pyranometer to any of the logger analog channels. Kipp&Zonnen is one of the well known manufacturers. This pyranometer is a direct option to connect to an *Eol Zenith*®

Kintech has a specific department for solar radiation measurements. Do not hesitate to consult Kintech Technical Service.



## 5. LOGGER INSTALLATION

### Important Notes

*All Eol Zenith® data-loggers units manufactured by Kintech Engineering pass through strict quality controls to ensure correct functioning. Every input and output is tested with an automatic quality control system that emulates the same signals produced by real sensors. Results are recorded in a quality control data sheet personalized for every unit.*

All loggers' telemetry communication modes are also tested before shipping.

Before going to the site for installation check everything, settings, inputs and communications, at the office. It is better to find the problems at the office than on field. We strongly recommend these checkings in the office specially if it is the first time that you work with the Eol Zenith in a new country or new GSM operator.

We recomend carrying an unlocked mobile phone to the site so you can test SIM card settings and signal on site.

### Data-logger Configuration

Please refer to the software section.

### Transport

All electrical and mechanical components of the Eol Zenith are carefully tested before the unit is shipped. After unpacking, please check the data-logger for any signs of mechanical damage, which might have occurred during shipping. Report immediately any shipping damage to booth the incoming carrier and Kintech Engineering.

Keep the original packing material, as it is the optimum packaging for shipping the unit.

### Mounting the shelter box to the tower

Unit should be installed inside an electric enclosure (or shelter box) rated for outdoor use (IP66 or NEMA 4). Customers can buy the shelter box to any provider or directly to Kintech.

The enclosure will keep safe from elements the next items: data-logger, solar regulator, battery and small accessories. Depending the kind and purpose of the met tower, more items could be inside of the enclosure, so its measures could be different to adapt different configurations (for recommended enclosure measures refer next chapter).

Eol Zenith box has 2 mounting keyholes slots in the back for attaching to the metallic enclosure (see measures in the appendix)

All sensor wires must pass through strain relief connectors located in the bottom of the shelter box (to keep the shelter box dry).

We encourage keeping always a channel layout located inside the logger's door.

Booth logger and shelter box must be grounded to protect against ESD (refer to the next chapter).

Installation tips:

- For lattice towers located in north hemisphere, install the shelter box in the north side of the structure (or south for south hemisphere) to avoid direct sun beams exposition
- Avoid unnecessary drillings in the shelter box. Seal any empty hole to keep the shelter box dry
- Label each wire indicating sensor class, number and height to facilitate future station maintenance including sensor replacement
- Strain relief connectors' holes must be drilled in the bottom of the shelter box (to keep the shelter box dry). All wires coming from sensors must have a loop before entering to the shelter box through the strain relief connectors.
- Install GPS and GSM/satellite antennas out of the shelter box and as far as possible from tower structure to improve reception.
- Data-logger and shelter box grounding: refer to the next chapter

## ESD protection and grounding

All electronic devices and sensors installed in a metallic structure must be grounded to:

- Minimize ESD damages providing a low impedance path to the ground for lightnings strikes
- Providing a safer working environment for installation and maintenance crews
- Improve signal quality minimizing electromagnetic noise
- Equal the electrical potential difference among all tower elements, providing a unique potential level reference

Metallic tower structures are lightning spikes by its own so it's essential to provide the best ESD and grounding protection to minimize damages. To attract and absorb lightning strikes all towers must have a complete lightning protection system including a copper-clad lightning spike, copper ground wire and one or more copper-clad ground rods depending the soil resistivity.

It's recommended that you determine the soil type of the installation site and classify its resistivity. The lower the resistivity, the better the earth grounding must be. Soil resistivity depends to soil moisture and temperature (low temperatures mean higher resistivity).

The industry standards for grounding are often out of the budget and scope of the met mast for wind assessment as the cost of adding salt soils, measuring resistivity etc would significantly increase the

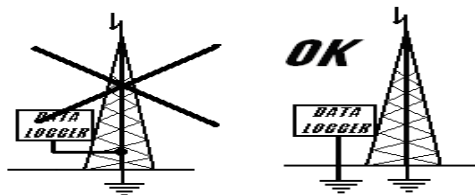
cost for a temporary installation. We just mention in this chapter the basics of grounding and lightning protection.

The first element of a grounding system is the Franklin spike: a copper-clad lightning spike (sometimes a metal spike covered with wolfram to resist the heat of the strike). The spike will be installed in the top of the structure over all elements installed there. The lightning spike gives effective protection to all elements located inside a 45º degrees cone underneath the spike.

To join the Franklin spike with the grounding rod we recommend using at least a 35 square millimeter section copper ground wire. Grounding rods are usually 1.5 meters long.

**Important:**

**Both Franklin spike located at the tower top and all electronic devices must have different and independent groundings installations (using different and separated grounding spikes)**



Copper ground wire should be as short as possible and should be installed as straight as possible avoiding loops or angles.

- To ground the Eol Zenith®, connect one end of the copper ground wire (usually yellow-green color) to the data-logger **GND** terminal and to an independent grounding spike in the other side. If the enclosure is metallic you must also connect it to the ground wire, to do so, all metallic enclosures have a connection screw terminal with the ground symbol on it.

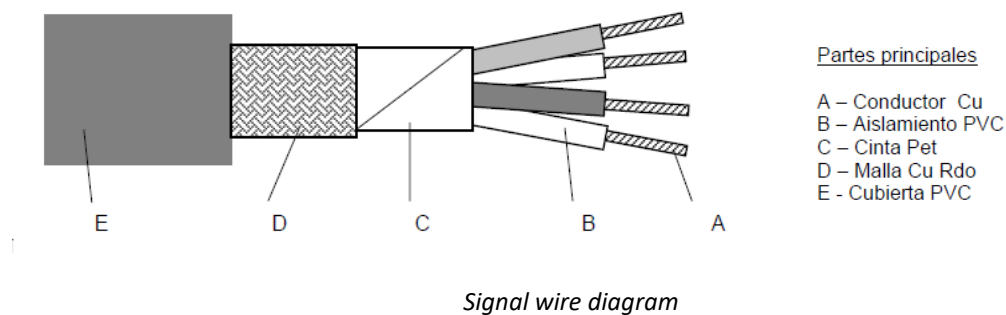


Shielded wires must be used for all sensors, the shield helps to minimize electromagnetic interference and provides additional mechanical resistance.

**Note:**

**All sensor wire shields must be connected to the data-logger GND terminal to be effective.**

For towers using a considerable amount of sensors is recommended to connect all shields in an external patch panel and then use a single wire to connect the patch panel to the logger GND terminal.



## Antennas

To improve GSM and GPS signals you should install both antennas as far as possible from tower structure (and out of the shelter box).

Antenna installation tips:

- Antennas should be located out of the shelter box
- GSM antennas in vertical position (except yagi antennas)
- No loops in antenna wires
- GPS antenna must be 0.5 meters (1 ½ feet) separated from tower structure

## Sensor connection

Find next a few installation tips for sensor connection:

- Use flexible shielded wires
- Label each wire with sensor type and height
- Introduce signal wires inside the shelter box trough strain relief connectors.
- All signal wire shields must be connected to the GND terminal.
- Try to use different supply terminals for different sensors so if some damaged instrument is pulling down supply voltage, other instruments connected to other supply terminals will not be affected. The continuous supply terminals "+5V" intended for anemometers and the discontinuous supply terminals "+" useful for analog equipment have its current output limited to 6mA. If some instrument is draining too much current because it is damaged or wrong connected it will not affect to the whole system autonomous supply.
- Use a wire termination crimper to crimp pin shaped pre-insulating terminals the logger end of signal wires



***Pin shaped pre-insulating terminals***

- Turn off the data-logger before sensor connection.

***!!!DO NOT CONNECT ANY SIGNAL WIRE WITH THE LOGGER ON!!!***

- Kintech provides all the connection diagrams for sensor connection to the *Eol Zenith*®. Contact Kintech customer service for any question concerning sensor connections.
- Once all sensors are connected to the data-logger turn on the unit and check using the keypad and screen.

## Outputs

The logger has three outputs for the control of the power supply of other instruments. When the output is active, the BAT+ terminal is connected to the OUT terminal. These OUT terminals are reversal polarity and short circuit protected. The equipment connected to the OUT terminals must withstand the power supply voltage in BAT+.

### **OUT1:**

Connects the BAT+ terminal at least thirty milliseconds before than the wind vane and analogue logger capture. After the capture, in order to reduce the power drained from the instruments, it shuts down the voltage in the terminal. This terminal is typically used for the power supply of the pressure transducers. Take into account that some equipment may have an output signal stabilization time longer than 30 milliseconds so they can't be supplied through this terminal.

## Powering on the logger

Prior to power on the logger, do all connections and check that all the cables are properly connected. Also check that the memory has been properly set up and inserted. Notice that, like the computers do, the logger performs access to memory for both reading and writing in the power on. If there is a power off during a write access, the memory could get corrupted. To avoid memory corruption, connect the battery terminals with the orange plug connector disconnected. After the battery is connected and cable connectivity is checked, you can connect the orange plug. When plugging and unplugging the orange connector, do it firmly, to avoid misconnection.

There is a two seconds timing after powering on the logger to ensure that the voltage stabilizes in all logger circuits. The green light '*CPU activity*' is on and the display is blank. Afterwards, the logger performs a system auto checking and shows '*EOL ZENITH*' and the firmware version on display.

After the system auto-checking, the logger accesses the external storage memory to load its configuration. In the memory access, the logger is seeking the last configuration storage and loads it as its current configuration. Then it seeks the last input data recording and then it loads the date and time. During this process, the logger shows *'Loading'*, followed by the higher part of the memory address and the *'Site Name'* loaded from the configuration. In the following line, it shows the estimated number of days stored on memory. In the penultimate line, it shows the status that the logger had before being powered off. In the last line, it shows the actual status obtained in the initial system auto-checking.

If there is no memory connected to the logger when it is powered on, it will wait for a while for the memory to be inserted, for going on with its logging tasks.

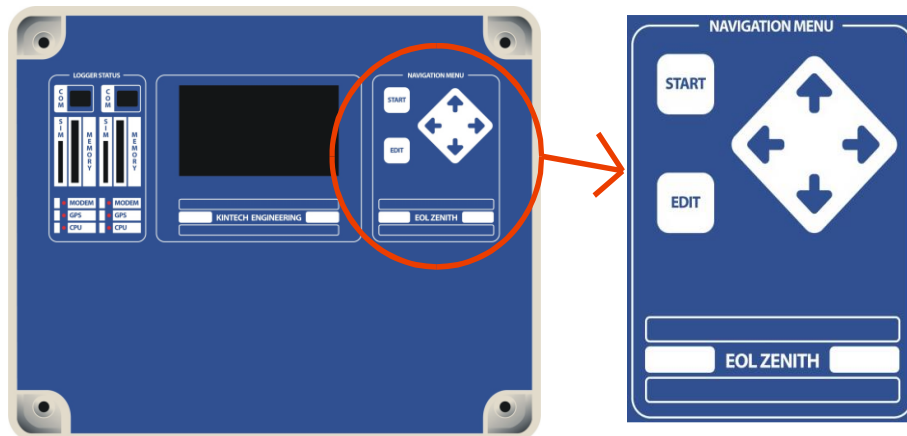
If for whatever reason, the logger can't find the proper settings in the external memory, it will show the *'Corrupt Mem'* indication and it will load the default settings. Note that in such case, if the SIM PIN request is not disabled, the logger will block it as it will enter wrongly three times the PIN code. If you get the *'Corrupt Mem'* indication, we recommend updating settings to the memory through memory card reader with Eol Manager®. If you can't have this option, you have to do it remotely or / and through logger front panel. Then we recommend downloading with *'Remove data from logger memory'* option so you only leave data with the right settings in the memory.



## 6. DISPLAY AND KEYPAD

### Using the Keypad

The *Eol Zenith*® keyboard has 6 keys for easy navigation.



Navigation keys are: START, EDIT and UP - DOWN - LEFT/BACK - RIGTH/ENTER arrows:

- **START:** press start to access all menus, turns on the display if it was turned off and goes to the main menu if the display is on.
- **EDIT:** press EDIT to modify date, time, sensor type, modem and more.
- **UP:** use it to scroll up across menus or increase values in editing mode
- **DOWN:** goes down across menus or decrease values in editing mode
- **RIGTH/ENTER:** is the general ENTER key. During navigation mode is used to page forward the menu that has an arrow in their left. In editing mode, press enter to save the visualized value.
- **LEFT/BACK:** During navigation mode is used to page backward jumping to the next main menu. If pressed several times goes to the logger main menu.

The keypad also has the next two special functions:

- **New memory installation:** Press START and EDIT simultaneously when inserting a new memory at the memory slot *to start a new recording period* (the procedure is shown by a message on the screen).
- **Firmware upgrade:** this is an emergency field firmware upgrade from MMC memory. Turn the logger off, press UP and DOWN keys simultaneously and turn the unit on. Press LEFT and RIGHT again after the LED flashes green to start the upgrade.

## Display info

A LCD display with 64x128 resolution is built into the logger to show all the information:



The main screen (shown above) has the next areas:

- **SCREEN TOP SYMBOLS:** shows battery and memory status, station ID number and communication status.
- **NAVEGACION AREA:** users can access to the different menus and edit values using the keypad. The arrow shows the selected menu.
- **SCREEN BOTTON SYMBOLS:** shows date, time, GPS status and warning messages.

### Screen Top Symbols

- **Battery:** the battery icon shows the system power information. When the system is powered by a 12V battery, 5 level bars means that the battery is fully charged, just one bar means a low voltage. When voltage is above 12.9V a flashing arrow will appear meaning that the system is connected to an AC-DC power supply (12.9V it's an approximated value: most 12V batteries never provide working voltages above 12.9V). When voltage is above 12.9 it's probably that the charging system is working.

|  |  |
|--|--|
|  | Battery is being charged (bars flashing) |
|  | Battery fully charged                    |
|  | Medium level                             |
|  | Low battery                              |
|  | Very low battery                         |
|  | Discharged battery                       |

Note: for 2 or less bars levels check the complete power system. Most lead-acid batteries are deteriorated when the voltage level drops below 8.5V and must be replaced.

- **Memory**: when the system is reading or writing in the SD/MMC card, the memory icon appears in the screen.



Note: do not extract the memory when icon is present

- **Station ID**: shows the loggers' ID or "site number", a 6 figures number that should be configured in the EOL Manager software during the logger setting (also can be configured using the keypad).

SIT : 000000

- **Communication status**: different icons meaning different status are shown in the screen upper-right corner (expanded information is available in the telemetry chapter)
  - GSM connection ok: there is correct communication between logger and modem and the SIM card is registered in the GSM network.



- GPRS connection ok: the logger has received a correct IP address



- Internet connection ok: logger is connected to the internet



- Online mode: the logger is ready for receive and transmit data over the internet using the *EOL Manager*® software



- Satellite mode: the logger is set for using a satellite telemetry module



- Connection Error: there is a communication error such incorrect PIN, modem not detected...



- E-mail transmission: icon shown during an e-mail transmission (with an envelope after “online”)



### Screen bottom symbols

- **Time and date**: when a temporary system message is not present, time and date are shown in the screen bottom. (Both are editable in “Time and date” menu).

16:39:27 01/01/2010

- **GPS status**: shows the signal of the GPS receiver. When the GPS has a malfunction an X is shown instead the bars.



### Navigation menus

Accessing the *Eol Zenith*® menus is fast and easy using the keypad.

Use UP and DOWN keys to scroll across different menu options (an arrow located in the left shows the selected menu) and then press RIGTH/ENTER key to enter in that option.

All menus and submenus are cyclic: pressing DOWN key in the last menu option skips once again to the first option (and vice versa).

English, Spanish and French messages are configurable for the main menus:

| Spanish          | English      | French        |
|------------------|--------------|---------------|
| VISTA RAPIDA     | QUICK VIEW   | VU RAPIDE     |
| ANEMÓMETROS      | ANEMOMETERS  | ANEMOMETRES   |
| VELETAS          | WIND VANES   | GIROUETTES    |
| ANALOGICAS       | ANALOG       | ANALOG.       |
| ANALOGICAS EXTRA | EXTRA ANALOG | ANALOG. EXTRA |
| ESTADO           | STATUS       | ETAT          |

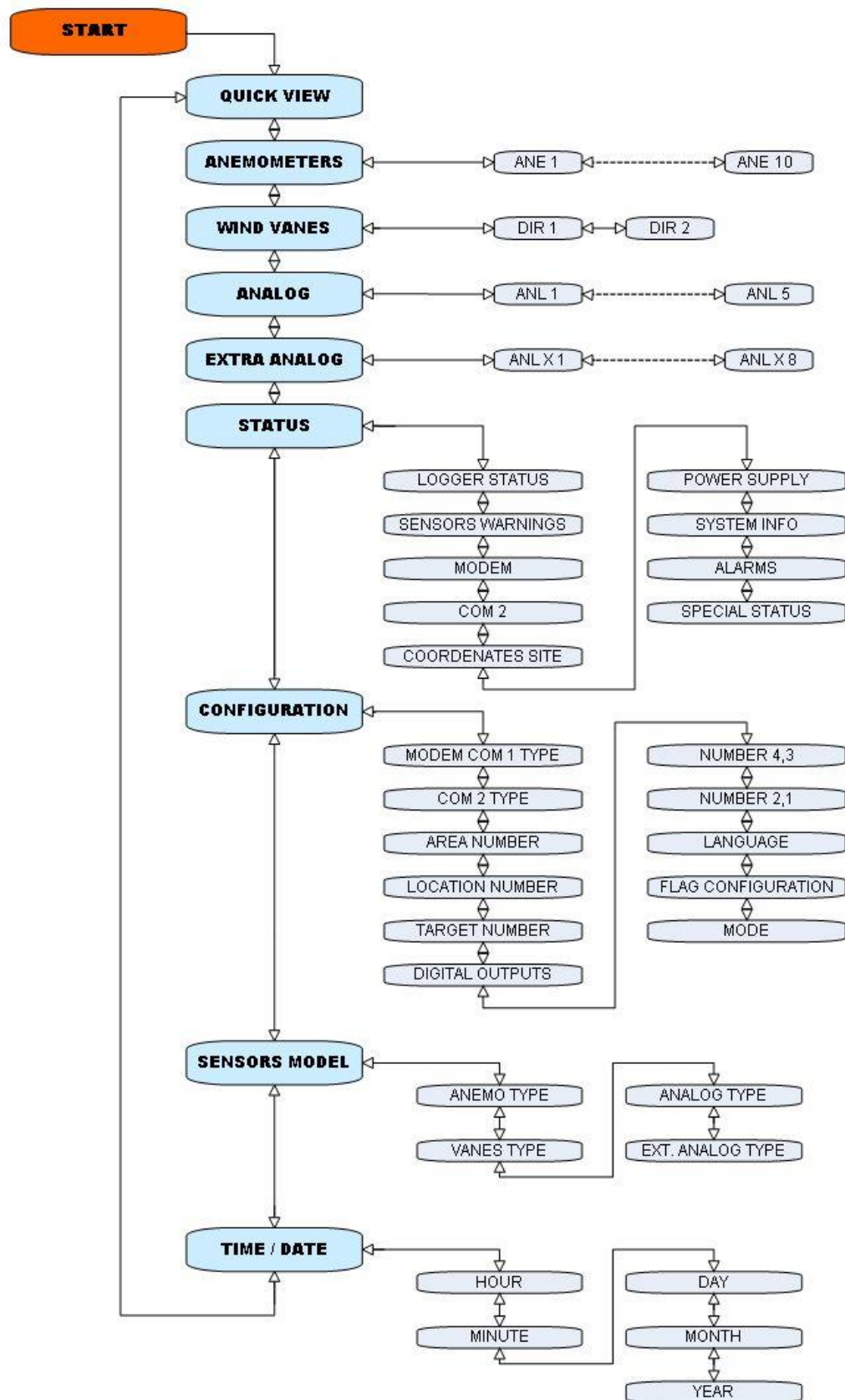
Values shown above are not configurable for being system outputs.

Readable and editable menus configurable by user are:

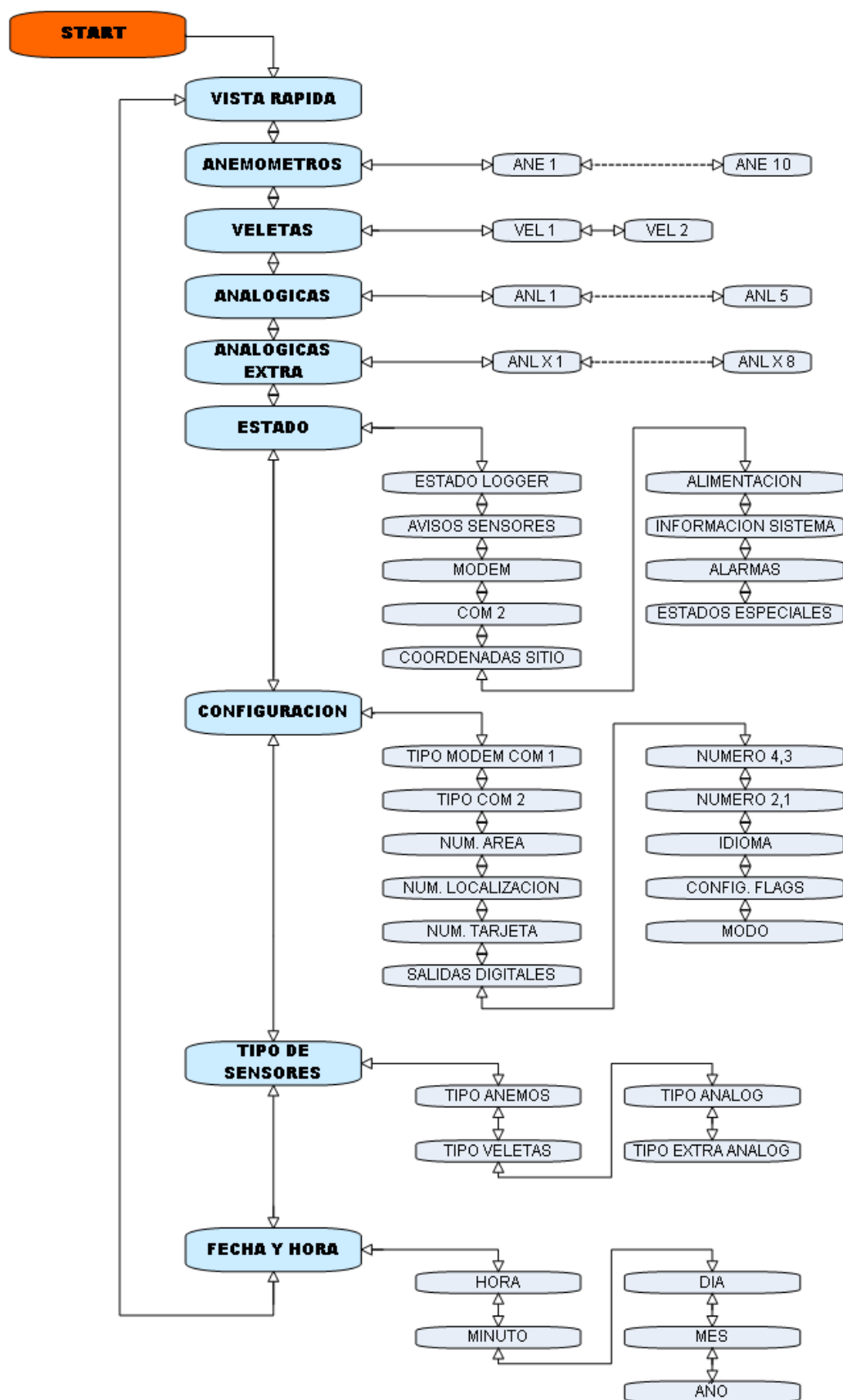
| Spanish           | English       | French           |
|-------------------|---------------|------------------|
| CONFIGURACION     | CONFIGURATION | CONFIGURATION    |
| TIPOS DE SENSORES | SENSOR MODEL  | TYPE DE CAPTEURS |
| FECHA / HORA      | TIME & DATE   | HEURE / DATE     |

A menu and submenu map is shown in the next.

Main menus are shown in capital letters and submenus are shown in lower type case.



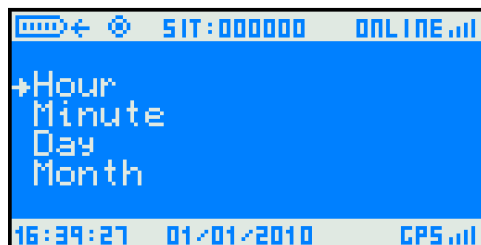




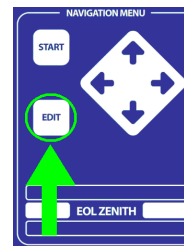
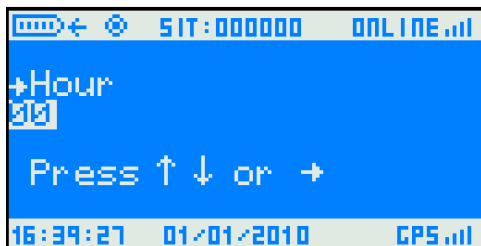
## Edit Mode

To edit a value, follow the next steps:

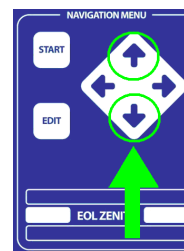
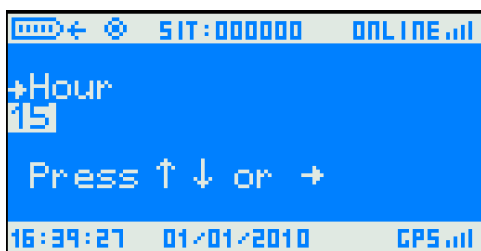
1. Use navigation keys to select the value to be edited; i.e.: to edit the time first go to TIME/DATE, then select "Hour" (the arrow must be on the left of word "Hour")



2. Pressing EDIT the value to be edited will be highlighted



3. Press UP or DOWN to get the desired value.



4. Press RIGTH / ENTER till the validation message OK appears.



**Note:** configuration changes made using the keypad are recorded in the non-volatile memory at the end of every ten minutes recording period (every minute 10, 20, 30, 40, 50 and 00 of the hour). If after editing using the keypad the logger is turned off, those changes will be lost.

**Note 2:** By default, two anemometer inputs and two wind vane inputs are always active (configured) in the logger. When an additional sensor is connected to a specific logger input, that channel must be activated (enabled) in the Eol Zenith settings to be processed (so the logger knows there is a sensor connected). To activate an additional anemometer input all previous input channels must be activated beforehand. For instance, if you want to activate anemometer input channel 5, then anemometer input channels 1, 2, 3 and 4 have to be activated. If a channel is deactivated (type set up to 0), following channels are also deactivated; do therefore not leave an intermediate channel number deactivated. This activation hierarchy is also used for wind vane and analog channels.

**Note3:** Eol Zenith display contrast and backlight are pre-set at the factory. In the situation of display failure please contact Kintech engineering customer service.

**Note4:** After 3 minutes without pressing any key the displays automatically turns off to save battery.

**Note5:** It is not possible to change date and time if GPS is enabled.

## Logger Functions

### Quick View Menu

See the main sensor real time values in the quick menu. Values are refreshed every second and expressed in the units set for each type of sensor.

The next channels are shown in the Quick View:

|                    |                   |
|--------------------|-------------------|
| Anemometer 1 (m/s) | Wind vane 1 ( ° ) |
| Anemometer 2 (m/s) | Wind vane 2 ( ° ) |
| Anemometer 3 (m/s) | Analog 1          |
| Anemometer 4 (m/s) | Analog 2          |
| Anemometer 5 (m/s) | Analog 3          |
| Anemometer 6 (m/s) | Battery ( V )     |



|                   |                |
|-------------------|----------------|
| 51T:000000 ONLINE |                |
| Ane1:05.3         | Dir1:153°      |
| Ane2:05.3         | Dir2:155°      |
| Ane3:04.8         | Anl1:24.8      |
| Ane4:04.8         | Anl2:          |
| Ane5:04.6         | Anl3:          |
| Ane6:             | BATT:12.6      |
| 16:34:27          | 01/01/2010 GPS |

**Note:** sensors not declared in the logger are not present in the Quick View.

### Anemometer Menu:

This option shows the basic readings for up to 10 anemometer inputs.

To expand information, every anemometer channel can be accessed using keypad and the next information is available:

- **Anemometer Model:** shows the anemometer input number in the first line and the model set for that input on the second line (in the figure we are configuring *channel number 1* and the model is an *Ornytion 107*).
- **"Instant" speed reading:** is the average speed (m/s) of the last second interval.
- **Average speed:** is the average of the last 600 instant speed readings, that is calculated every 10 minutes interval (every minutes 00, 10, 20, 30, 40 and 50 of the hour). As an example, when the time is 00:20:00 the logger calculates the average of the 600 readings between 00:10:00 and 00:19:59. A new average will be calculated at 00:30:00

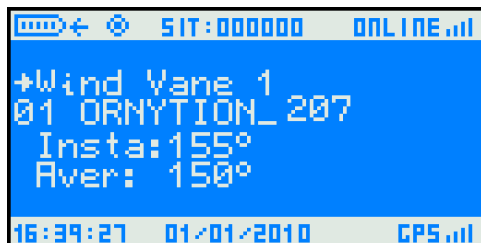


Note: just after turning on the unit, there will be no average available till a complete 10 minutes interval has passed.

### Wind vane Menu

This option shows basic reading for wind vane channels #1 and #2. Each channel can be accessed independently and the next information is available:

- **Wind vane model:** shows the wind vane input number in the first line and the model set for that input on the second line (in the figure we are configuring *channel number 1* and the model is an *Ornytion 207*).
- **Instant wind direction:** direction of the wind captured every second expressed in sexagesimal degrees N-E-S-W -> 0-90-180-270°
- **Average direction:** is the average of the last 600 instant direction readings, that is calculated every 10 minutes interval (every minutes 00, 10, 20, 30, 40 and 50 of the hour). As an example, when the time is 00:20:00 the logger calculates the average of the 600 readings between 00:10:00 and 00:19:59. A new average will be calculated at 00:30:00.



### Analog Inputs Menu

This menu shows basic readings for analog inputs 1 to 5. Each channel can be accessed independently being the next information available:

- **Sensor model:** shows the sensor input number in the first line and the model set for that input on the second line (in the figure we are configuring *analog channel # 1* and the sensors is a Setra pressure transducer).
- **“Instant” value reading:** is the average value of the last second interval expressed in a physical magnitude according to the type of sensor declared: volts, sexagesimal degrees, millibar, % or m/s.
- **Average value:** is the average of the last 600 instant readings, that is calculated every 10 minutes interval (every minutes 00, 10, 20, 30, 40 and 50 of the hour). As an example, when the time is 00:20:00 the logger calculates the average of the 600 readings between 00:10:00 and 00:19:59. A new average will be calculated at 00:30:00



Note: just after turning on the unit, there will be no average till a complete 10 minutes interval has passed.

### Analog Extra Menu

With the same features that the first five analog inputs these 8 extra channels provide extra inputs that can be configured independently.

### Status Menu

Status Menu provides read only information concerning the system different from meteorological data. We will focus in the next chapter in the different status information options available to read.

### Configuration Menu

Use the configuration menu to change variables, logger configurations and sensor types. This task must be performed by qualified personnel only and under the owner supervision.

The next options are user configurable:

- **Com1 Modem Type:** sets the main telemetry modem type. Main options are:
  - 00: No modem.
  - 01: Analog Modem, CDMA or Maxon.
  - 02: GSM Wavecom.
  - 03: GSM Siemens.
  - 04: WindFarm Module (connection to a wind farm SCADA).
  - 05: CDMA MultiTech.
  - 12: Kintech GSM/GPRS internal modem (by default).
  - 48: GPS connected in COM1.
- **Com2 modem type:** COM2 port allows the connections of Modbus and GPS devices (See details at **"FIELD MANUAL LOGGER CONFIGURATION USING THE KEYPAD"**)
- **Area:** we recommend using the first two figures of the telephone access code of the country (where the tower is being located) for the site number (SIT). I.e.: SIT**33**1201.
- **Location:** used for define a sub-area localization: i.e. SIT33**12**01
- **Card:** Define used to define a tower number inside that area: i.e.: SIT3312**01**
- **Digital Outputs:** can be activated /deactivated using this function. Every output value is configured as a decimal number having a binary code that represents itself: every bit is an output. As an example: binary representation of number 03 is 000000**11** meaning that output numbers 1 and 2 are activated; binary representation of number 08 is 00000**1**000 meaning that output number 4 is activated.
- **Num 1 2:** Are the first 2 figures of the PIN number according to what the logger has programmed.  
  
**Note:** for security reasons this is a read only variable.
- **Num 3 4:** are the third and fourth figures of the PIN number according to what the logger has programmed. This number can be read and edited.
- **Language:** there are 3 different languages available for the logger menus:
  - 00 English
  - 01 Español
  - 02 Française
- **Flags config:** reserved operation



- **Modes:** Reserved operation: set mode to 2 to make discontinuous power supply in + terminals and OUT1 become steady ON (continuous). By setting Mode to 4 the display will not be turned off automatically after two minutes of no usage. By setting mode to 6 (4+2), both options will be activated.

Note: all configuration changes are recorded after the following 10 minute recording period (and just then effective) so keep the logger on for at least 10 minutes to avoid losing the modifications.

### **Sensor Type Menu**

For a correct functioning, user must inform the logger using the configuration tool what types of sensors are connected and where they are. Each sensor uses one logger's channel. The logger must know the sensor type to perform correct calculations on it.

The next sensor channels are available:

- Anemometers ( 10 channels)
- Wind vanes only ( 2 channels)
- Analog (5 channels)
- Extra Analog Inputs (8 channels)

Note1: most sensors and modem options are "plug\_and\_play" with the Eol Zenith. If you want to use a non compatible sensor or modem please contact Kintech Engineering.

Note2: all configuration changes are recorded after the next 10 minute recording period (and just then are effective) so keep the logger on for at least 10 minutes to avoid losing the modifications.

### **Date and Time Menu**

It contains information for time and date configuration.

#### **IMPORTANT:**

The Eol Zenith synchronizes time and date with the GPS every minute 59 of the hour, using standard UTC time. Even if you manually configure a different time the logger will synchronize in the next hour.

Note: if you modify time using the keypad please wait to the end of the next 10 minutes period before turn off the logger.

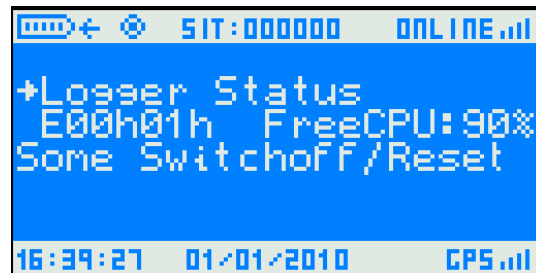
### **System Status information on display**

This menu provides read only general data-logger status information.

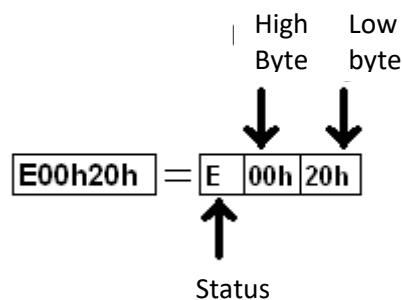
The next options are available:

### Logger Status

Offers general logger status:



- Error Code Number: shows errors produced in the last 10 minutes recording period. Shown in hexadecimal format having 2 bytes (up and down). Each of the 16 bits corresponds to one error and the complete code can have more than one error. As shown below, the logger offers a brief error summary in addition to the code. Errors are shown after every 10 minutes period end.



- Microprocessor Performance: shows the % of free CPU. The lower the % the busiest the system is.
- Errors: shows in text format error occurred. Each code belongs to a specific error; i.e.: E00h01h = reset error.

| High Byte | Meaning  |
|-----------|--|
| 01h       | Sensor error                                   |
| 02h       | Reserved                                       |
| 04h       | GPS error (there is no valid FIX)              |
| 08h       | Special Status, some functions are disable     |
| 10h       | Alarm codes inhibited by user                  |
| Low Byte  | Meaning  |
| 01h       | A Reset has occurred                           |
| 02h       | Low battery                                    |
| 04h       | MMC memory error                               |
| 08h       | MMC memory corrupted                           |
| 10h       | MMC memory not connected                       |
| 20h       | Error accessing to internal EEPROM memory      |
| 40h       | A/D converter error                            |
| 80h       | Automatic connection to emergency power source |

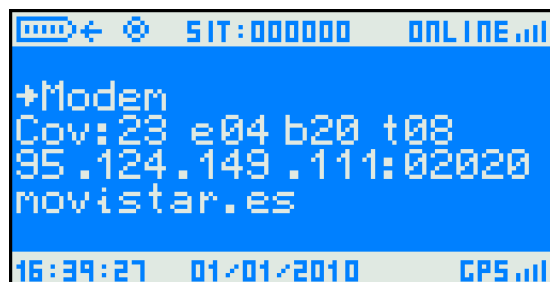
### Sensor warning messages

Find next a list of warning messages like sensor failure or sensor freezing. The logger uses the data from the last recording periods to estimate the existence of an error.

### MODEM

Shows all the information concerning the modem set in Com1.

This is a screen example:



For more information refer to the telemetry chapter.

The screen shows all this information:

- Second line:
  - Signal (Cov): 2 digits show the numeric value of the signal when available (0 to 31 scale in GSM and 0 to 5 in satellite).
  - Telemetry hardware status (e): 'e' followed by 2 digits that provide the telemetry status code number.
  - RX Buffer (b): is the last number of bytes received by the modem.
  - Time-Out Timer (t): for logger internal operations.
- Third line
  - IP Address: shows the dynamic or static address when logger is connected to the internet followed by the port number listening to incoming connections.
- Forth line
  - APN: Access Point Name, is the setting recorded in the logger for accessing to the General Packet Radio Service (GPRS). This code is provided by the wireless carrier and allows data transmission and reception over the internet.

The COM1 in front panel can be redirected to the logger internal COM1 port so it communicates to external devices instead to the internal GSM/ GPRS modem. We do that with Satellite modem that is external. To do so it is necessary to open the logger and modify some microswitches.

## COM2

This submenu shows information about the device connected to this serial port. That device has been defined when configuring *Type\_Com2* variable. The device set up by default is the internal logger's GPS, so the submenu will show values of signal, number of satellites and internal status (coordinates are shown in the next submenu).

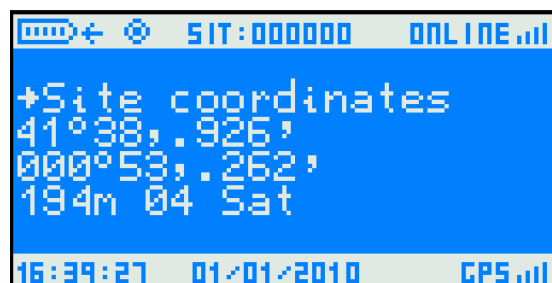
The most important value here is the one just after Cov: that is the number of satellites. The higher the number the higher accuracy for both time and coordinates.

The COM2 on the front panel can be redirected to the logger internal COM2 port so the Eol Zenith communicates with external devices instead of the internal GPS. It is intended to connect to wind farm SCADA or serial output equipments like sonic anemometers. See both sections in this user guide for more information. Contact Kintech technical support for details on how to redirect the port.

When a WindFarm Module is active, a modem for communication between the logger and the SCADA will be connected in this port. All messages will be SCADA related.

## Site Coordinates

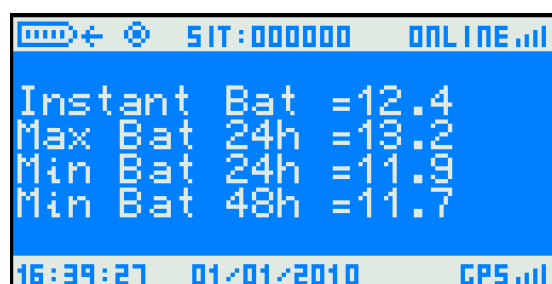
The site coordinates in WS84 format are shown in the first and second line beginning with latitude. The third line shows the altitude of the logger above the sea level and the amount of satellites. Coordinates accuracy depends in how many satellites are accessible to the GPS (12 satellites maximum). Altitude is calculated approximately and sometimes is considerably different from the real value (due to technical limitations of the GPS technology).



The screenshot shows a blue LCD screen with white text. At the top, there is a status bar with a battery icon, a signal icon, 'SIT:000000', and 'ONLINE.all'. The main text reads: '+Site coordinates', '41°38,.926'', '000°53,.262'', and '194m 04 Sat'. At the bottom, there is a timestamp '16:39:27', a date '01/01/2010', and 'GPS.all'.

## Power

It shows information regarding the battery status. It records instant voltage, min & max of the last 24h period and the minimum of the last 48 hours period. This allows checking solar charging system by evaluation of differences between night and day voltages. Comparing the 3 values is easy to determine problems in the solar regulator, battery or connections.



The screenshot shows a blue LCD screen with white text. At the top, there is a status bar with a battery icon, a signal icon, 'SIT:000000', and 'ONLINE.all'. The main text reads: 'Instant Bat =12.4', 'Max Bat 24h =13.2', 'Min Bat 24h =11.9', and 'Min Bat 48h =11.7'. At the bottom, there is a timestamp '16:39:27', a date '01/01/2010', and 'GPS.all'.

**Instant Bat:** Instant voltage on battery terminals.

**Max Bat 24h:** Last 24 hour maximum voltage.

**Min Bat 24h:** Last 24 hour minimum voltage.

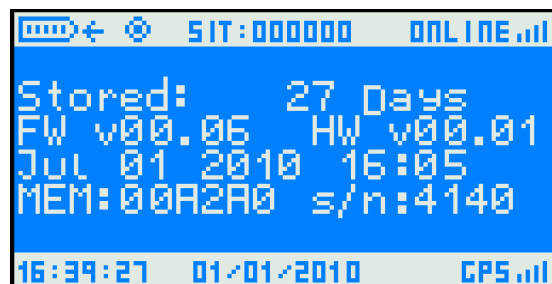
**Min Bat 48h:** Last 48 hour minimum voltage.

### System Info

Internal logger information is shown in this screen:

Information line by line:

- Number of days of data recorded in memory.
- Firmware & Hardware version.
- Time and Date of the firmware version.
- MEM: Internal memory variable.
- s/n: serial number (this number is important!).



### Alarms

Shows alarm status and logger warnings

### Special Status

This menu shows any special status that the system has.

## 7. "ON-SITE" LOGGER CONFIGURATION USING KEYBOARD

There are 3 different menus that allow "on-site" logger configuration using the keyboard.

- **Configuration:** Allows some changes in both logger ID and internal hardware.
- **Sensor Type:** Allows configuration for the sensors connected in logger inputs.
- **Date and Time:** to update the logger date and time.

**NOTE:** all changes are effective only after the next 10 minutes recording period so do not turn off the logger before.

### CONFIGURATION

#### COM1 modem type

Eol Zenith® data-logger has 2 COM ports for connecting/configure different devices with serial communications.

Different MODEM types are user configurable for data download and monitoring. The next list shows the compatible devices:

- **Anl / CDMA MAXON (type 1)** : for CDMA wireless networks, manufactured by MAXON
- **GSM Wavecom (type 2):** Is the default internal GSM modem manufactured by Wavecom. It will not log on the GPRS network
- **GSM Siemens (type 3):** For GSM networks by Siemens.
- **CDMA MultiTech (type 5):** For CDMA networks by Multitech
- **KINTECH GPRS (type 12):** choose this option for using communication over GPRS. APN, user and password must be configured to use this option (works with an internal modem).

| Modem Type 1 | Device            |
|--------------|-------------------|
| 1            | Anl / CDMA MAXON  |
| 2            | GSM (no internet) |
| 3            | GSM Siemens       |
| 5            | CDMA Multitech    |
| 12           | KITENCH GPRS      |
| 2X           | WindFarm module   |



## COM2 Type

Two different special devices are COM2 compatible:

- **Modbus (type 22-26):** this device communicates the logger that is a Modbus slave (see Note1) and it will respond any enquire sent to that number.

The value should be configured in the *Card Number* variable, available in the configuration menu. According to the number selected, communications will have different speeds:

- Type 22: 9600bps
  - Type 23: 19200bps
  - Type 24: 38400bps
  - Type 25: 57600bps
  - Type 26: 115200bps
- **GPS (type 48):** Select this option for having automatic date, time and coordinates upgrades. After selecting this option, the blue led turns on and starts flashing when the device is synchronized and starts time the data upgrades (shown in WGS84 datum and UTC time).

| Modem Type 2 | Connection | Speed     |
|--------------|------------|-----------|
| 22           | MODBUS RTU | 9600bps   |
| 23           | MODBUS RTU | 19200bps  |
| 24           | MODBUS RTU | 38400bps  |
| 25           | MODBUS RTU | 57600bps  |
| 26           | MODBUS RTU | 115200bps |
| 48           | GPS        |           |

Note1: An additional device called *WindFarm* module is required for Modbus communications. This device it's sold separately; please mention when purchasing that the logger unit is going to be used in a wind farm.

Note2: select 0 in "Com2 Type" for disabling logger (time and date) automatic upgrades. Then manually configure your own date and time information.

## Site Identification

Site ID has 3 variables. Each logger needs a unique ID number to avoid data processing and maintenance errors.

When editing any variable of site identification, there is a second information line situated below showing the site info registered in the Software *EOL Manager*® (with alphanumeric characters).

Variables are available from 0 to 99. A brief description next:

- **Area number:** we recommend using the first two figures of the telephone access code of the country (where the tower is being located) for the site number (SIT). I.e.: SIT**33**1201.
- **Location number:** used for define a sub-area localization: i.e. SIT33**12**01
- **Card number:** for loggers not using a Modbus device the card number can be any number from 0 to 99. For loggers using a Modbus device, the card number must be the slave number assigned in the SCADA system for recognizing that specific logger. I.e.: SIT34**12**01

### Digital Outputs

Function used for activate/deactivate digital outputs. Every output value is configured as a decimal number having a binary code that represents itself: every bit is an output. As an example: binary representation of number 03 is 00000011 meaning that output numbers 1 and 2 are activated; binary representation of number 08 is 000001000 meaning that output number 4 is activated

### PIN code

The *Eol Zenith*® allows to change the PIN number that logger uses to access the SIM card inserted in the modem. This value is normally configured on the *EOL Manager*® software however it's also configurable using the keypad. The PIN number of the SIM card doesn't change, just the one used by the logger to access it.

#### WARNING!

**IF THE LOGGER INTRODUCES AN INCORRECT PIN NUMBER THREE TIMES, THE SIM CARD WILL BE BLOCKED. To unblock the SIM card, insert the SIM card in a mobile phone and enter the PUK code and then correct PIN code.**

PIN number has two different variables:

- **Num 1,2:** Are the first 2 figures of the PIN number according to what the logger has programmed. Even being editable this variable is not readable for security reasons (2 asterisks will be shown instead numbers \*\*) i.e.: for pin number **2857**, the number **28** will be recorded in this variable.
- **Num 3,4:** are the third and fourth figures of the PIN number according to what the logger has programmed. This number can be read and edited

For programming a PIN number in the logger there will be two different steps. For example if the PIN number is 2857, the procedure is like this:

**Num 1,2,: 28**

**Num 3,4 : 57**

This is the procedure to program a PIN number using the keypad (MMC card must be inserted during the entire process):

1. Turn off the logger.
2. Extract SIM card.
3. Turn on logger (without the SIM card).
4. Edit the new pin number on the "Num 1,2," y "Num 3,4" variables. When changes are recorded the text "**Press ↑ ↓ or →**" disappears.
5. Wait till the next 10 minutes period
6. Turn off the logger.
7. Insert SIM card.
8. Turn on the logger.

### Language

All screen messages are available in 3 languages:

| Type | Idiom     |
|------|-----------|
| 0    | English   |
| 1    | Espanol   |
| 2    | Française |
| 3    | Reserved  |

### Flag Configuration

Reserved variable

### Mode

Reserved variable

## SENSOR TYPE Menu

This menu is intended to set up which sensors are connected on every specific input channel. Changes in this menu are normally configured using the *EOL Manager*® software and then recorded in the MMC card (however is also editable using the keypad).

Any mistake while changing sensor configuration could cause error on data. Please contact Kintech customer support department for any question regarding sensor configuration.

Each logger input has a variable to configure the type of sensor connected.

| Input Type | # of variables/Menu entries |
|------------|-----------------------------|
|------------|-----------------------------|

|              |    |
|--------------|----|
| Anemometers  | 10 |
| Wind vanes   | 2  |
| Analog       | 5  |
| Analog Extra | 8  |

To avoid mistakes and facilitate sensor configuration using keypad, sensor name is shown together the sensor code number.

All the sensors shown in the next list are compatible with the Eol Zenith (contact Kintech customer support if you want to connect other sensors).

### ANEMOMETERS

| Type | Sensor Model          |  |
|------|-----------------------|--|
| 1    | NRG 40/40H            |  |
| 2    | Young 3102            |  |
| 3    | Vector A100R          |  |
| 4    | RISO P2456            |  |
| 5    | NRG IceFree           |  |
| 6    | THIES P6137           |  |
| 7    | Ornytion 107          |  |
| 16   | Rain Gauge 0.2mm      |  |
| 17   | Rain Gauge 0.1mm      |  |
| 21   | Young 05103           |  |
| 22   | Thies First Class     |  |
| 23   | Vector A100LK         |  |
| 24   | Vaisala WAA252        |  |
| 25   | Ornytion 107H (optic) |  |

Note: For serial input channels like ultrasonic anemometers, see serial input channels section

### WINDVANES

| Type | Sensor Model                   | Notes         |
|------|--------------------------------|---------------|
| 1    | Ornytion 207                   | Potentiometer |
| 2    | NRG 200P                       | Potentiometer |
| 3    | Young 03001                    | Potentiometer |
| 4    | Vector W200P                   | Potentiometer |
| 5    | Young 05103                    | Potentiometer |
| 6    | Thies First Class/Compact (2K) | Potentiometer |
| 7    | Thies First Class (10K )       | Potentiometer |
| 8    | Climatronics F460              | Potentiometer |

| Type  | Sensor Model                   | Notes             |
|-------|--------------------------------|-------------------|
| 9     | 2.5V powered wind vane         | Potentiometer     |
| 10    | Friedrichs                     | Potentiometer     |
| 11-19 | Reserved                       |                   |
| 20    | Thies Gray Code 8 bits         | Digital(see note) |
| 21    | Thies Gray Code 8 bits invert. | Digital(see note) |
| 22    | Thies Gray Code 7 bits         | Digital(see note) |
| 23    | Thies Gray Code 7 bits invert. | Digital(see note) |
| 24    | Generic digital                | Digital(see note) |

**Note 1:** Wind vanes 20-24 with digital output are configured in “wind vane type” and visualized at wind vane menu however must be connected at the digital bus. When a digital wind vane has been configured and connected to a digital bus; do not connect a standard Potentiometer wind vane at the DIR input.

**Note 2:** For serial input channels like ultrasonic anemometers, see serial input channels section

**Example:** A Grey code wind vane type 20 has been configured as “wind vane #2” and connected to Digital Bus 2: DIR2 input shouldn't be used to connect any wind vane.

## ANALOGS

| Type | Magnitude     | Units         | Sensor Model              | Notes           |
|------|---------------|---------------|---------------------------|-----------------|
| 1    | Milivolts     | mV            | Milivolts                 |                 |
| 2    | Temperature   | ° Celsius     | EOL 307                   |                 |
| 3    | Temperature   |               | Young 41342VC             |                 |
| 4    | Temperature   |               | NRG 110S                  |                 |
| 5    | Temperature   |               | GALLTEC KPC1/5            |                 |
| 6    | Temperature   |               | Vaisala HMP45A            |                 |
| 7    | Temperature   |               | Rotronic                  |                 |
| 11   | Direction     | ° sexagesimal | Ornytion 207              | Wind Vane       |
| 12   | Direction     |               | NRG 200P                  | Wind Vane       |
| 13   | Direction     |               | Young 03001               | Wind Vane       |
| 14   | Direction     |               | Vector W200P              | Wind Vane       |
| 15   | Direction     |               | Young 05103               | Wind Vane       |
| 16   | Direction     |               | Thies FirstClass/Compact  | Wind Vane       |
| 17   | Direction     |               | Thies First Class (10K)   | Wind Vane       |
| 18   | Direction     |               | Climatronics F460         | Wind Vane       |
| 19   | Direction     |               | Wind Vane powered w/ 2.5V | Wind Vane       |
| 21   | Speed         | Meters/second | Young Propeller 27106     | Vertical Anem.  |
| 22   | Speed         |               | Young Propeller 27105     | Vertical Anem.  |
| 25   | Speed         |               | Thies Ultrasonic          | Coordinate X    |
| 26   | Speed         |               | Thies Ultrasonic          | Coordinate Y    |
| 27   | Speed         |               | Thies Ultrasonic          | Coordinate Z    |
| 31   | Pressure      | millibar      | Setra 276                 |                 |
| 32   | Pressure      |               | Vaisala PTB100            |                 |
| 33   | Pressure      |               | NRG BP20                  |                 |
| 37   | Humidity      | %             | Galltec KPC1/5            | Relat. Humidity |
| 38   | Humidity      |               | Vaisala HMP45HR           |                 |
| 39   | Humidity      |               | Rotronic                  |                 |
| 42   | Radiation     | Watt / sq     | Kipp & Zonen CM6B         |                 |
| 43   | Radiation     |               | Kipp & Zonen CM3          |                 |
| 44   | Radiation     |               | Davis 7821                |                 |
| 48   | Noise         | dBA           | Cesva                     |                 |
| 49   | Noise         | Decibels A    | Brüel Kjaer               |                 |
| 51   | Contamination | PPM           | Bieler & Lang             |                 |

Note: For serial input channels like ultrasonic anemometers, see serial input channels section



## TIME and DATE Menu

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Use this menu to configure: hour, minute, month, day and year.

Note: When *Type\_MODEM\_2* is set as GPS, the time will be automatically synchronized to UTC as soon as the GPS has signal. You can avoid this by disabling the GPS. To disable the GPS set up *Type\_MODEM\_2* to 0.

## 8. Eol Zenith® communication options

Eol Zenith can communicate in a wide variety of systems and protocols. Each of them has advantages and disadvantages in relation with its cost, efficiency and availability depending on the geographic region.

The communication tasks don't stop all other basic data-logging tasks. They are performed in a lower priority scheme in the CPU free time.

### Hardware Options

The equipment is provided with two slots for connection of Communications boards. It can communicate with both boards simultaneously. At the time this manual was written, there are four communication board options:

- GSM/GPRS
- Satellite (Satellite Module)
- WindFarm (WindFarm module)
- Serial input channel (Ultrasonic Module)

Each of the previous boards allows the following operations:

| Hardware   | Operation<br>\ LINK | Real<br>time | Data<br>Download | Upload<br>Settings | Firmware<br>upgrade | geo &<br>time sync | Modbus | Ultrasonic |
|------------|---------------------|--------------|------------------|--------------------|---------------------|--------------------|--------|------------|
| GSM/GPRS   | <b>SMS</b>          | Yes          | comp             | Yes                | comp                | comp               | comp   | comp       |
|            | <b>CSD</b>          | Yes          | Yes              | Yes                | Yes                 | comp               | comp   | comp       |
|            | <b>Internet</b>     | Yes          | Yes              | Yes                | Yes                 | comp               | comp   | comp       |
|            | <b>e-mail</b>       | comp         | Yes              | comp               | comp                | comp               | comp   | comp       |
|            | <b>Web</b>          | Yes          | comp             | Yes                | comp                | comp               | comp   | comp       |
|            | <b>GPS</b>          | comp         | comp             | comp               | comp                | Yes                | comp * | comp *     |
| Satellite  | <b>Satellite</b>    | Yes          | Yes              | Yes                | Yes                 | comp               | comp   | comp       |
| WindFarm   | <b>Modbus</b>       | Yes          | comp             | comp               | comp                | comp *             | Yes    | No         |
| Ultrasonic | <b>RS232</b>        | Yes          | Yes              | comp               | Yes                 | comp *             | No     | Yes        |

Notice that *comp* denotes compatible here.

\* compatible for firmware versions 30 and above and hardware versions.

The following information is intended for deeper understanding of the way the logger communicates with the attached COM devices. Eol Manager will make it unnecessary to fully understand the information below, so you can skip reading it. When the logger is provided with secondary com board because it was supplied with either Windfarm Module or Ultrasonic Module, depending on the firmware and hardware version, the GPS will be included with GSM/Satellite modem in the primary COM board.

Logger without secondary COM board (standard version):

- COM1 has to be set up to GSM or satellite modem

- COM2 can be set up to GPS or can be disabled (00)

Logger with secondary COM board (provided with Modbus or Windfarm Module):

- COM1 has to be set up to GSM or satellite modem
- COM2 can be set up to Modbus, Ultrasonic or disabled (00) but not set up to GPS
- GPS will be read multiplexed for versions  $\geq 30$

When the GPS is multiplexed, it works when the modem is off: around one minute after logger power on and every day at 23:55 logger time. While modem is off GPS is on for time and location update.

### **GSM/GPRS module:**

The data-logger is always equipped with a GSM/GPRS board. Kintech Engineering recommends the use of the GSM/GPRS communication network. It is the most effective communication system. *Eol Zenith®* is specially suited to use this network.

The communication hardware is internally integrated in the equipment. The user sees it as a compact product. The only accessible parts are the SIM card holder and the modem status LED in the front panel and the GSM antenna connector at the bottom side of the box.

Older hardware versions are provided with quad band GSM/GPRS modems. So they work in the four standard GSM frequency bands: 850MHz, 900 MHz, 1800 MHz and 1900 MHz. As a result, there is no need to ask for a specific GSM band option. Depending on the GSM/GPRS com board version provided, the system will select automatically any of the four possible bands. Other versions need for a manual band selection. Follow the *Indications of changes in status of communications* chapter to know how to select the frequency band.

Newer hardware versions are provided with pentaband GSM/GPRS/3G modems, increasing the compatibility to the maximum level.

### **Satellite module:**

There are currently two optional satellite modules for satellite communications one in the Iridium network with global coverage and the other one in the Inmarsat network. This modules include everything necessary to start working: the COM board with serial communication and supply cable, the attachment to the logger door and the satellite antenna with a small boom adaptor.

Contact Kintech sales team to get more information about the available options for satellite communications.

### **WindFarm Module:**

The wind farm module is intended for data-loggers with permanent connection to the network. This is the most common condition of met masts installed in wind farms. This optional secondary COM board is supplied additionally to the GSM/GPRS primary COM board. It allows having Modbus connectivity to the logger usually for integration of the meteorological real time data in the SCADA of the wind farm. Communication devices such as optic fiber modems, radio modems, etc are connected

to the black Molex RS232 connector on *Eol Zenith*® front panel. The cable to connect to that connector is also supplied with the module. Keep in mind that the cable not only contains the RS232 communication cables but the power supply from the battery positive terminal on logger controlled by the logger through a solid state relay. This feature lets the logger perform a daily reset on the communication devices.

### **Ultrasonic module**

There is an optional COM board for communication with certain instruments that provide the readings from transducers through serial communication. This is the typical case of ultrasonic anemometers.

The ultrasonic module provides both hardware and firmware necessary for using such instruments. The logger processes data from serial input as other data from voltage or frequency input channels.

You can find more information in the corresponding chapter.

## **Communication on GSM/GPRS networks**

Kintech Engineering considers the GSM/GPRS network the best communication network for logger telemetry. For that reason GSM/GPRS hardware is integrated in every logger supplied by us.

The GSM/GPRS network supports different kinds of connections which availability depends on the GSM provider.

### **Communicating through SMS:**

It is the most effective way of communication when there is a low GSM signal. The SMS transmissions have a very low byte transfer capacity so it is useful only for inputs and status, instantaneous monitoring or settings modifications. Its main advantage is that there is no need to use any specific software. Modem or internet connection is not necessary either. The equipment can send SMS (GSM short messages) after reception of any request by SMS. The SMS contains information of the last ten minutes average values of input channels and system status.

#### **Real time SMS:**

You can request this message at any time by sending an SMS with the text “**EOL**” (uppercase). In less than a minute you will receive a SMS back with the site information. A typical use of SMS is the maintenance staff wanting to know if wind conditions are good enough to work in the wind farm. Another typical use is to know when the logger is powered on in the system commissioning or when the system recovers the GSM signal after long time of lost of GSM signal.

The SMS report contains information like site number, date and time, battery, last ten minute averages of wind speeds in m/s, wind direction in degrees and other analog inputs in the configured physical unit for each input.

#### Example:

*Sit 990003 06:23 15/07/2010 Bat=13.6V Status: OK*

*m/s: 9.5 9.4 9.0 9.5  
Dir:264 307 Analog:18C 907mbar -0.3m/s 63%*

### **SMS for setting up logger parameters:**

You can set up some system parameters through SMS by adding certain control characters to the SMS EOL text. One of the most commonly used is to ask for the logger IP address by adding '@' just before the EOL. When the logger receives the '@EOL', it includes its IP address in the response SMS.

The software and Kintech technical support provide in the text sent to a logger modifications for its settings. Before sending the SMS confirm that the text is exactly what it should be.

Some standard GSM SMS commands can be useful when low GSM signal conditions,. For instance, delivery confirmation implies the notification through SMS of the moment that the logger recovers GSM signal after a time out of coverage.

### **Communications using a standard modem call (CSD):**

Some GSM service providers offer data exchange communications through a GSM call made from one GSM MODEM to the GSM MODEM of the logger. So, using a GSM MODEM connected to the computer where *EOL Manager*® software is running, the software dials to the telephone number of the SIM card on logger. This service is generally called CSD or GSM data reception or 2G data communication. It is available in most Western Europe countries but not in other geographical areas.

To perform this type of communication it is necessary to have a MODEM connected to the PC where *EOL Manager*® application is being executed. The modem connected to the computer can be a landline modem or a GSM modem. If you use landline modems there are some restrictions on the type of telephone line used as it has to be an analogue line connected to the PSTN (Public Switched Telephone Network). This is the case of the lines used by fax machines. Many GSM telephones can be used as GSM modems when connected to the PC either by USB connector or by Bluetooth connection. The only prerequisite is that a COM port is created in the computer for that connection.

CSD allows speeds up to one kilobyte per second. The cost of communication depends on the time the communication lasts and not in the amount of bytes transferred. CSD is a good option for *Eol Zenith*® Communications.

Unfortunately, this service is not always offered by the GSM operators. It often takes too much time to find it and contract it as this type of machine to machine communications is a small business for GSM operators when compared with voice services. To learn more about contracting a new GSM line check the related chapter.

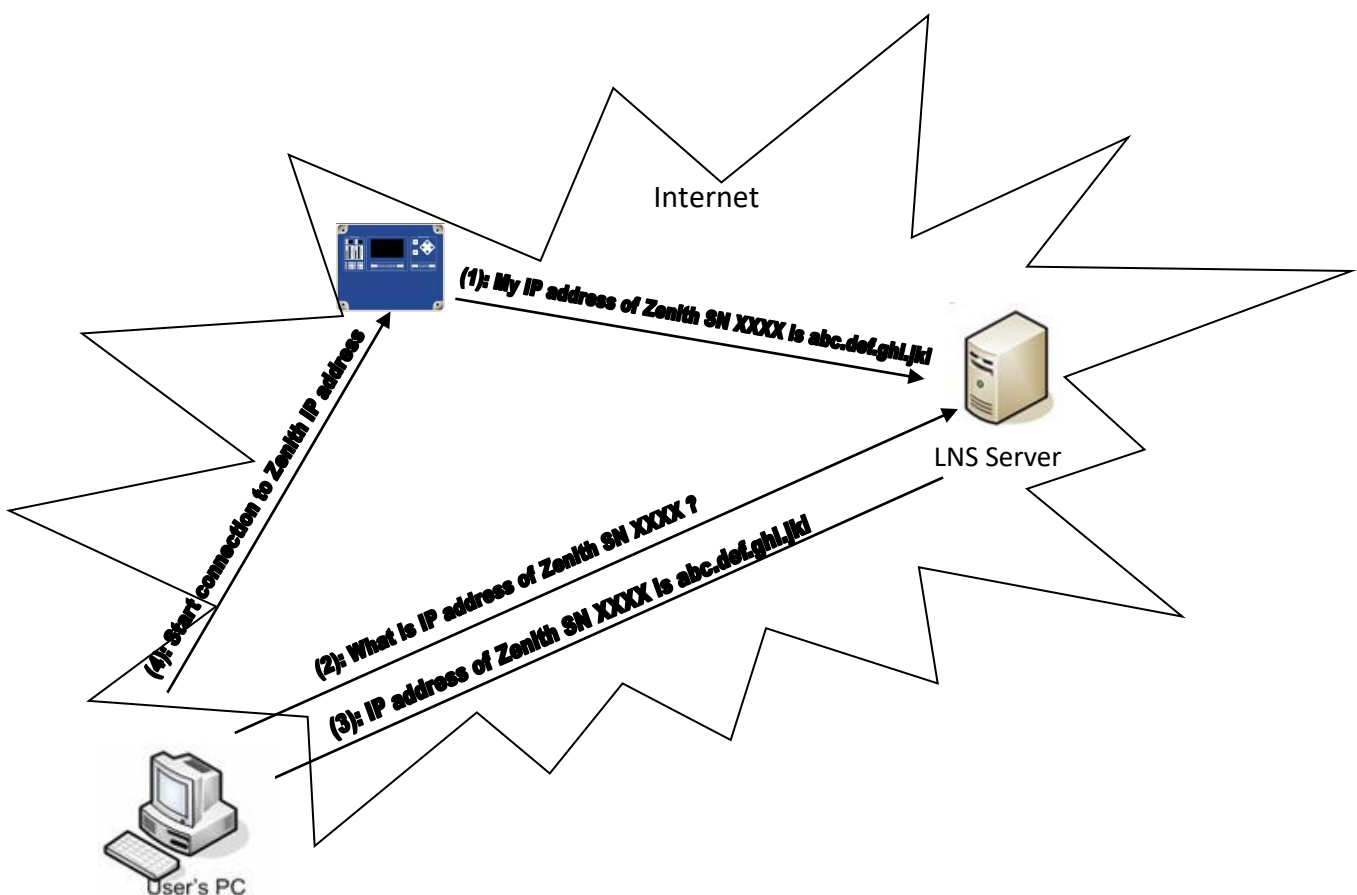
### **Communication through Internet with EOL MANAGER Software:**

All GSM operators allow access to the GPRS data network. These networks allow connections to the internet through the APN (Access Point Name). The APN is the link between the GSM network and the internet.

The *Eol Zenith*® can connect to the Internet through the APN configured in its memory. When the equipment is connected to the internet, it is waiting for incoming connections from the internet. The

*EOL Manager*® software needs to know the logger's IP address to be able to communicate with it. As the logger IP address may be unpredictably changing, Kintech Engineering has developed the necessary infrastructure to let *EOL Manager*® get the logger IP address from a server on the internet. This LNS server collects in a table every IP address of every logger serial number.

When the data-logger connects to the APN and gets its IP address, the logger shows INET in the upper right corner of the display. Then the logger starts a connection to a Logger Name Server (LNS) and updates in the IP address table its serial number input. After that, the logger shows on display upper right corner the ONLINE communication status. Then, every time that *EOL Manager*® is trying to connect to a logger, first it gets the logger IP address from the LNS.



Unfortunately, not all GSM lines and GSM operators allow reception of incoming connections from the internet. In other words, they don't allow devices connected to internet through their APN to work as a server. In such conditions the assigned IP address that the equipment updates to the LNS is not a public IP. There is no response to ping commands or the peer IP that responds to the ping command doesn't correspond to the equipment.

Some GSM operators require ordering specific Internet contracts that allow public IP and Internet incoming connections. Sometimes the service that matches the necessities also includes static IP assignment which isn't really necessary. Other GSM operators offer IPsec to VPN's. Ask our technical support to learn more about contracts in your country.



See also the chapter How to get the proper GPRS settings from the GSM operator.

### *Communications through e-mail*

As described in the previous chapter, it is not always possible to get the GSM line settings that allow for direct internet connection to the logger from the computer. In this situation, the way to download a logger with internet connection is through e-mail. You can check in the software chapter how to program the logger to send periodic e-mails.

If a logger has been set up to send e-mails for downloading, every time the logger is powered on it will send a report e-mail with the same text than the SMS reports, but including its IP address and TCP port waiting for connections. The e-mail subject will be site name, space, year, month and day of the logger at the time the e-mail is sent. The file name format is 'ID', site number, underscore, year, month, day, underscore, hour, minute, second. It will have extension '.elog'.

At any time, it is possible to remotely order the logger to send an e-mail with the data attachment. It is necessary to send a SMS to the logger with the text 'EOLCONF0160901\$003' to remotely order the logger to send an e-mail with the data attachment. In less than one minute we will receive an SMS back from the logger with the usual SMS information. After that, the logger will send an e-mail with data file attachment in the same way than the programmed e-mails. The data that is sent in that e-mail will not be sent in the next e-mail.

For the logger to be able to send emails, you have to configure the SMTP Server. This SMTP server can be your own email account, or you can create a new account for the exclusive use of the logger. Do not use TSL/SSL servers as logger SMTP server. If you do it you will see E114 as the maximum e-mail status.

There are big differences in the performance of the SMTP servers when there are interruptions in the communication. As the GSM signal is often interrupted in some locations, it is important to choose a good SMTP server. Kintech Engineering has tested some of the top 20 SMTP servers in the world and our recommendation to use because its good performance is in [www.yahoo.com](http://www.yahoo.com).

An example of how to setup a yahoo account

- SMTP Server: [smtp.mail.yahoo.com](mailto:smtp.mail.yahoo.com)
- SMTP Port: 25
- SMTP User Name: [whateveruserIsetup@yahoo.com](mailto:whateveruserIsetup@yahoo.com) (email address)
- SMTP Password: mypassword (email account password)

An example email account would look like this setup in the Eol Manager

Verify that the parameters have been entered correctly by clicking on "Send Test Email." A test e-mail will be sent to all recipients.

### *Communications through Internet using a web browser*

It is possible to have a short report similar to the SMS report using most of the web browser programs. For this type of communication it is not necessary to have the EOL Manager® software. To do that type, in the address bar of the navigator the text 'http://' followed by the IP address of the logger followed by ':' and the configured TCP port for incoming connections of the logger. Some browsers show the report as an attachment file and some other show it as text in the browser itself.

### **How to get the proper GPRS settings from the GSM operator**

Most of the sales offices of the GSM operators have neither the knowledge nor the experience to provide the proper settings for GPRS point to point incoming communications necessary for the logger real time connections. This makes it more difficult to start operation with a logger for the first time with a specific GSM operator.

Ask Kintech technical support for help in your country about ordering the proper GSM settings from GSM operators.

There is a wide variety of communications plans for all the GSM operators in the world. There isn't a valid procedure or a guide for contracting for all of them. In some countries any standard GSM line will work, as all of them are provided with public IP that accepts incoming connections. However, in many other countries, the service is not offered as a default. In this chapter we will explain how to order the settings necessary for the line. The good thing is that when you know how to order them for the first line, it will not be a problem for future lines.

Depending on the type of Communications that we want to use with the equipment and the GSM operator services, it is possible to contract different services with the GSM operator.

**You should not go to site to install the logger without having tested before the communications in the office with the SIM card you will use and the logger settings you want to use.** Failing to do so may result in an impossible logger connection.

To get the maximum benefit from the *Eol Zenith*® communication capabilities we encourage you to contract at least one of the following options:

#### **1. Internet GPRS communication:**

The GPRS line has to have a public IP and it has to allow internet incoming connections. With such settings, it is possible to start a communication with the data-logger at any time from a PC with internet connection. There is no need to wait for the data-logger to start a connection

One way to check if the line doesn't comply with the requested settings is by pinging to the IP address that the logger shows on display when accessing to *status > modem*. If there is no response or the response comes from a different IP address than the logger displayed, the equipment will not be able to receive incoming connection through the Internet. If the ping

response is positive, then you can try to access the equipment using the *EOL Manager*® software or you can try to access through a web browser as explained in the previous chapter. If you can get data from the station, then the communication is correct.

The real necessity of a GPRS contract is for full logger connectivity, the GSM operator provides a public IP and the network allows incoming connections. However, there are two indirect ways of requesting the necessary settings that will enable the intended logger communications. The first is asking for settings for a web server (or any kind of server) hosted on the GSM device. The settings for a server match the logger settings necessities. Similarly, asking for a static IP address is also a way to get the necessary settings even though it is not really necessary to have a static IP.

## 2. CSD Communication:

With this kind of Communications it is possible to start a connection with the logger at any time. So we can remotely download, real time, upload settings or update firmware. To perform this type of communication, it is necessary to have a dial-up modem connected to a COM port of the PC. It is also necessary that the GSM line have the proper settings for CSD communications.

With this kind of Communications it is possible to start a connection with the logger at any time. So we can remotely download, real time, upload settings or update firmware. To perform this type of communication, it is necessary to have a dial-up modem connected to a COM port of the PC. It is also necessary that the GSM line have the proper settings for CSD communications.

CSD service for GSM lines is often ignored by the GSM sales agents.

The programmed e-mail download over GPRS is way of communication that works in almost every type of GSM line. The big disadvantage of this way of communication is that the two only possible connections are by e-mail sent by logger according to its schedule and SMS reports.

## Satellite communications

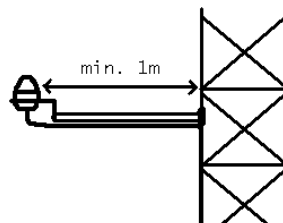
Kintech Engineering offers the *Satellite Module* that consists of the hardware, firmware and software components to communicate to the loggers through the either Iridium or the Inmarsat Satellite network.

This communication system has the important advantage of assuring perfect performance of communications in whatever location on the planet in Iridium or almost any location on the planet for Inmarsat. As a consequence, if you intend to use Iridium, you don't have to worry if there will be satellite signal coverage on a specific site. Another big advantage of these solutions is that you don't have to worry about getting the proper settings to perform the communications and that you get one billing entity for communications in every country.

## Hardware

The hardware consists of:

- Modem and its fixing elements. The Iridium modem is supplied attached to the internal side of the logger door. So, there is no external change in dimensions as it is integrated inside the logger box. The Inmarsat modem is supplied as an external component connected to the logger through a communications and power cable connected to the logger front panel molex connector. The modem has an accessible SIM card holder. The SIM card is similar to the GSM SIM cards and has to have its PIN1 code request disabled. The modem has been set up to match the Eol Zenith features.
- Satellite antenna. The Iridium antenna has to be installed in vertical position with cable entry facing to the floor. The antenna should have the largest open sky visibility with the only interruption of the tower structure. So the boom for the antenna should be the longest possible.



The antenna for Inmarsat has to be oriented to a particular position that depends on the exact location provided by the device configuration manager. There is also a procedure to get signal strength through headphones during the system start-up.

- Small adaptor for tubular booms.
- Coaxial radio-frequency cable that connects antenna to MODEM. The Iridium version antenna cable gets inside the logger enclosure through the gland on the lower side of the logger door. The antenna cable has to be connected to the coaxial connector that is labeled with 'ANT' in the Iridium version.
- Cable for RS232 communication and power supply. It connects the COM port connector in logger front panel to modem connector. The Inmarsat version includes a serial to internet adaptor, typically a Moxa Nport.
- Board for RS232 communication and power Management of the satellite modem. The board is internally connected to the logger. Newer versions of the communication board are provided with a very small micro-switch located right on the left side of the Molex connector. This micro-switch allows for selecting internal (GSM/GPRS/3G) or external modem. This also allows for Eol Manager direct com serial communication option.

For the proper solar power supply dimensioning, many factors have to be considered like sunshine hours, latitude, duration of connections, dirt and orientation of solar panels, etc. As a general rule, the solar panel recommended for a specific location is twice the one used for a standard GSM logger.

So, the most common solar power supply for satellite module will be 20W solar panel and 24Ah battery.

### *Iridium modem troubleshooting*

Necessary tools: Voltmeter, screwdriver, computer with EolManager installed and active license provided with SD card reader.

Optional recommended tools: Iridium telephone, replacement parts (modem, antenna, battery, logger), activated, tested and with remaining credit Iridium SIM card. For activation it is necessary to request to Kintech at least two working days in advance with IMEI or SIM card information.

1. Power on the logger and check display turns on. Go to Quick View to check that all sensors show plausible information.
2. Check on display upper right corner the communication status. As soon as the logger detects the Iridium modem 'SAT' should be shown. Later, when the logger finds Iridium signal, it will show on upper right corner the coverage bars according to the signal strength.
3. If SAT is not shown on upper right corner, check the power and data cable from logger to modem. If no coverage bars are shown, then check antenna orientation, antenna cable proper connections with special attention to the status of antenna cable connectors.
  - a. The Iridium antenna has to be installed in vertical position with cable entry facing to the floor. The antenna should have the largest open sky visibility with the only interruption of the tower structure. So the boom for the antenna should be the longest possible.
  - b. Check the power supply from logger to modem. If after several minutes no 'SAT' indication is shown, disconnect and connect power, and later disconnect the modem data cable in the logger side. There should be 12V present between pins 1 and 2. If there are 12V, then replace modem and cables. If not replace logger.
  - c. If you have replacement parts you can try the following steps:
    - i. Take the Iridium SIM card and put it on an Iridium handheld. Check signal and communications to discard problems on SIM or contract
    - ii. Replace modem keeping the original SIM card
    - iii. Replace modem with a new activated and tested SIM card
    - iv. Replace the whole datalogger and iridium system keeping the original SIM card
- a. Replace the whole datalogger and iridium system with a new SIM card

## Software

Using the *EOL Manager*®, edit the site you want to set up, go to the access tag and set up the modem type for the satellite modem. For Inmarsat, you must choose the TCP tunnel/BGAN option. Fill in the PIN code and telephone number supplied with the Iridium modem. The Iridium telephone numbers start with a +88. Don't set up APN or email as these functions aren't available with satellite connections. Then the system is ready to upload settings.

Check that the logger communications work fine before going to the installation site. So, place the antenna in an open sky location and power on the logger in the office. Following the instructions in the chapter of communications check the proper status of Communications (SAT/BGAN indication and coverage bars) and make a real time connection test. To work with TCP tunnel/BGAN option the logger firmware version must be x.46 or above.

Similarly to GSM lines, each satellite line requires buying a Satellite line and activation of the line. The bundles offered by Kintech include a certain amount of minutes (Iridium) or KB (Inmarsat) enough for one year of normal logger communications of every three days downloads. The minutes expire after 12 months.

## How to start satellite communications

The Iridium satellite communication is essentially the same type and procedure as the CSD communication. So, please read that chapter of this manual. Both Iridium and Inmarsat satellite module allow downloading, real time connections and uploading settings to the logger. SMS or e-mailing communications are not available under these satellite solutions.

The main difference between Iridium and CSD communications is that to avoid expensive price of calls, the call made by the *EOL Manager*® should be done through an Iridium satellite modem connected to the PC where the *EOL Manager*® application is running. The modem connected to the PC has to be connected to an antenna with open sky view. To connect to a logger with satellite modem, select the satellite modem on the list of modems to start communication. The same has to be done when programming the automatic download.

As stated above, an Iridium call is quite similar to any standard CSD call with the only exception that the speed is lower. Thus, the time-outs for these communications are higher. In general, we can say that if a communications attempt closes 10 seconds after starting it, the called SIM card never logged into the network. The 'connected' indication should be present after 25 to 35 seconds. The 'prologue OK' indication should be present after 50 seconds.

If your logger is provided with an Inmarsat modem, you can connect to the logger through your computer's internet connection by specifying in the logger settings the IP provided together with the modem.

## SCADA communications

If you intend to use the logger in a WindFarm add the WindFarm Module option in your logger order. Check with Kintech engineering for more details, options and prices.



The *Eol Zenith*® data logger has SCADA communication capability when it is provided with the WindFarm module.

The *WindFarm* module has been designed to make its operation easier and more efficient in such a critical area as the meteorological data. It establishes permanent communication with the meteorological tower on a wind farm to integrate real time data to SCADA using modbus protocol. At any time while these operations are performed, the data logger can be remotely accessed through GSM/GPRS or satellite to download recorded data or SMS to get brief met mast reports.

*Eol Zenith*® is compatible with all of the most common SCADA's for wind farms.

The WindFarm module performs the following functions:

- Integration of real time data in WindFarm SCADA allowing **O&M staff** to access meteorological information with the SCADA tools that they are used to.
- Remote GSM or satellite download of data processed and recorded by the datalogger following the same procedure than a standard *Eol Zenith*®. This utility will be useful for the **wind power forecasting department**
- All of the functions performed by a standard *Eol Zenith*®. This utility will be useful for **wind resource assessment department**

It has been produced with the same philosophy of both ease-of-use and security in data acquisition which is shared by the other EOL products

### *WindFarm module operational work*

The added functions allow, in summary, to send real time data to the wind farm SCADA and, at the same time, to be able to have all of the remote access options to the data logger. The logger is the entire time ready for both local and remote communication.

The remote communication will not stop the local communication, although depending on the CPU load and the total amount of traffic on both interfaces, the remote connection could eventually delay some response on local connection for one second.

Both local and remote operations aren't stopped by any other logger operation like display access or manual memory download. The only operation that will stop modbus communication is a firmware update.

### *Hardware*

The logger is provided with an additional communication board with a COM connector on its front panel for local RS232 communications.

There is a wide variety of hardware communication devices for SCADA that adapt different communication protocols to the RS232 input port on *Eol Zenith*® front panel. These devices can be

supplied together with the WindFarm module. Examples of these devices are optic fiber converters, radio-modems, RS485 adapters, ethernet converters and modbus RTU to modbus TCP adapters.

### Modbus protocol

Eol Manager® let the user set up which calculated variables you want to provide in the modbus telegrams but not the address used by those variables. The system is compatible with MODBUS RTU, for the reading of the whole collection of holding registers set up in the logger configuration for modbus operation. It is not possible to query a portion of the variables (modbus registers), i.e. all the set up variables must be read at the same time. See the example at the end of this chapter.

Following a screenshot of the modbus settings tag, where you can choose which variables you want to send through modbus:

EOL Zenith Logger Settings - Fernando (000001)

Site Info | Inputs | Access | Modbus

☒ Enable Modbus Mode    Protocol: Modbus RTU 9600bps    Register Count: 48

**Anemometers/Frequency**

| Channel | Type       | Model             | Inst Value                          | Mean Value                          | Maximum                  | Minimum                  | Variance                 | T130                     |
|---------|------------|-------------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| ANE1    | Anemometer | THIES FIRST CLASS | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE2    | Anemometer | THIES FIRST CLASS | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE3    | Anemometer | THIES FIRST CLASS | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE4    | Anemometer | THIES FIRST CLASS | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE5    | Anemometer | -----             | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE6    | Anemometer | -----             | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE7    | Anemometer | -----             | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE8    | Anemometer | -----             | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE9    | Anemometer | -----             | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANE10   | Anemometer | -----             | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Wind Vanes**

| Channel | Type     | Model        | Inst Value                          | Mean Value                          | Maximum                  | Minimum                  | Variance                 |
|---------|----------|--------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|
| D1      | Windvane | THIES GRAY 8 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2      | Windvane | THIES GRAY 8 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Analog Inputs**

| Channel | Type               | Model                 | Inst Value                          | Mean Value                          | Maximum                  | Minimum                  | Variance                 |
|---------|--------------------|-----------------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|
| ANL1    | Temperature        | GALLTEC KPC 1/5       | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANL2    | Temperature        | GALLTEC KPC 1/5       | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANL3    | Pressure           | Setra276 800-1100 12V | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANL4    | Pressure           | Setra276 800-1100 12V | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ANL5    | Vertical Anemom... | PROPELLER 27106       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

KBytes/Day: 8    Minutes/Month (GPRS): 9-16    Minutes/Month (Satellite): 47    Minutes/Month (CSD): 22    \* Required Field    OK    Cancel

The serial communication format is 8 data bits, no parity bit and one stop bit. The baud-rate can be set up to the following values:

| Modem Type 2 | Connection | Speed     |
|--------------|------------|-----------|
| 22           | MODBUS RTU | 9600bps   |
| 23           | MODBUS RTU | 19200bps  |
| 24           | MODBUS RTU | 38400bps  |
| 25           | MODBUS RTU | 57600bps  |
| 26           | MODBUS RTU | 115200bps |

The data type is two modbus registers per variable coded in float (not swapped). So, each data takes two holding registers. The bits of the float variable are ordered as following:

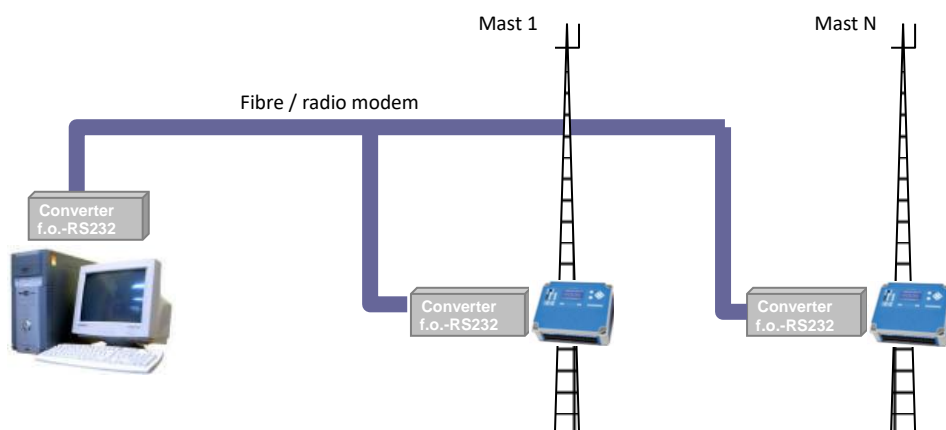
b15; b14; b13; b12; b11; b10; b9; b8; b7; b6; b5; b4; b3; b2; b1; b0; b31; b30; b29; b28; b27; b26; b25; b24; b23; b22; b21; b20; b19; b18; b17; b16

b31 is the MSB (more significant bit) and b0 is the LSB (less significant bit).

The data logger will response one modbus interrogation per second. If there is more than one interrogation per second, they will be ignored. It is advisable to set up the response time out to 4000 milliseconds.

The modbus map of variables cannot be set up by the user, so the user can set up the variables to send through modbus but cannot set up the addresses that they will take. Depending on your configuration of modbus variables, there is a specific map of variables with specific modbus addresses starting at address 40001. Addresses from 40001 to 40013 correspond always to site number, battery, hour, minute, day, month and year. Channel calculations take addresses starting at 40015. The variables are sent following the same order than the columns in the modbus configuration window (instant, average, maximum, minimum, variance of the last ten minutes interval, turbulence intensity of the last thirty second interval) and for the same order of channels of the window (from top to bottom).

In modbus protocol, it is possible to connect to the same communication lines an indefinite number of loggers using different slave numbers. Each data logger will have the modbus slave address given by the identification configuration parameter '*target*' i.e. the last two digits of the site number. So when the slave 'N' holding register read is requested, the logger with target N will respond and other data loggers will ignore that request.



#### Example:

Following you can find the typical interrogation hexadecimal bytes for logger slave number 1:

01 03 00 00 00 46 C4 38 0D

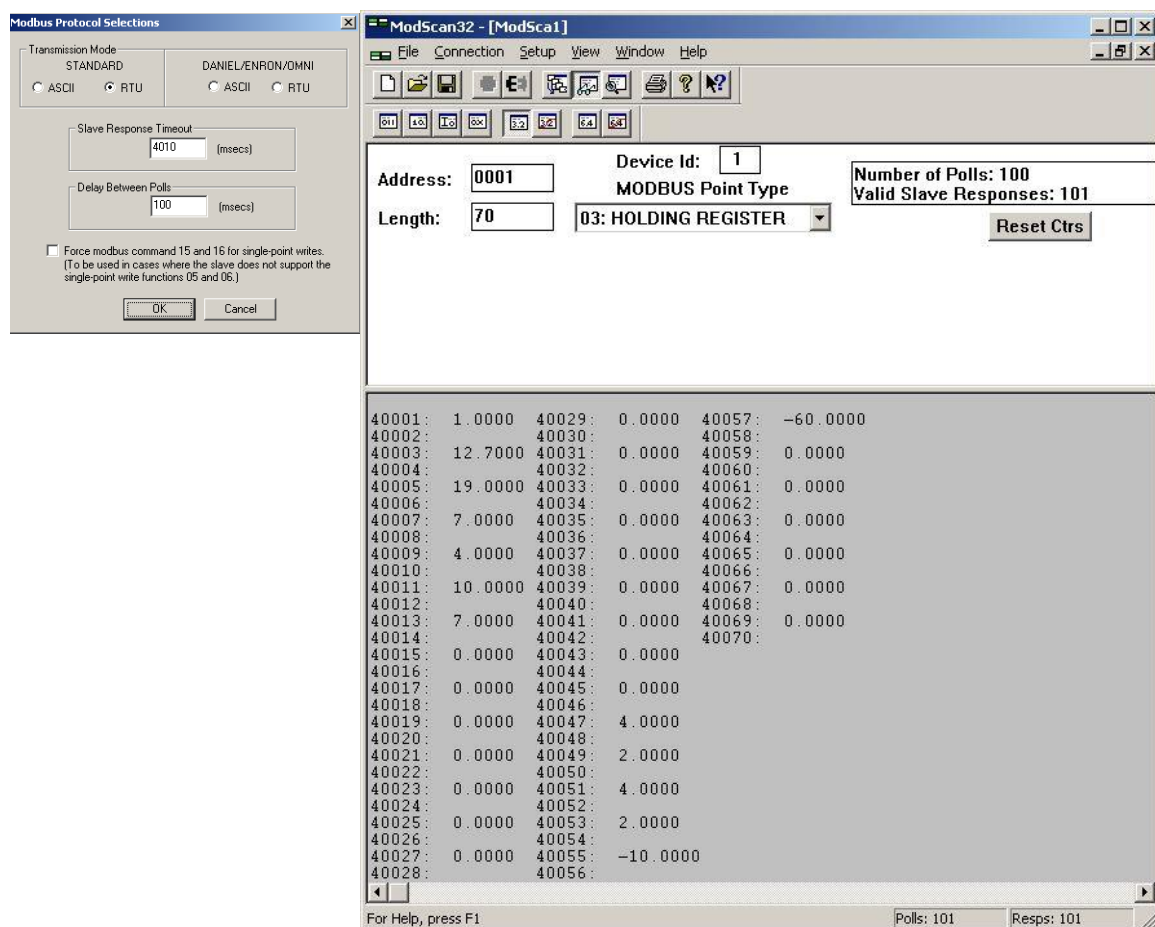
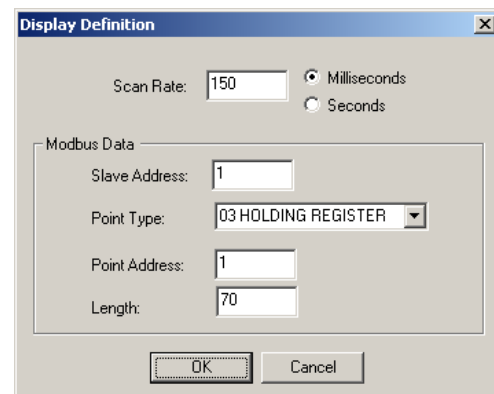
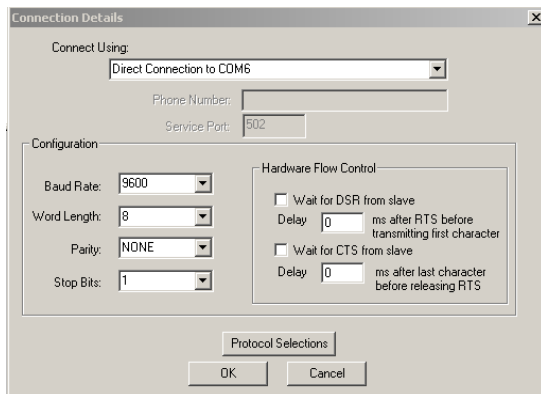
See below a typical configuration for a logger:

| Byte # | Modbus address | data     | variable                   | decimal |
|--------|----------------|----------|----------------------------|---------|
| 0      |                | 01       | slave                      | 1.0     |
| 0      |                | 03       | function                   | 3.0     |
| 0      |                | 8C       | Comput                     | 140.0   |
| 1      | 40001          | 43FA8000 | ID                         | 501.0   |
| 2      | 40003          | 41480000 | Bat                        | 12.5    |
| 3      | 40005          | 41800000 | Hour                       | 16.0    |
| 4      | 40007          | 41B00000 | Minute                     | 22.0    |
| 5      | 40009          | 41D00000 | Day                        | 26.0    |
| 6      | 40011          | 41200000 | Month                      | 10.0    |
| 7      | 40013          | 40E00000 | Year                       | 7.0     |
| 8      | 40015          | 00000000 | v1 instantaneous           | 0.0     |
| 9      | 40017          | 00000000 | v1 average                 | 0.0     |
| 10     | 40019          | 00000000 | TI30_1                     | 0.0     |
| 11     | 40021          | 00000000 | variance10_1               | 0.0     |
| 12     | 40023          | 00000000 | V1 max                     | 0.0     |
| 13     | 40025          | 00000000 | v1 min                     | 0.0     |
| 14     | 40027          | 00000000 | V2 instantaneous           | 0.0     |
| 15     | 40029          | 00000000 | V2 average                 | 0.0     |
| 16     | 40031          | 00000000 | TI30_2                     | 0.0     |
| 17     | 40033          | 00000000 | variance10_2               | 0.0     |
| 18     | 40035          | 00000000 | V2 max                     | 0.0     |
| 19     | 40037          | 00000000 | V2 min                     | 0.0     |
| 20     | 40039          | 00000000 | V3 instantaneous           | 0.0     |
| 21     | 40041          | 00000000 | V3 average                 | 0.0     |
| 22     | 40043          | 3E4CCCCD | V3 max                     | 0.2     |
| 23     | 40045          | 3E4CCCCD | V3 min                     | 0.2     |
| 24     | 40047          | 40800000 | dir1 instantaneous         | 4.0     |
| 25     | 40049          | 40800000 | dir1 average               | 4.0     |
| 26     | 40051          | 40800000 | dir2 instantaneous         | 4.0     |
| 27     | 40053          | 40800000 | dir2 average               | 4.0     |
| 28     | 40055          | 41A80000 | Temp instantaneous         | 21.0    |
| 29     | 40057          | 41A80000 | temp average               | 21.0    |
| 30     | 40059          | 42500000 | HR instantaneous           | 52.0    |
| 31     | 40061          | 42500000 | HR average                 | 52.0    |
| 32     | 40063          | 444E0000 | Pressure instantaneous     | 824.0   |
| 33     | 40065          | 444E0000 | pres average               | 824.0   |
| 34     | 40067          | 00000000 | Ane vertical instantaneous | 0.0     |
| 35     | 40069          | 00000000 | Ane vertical average       | 0.0     |
| 36     |                | D354     | CRC                        | D354    |

That corresponds to the following:

01038C800043FA0000414800004180000041B0000041D000004120000040E000000000000000000  
000  
000000000000CCCD3E4CCCCD3E4C00004080000040800000408000004080000041A8000041A80000  
4250000042500000444E0000444E0000000000000000D354.

We suggest starting the tests with the standard modscan32 application with the following settings:



### New modbus types in EOL Zenith

- **Acciona (from firmware 37):** Adaptation to SCADA WinCC (Siemens), adds compatibility to Acciona SCADA.
- **Suzlon (from firmware 43):** Adaptation to SCADA SC-METSTATION (Suzlon Energy - legacy datalogger modbus telegram). It is configured at type 27 (baudrate: 9600). EOL

Zenith datalogger receives a request (register count: 10d) and the answer (register count: 20d) contains these values in 16 bits integer format:

- 40001: anemometer 1.
- 40002: constant 9999d (Beafourt legacy not implemented).
- 40003: windvane 1.
- 40004: temperature sensor. It must be Galltec KPC1/5 (Slope: 100 – Offset: -30). This sensor has to be configured between analog channel 1 and analog channel 5 (logger takes the first temperature sensor on this range).
- 40005: pressure sensor. This sensor has to be configured between analog channel 1 and analog channel 5 (logger takes the first pressure sensor on this range).
- 40006: constant 9999d.
- 40007: humidity sensor. This sensor has to be configured between analog channel 1 and analog channel 5 (logger takes the first humidity sensor on this range).
- 40008: rain sensor. It must be configured as voltmeter. This sensor has to be configured between analog channel 1 and analog channel 5 (logger takes the first voltmeter on this range).
- 40009: met station. Logger status.
- 40010: constant 0d.
- **Enercon (from firmware 45):** Adaptation to SCADA Meteo-32 (legacy datalogger proprietary telegram - Woben). It is configured to type 28 (baudrate: 9600), type 29 (baudrate: 19200) and type 30 (baudrate: 38400). EOL Zenith datalogger sends continuously (once per second) two ASCII format telegrams (8 bits, no parity, 1 bit stop):

*#t 14/11/24 15:38:34 \$2E*

*#a s1=0 s2=26 s3=0 d1=886 d2=942 h1=56 t1=2950 b1=992 r1=1438 \$33*

The checksum value is at the end of each telegram, after the “\$” character (but it is not included on the checksum calculation).

The first telegram (starts with #t) contains timestamp information (day/month/year hour:minute:second).

The second telegram values (starts with #a) are:

- s1: anemometer 1 (0.1 m/s scale) -> 0 m/s



- s2: anemometer 2 (0.1 m/s scale) -> 2.6 m/s
- s3: anemometer 3 (0.1 m/s scale) -> 0 m/s
- d1: windvane 1 (0.1° scale) -> 88.6°
- d2: windvane 2 (0.1° scale) -> 94.2°
- h1: humidity sensor (%) - this sensor has to be configured between analog channel 1 and analog channel 5, logger takes the first humidity sensor on this range) -> 56%
- t1: temperature sensor (0.1 Kelvin scale - this sensor has to be configured between analog channel 1 and analog channel 5, logger takes the first temperature sensor on this range) -> 295.0K
- b1: pressure sensor (hPa - this sensor has to be configured between analog channel 1 and analog channel 5, logger takes the first pressure sensor on this range) -> 992 hPa
- r1: radiation sensor (W/m<sup>2</sup> - this sensor has to be configured between analog channel 1 and analog channel 5, logger takes the first radiation sensor on this range) -> 1438 W/m<sup>2</sup>

If an anemometer were configured in anemometer channel 4, it would be displayed after the radiation sensor (s4: anemometer 4 - 0.1 m/s scale):

```
#a s1=0 s2=39 s3=0 d1=886 d2=900 h1=58 t1=2950 b1=992 r1=1443 s4=0 $63
```

If a pluviometer were configured in anemometer channel 4, it would be displayed after the radiation sensor (p1: pluviometer - 0.1 mm/s scale):

```
#a s1=0 s2=11 s3=0 d1=886 d2=900 h1=56 t1=2950 b1=992 r1=1440 p1=0 $4E
```

## Working with ultrasonic instruments

### Introduction

Some equipment provide the readings from the transducers through a serial communication port rather than through voltage or frequency coded signals. Instruments with electronically complex transducers like ultrasonic instruments are a good example. Along this chapter we will refer to ultrasonic instruments but this is a particular case of serial output instruments.

Ultrasonic sensors usually provide more than one physical magnitude (horizontal wind speed, vertical wind speed, horizontal wind direction and temperature). Every time the ultrasonic instruments are polled, they send a response telegram with a specific format previously set up in the instrument. The telegram includes physical magnitudes, instrument identification and other instrument status information.

You can order the *Ultrasonic Module*, an optional supply of both hardware and firmware necessary for interfacing and processing such instruments.

### *Ultrasonic Module general overview*

The Eol Zenith has a dedicated firmware, code and memory space, -i.e. a logical channel- per each physical input reading from the instruments.

The Eol Zenith provided with ultrasonic module will poll once per second through its serial port every ultrasonic equipment previously set up in the logger configuration.

The Eol Zenith processes every message from the serial input, according to the format specified by the type of anemometer that matches that instrument. Then Eol Zenith associates every physical magnitude in the message to a logical (not physical) input channel for anemometer (ANEx) OR analog (ANLx) and not for DIR or extra analog. As a consequence, for those channels with Type 'ultrasonic', the signal from the physical terminal will be ignored. In the example below, signals from ANE1, ANE3, ANE4, ANL2, ANL3, ANL4 and ANL5 terminals are ignored as the logical inputs are associated to data from the ultrasonic instruments.



**EOL Zenith Logger Settings - mesa inigoazoteaGTV (000001)**

Site Info | Inputs | Access | Modbus

**Anemometers/Frequency**

| Channel | Type       | Model              | Units | Serial Number | Height | User Name       | Std Cal                             | Slope    | Offset   | Std Dev                             | Max                                 | Min                                 |
|---------|------------|--------------------|-------|---------------|--------|-----------------|-------------------------------------|----------|----------|-------------------------------------|-------------------------------------|-------------------------------------|
| ANE1    | Ultrasonic | Thies A            | m/s   |               | 0      | Thies_2D_A      | <input checked="" type="checkbox"/> | 0.050000 | 0.000000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE2    | Anemometer | THIES FIRST CLA... | m/s   |               |        | ThiesFirstCass  | <input checked="" type="checkbox"/> | 0.048400 | 0.220000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE3    | Ultrasonic | Gill 1             | m/s   |               | 0      | GillWindMaster1 | <input checked="" type="checkbox"/> | 0.050000 | 0.000000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE4    | Ultrasonic | Vaisala C          | m/s   |               | 0      | Thies2D_A       | <input checked="" type="checkbox"/> | 0.050000 | 0.000000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE5    | Anemometer | .....              | m/s   |               | 0      | Anemo5          | <input type="checkbox"/>            | 0.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE6    | Anemometer | .....              | m/s   |               | 0      | Anemo6          | <input type="checkbox"/>            | 0.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE7    | Anemometer | .....              | m/s   |               | 0      | Anemo7          | <input type="checkbox"/>            | 0.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE8    | Anemometer | .....              | mm    |               | 0      | Anemo8          | <input type="checkbox"/>            | 0.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE9    | Anemometer | .....              | m/s   |               | 0      | Anemo9          | <input type="checkbox"/>            | 0.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE10   | Anemometer | .....              |       |               | 0      | Anemo10         | <input type="checkbox"/>            | 0.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |

**Wind Vanes**

| Channel | Type     | Model              | Units | Serial Number | Height | User Name | Std Cal                             | Slope    | Offset   | Std Dev                             | Max                                 | Min                                 |
|---------|----------|--------------------|-------|---------------|--------|-----------|-------------------------------------|----------|----------|-------------------------------------|-------------------------------------|-------------------------------------|
| D1      | Windvane | NRG 200P / THIE... | °     |               | 0      | Windvane1 | <input checked="" type="checkbox"/> | 1.000000 | 0.000000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| D2      | Windvane | ORNYTION 207       | °     |               | 0      | Windvane2 | <input checked="" type="checkbox"/> | 1.000000 | 0.000000 | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |

**Analog Inputs**

| Channel | Type       | Model              | Units | Serial Number | Height | User Name    | Std Cal                             | Slope     | Offset      | Std Dev                             | Max                                 | Min                                 |
|---------|------------|--------------------|-------|---------------|--------|--------------|-------------------------------------|-----------|-------------|-------------------------------------|-------------------------------------|-------------------------------------|
| ANL1    | Anemometer | PROPELLER 27105    | m/s   |               | 0      | Propeller    | <input type="checkbox"/>            | -3.715000 | 9.290000    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL2    | Ultrasonic | Gill 1 Vert Anemo  | m/s   |               | 0      | GillVertical | <input checked="" type="checkbox"/> | 8.192000  | -20.480000  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL3    | Ultrasonic | Gill 1 Windvane    | °     |               | 0      | GillWV       | <input type="checkbox"/>            | 1.000000  | 17.000000   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL4    | Ultrasonic | Thies A Windvane   | °     |               | 0      | ThiesA_WV    | <input type="checkbox"/>            | 1.000000  | 38.000000   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL5    | Ultrasonic | Gill 1 Temperature | °     |               | 0      | GillTemp     | <input checked="" type="checkbox"/> | 81.920000 | -204.800000 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Averaging Time (Minutes): 10    Gust Integration Time (Seconds): 1    Ultrasonic Sensor Protocol: 9600bps

KBytes/Day: 10    Minutes/Month (GPRS): 11 - 20    Minutes/Month (Satellite): 58    Minutes/Month (CSD): 26    \* Required Field    OK    Cancel

As the instrument identification is included in both the request and the response message, it is possible to connect several instruments to the same bus of communication (same wires). The polled instrument will reply and the others will ignore the telegram request. Up to four ultrasonic instruments can be connected to a single Eol Zenith. Each instrument can provide up to four readings associated to four different input channels. The four instruments must have ID's 1 to 4.

### Ordering and preparing an ultrasonic instrument

Ultrasonic instruments provide different protocols, output message formats and response times depending on:

- brand and model of instrument
- actual instrument configuration (message format, averaging time, units, ID, etc)

As a consequence, it is necessary that the above characteristics follow one of the Eol Zenith standardized ultrasonic instrument and configuration. So, check with Kintech Engineering technical support to work with one of the approved instruments. Kintech only works with the most known recognized manufacturers of ultrasonic instruments like Gill, Thies or Vaisala.

When you order the instruments from Kintech Engineering you will get everything ready to connect and power on. The ultrasonic module also includes the necessary hardware:

- Isolated RS485 transceiver to adapt level to RS232 Eol Zenith input port through molex front panel connector: It is necessary due to the long distances between instruments and datalogger.

- Cable from molex front panel connector to RS485.

### Setting up ultrasonic instruments on the Eol Zenith through the Eol Manager Software

All you have to do is to choose from the drop-down menus:

- **Type:** 'ultrasonic'
- **Model:** according to manufacturer, instrument ID and physical magnitude.

| Channel | Type       | Model             | Units | Serial Number | Height | User Name    | Std Cal                             | Slope     | Offset      | Std Dev                             | Max                                 | Min                                 |
|---------|------------|-------------------|-------|---------------|--------|--------------|-------------------------------------|-----------|-------------|-------------------------------------|-------------------------------------|-------------------------------------|
| ANL1    | Anemometer | PROPELLER 27105   | m/s   |               | 0      | Propeller    | <input type="checkbox"/>            | -3.715000 | 9.290000    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL2    | Ultrasonic | Gill 1 Vert Anemo | m/s   |               | 0      | GillVertical | <input checked="" type="checkbox"/> | 8.192000  | -20.480000  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL3    | Ultrasonic | Gill 1 Vert Anemo | m/s   |               | 0      | GillwV       | <input type="checkbox"/>            | 1.000000  | 17.000000   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL4    | Ultrasonic | Gill 1 Windvane   | m/s   |               | 0      | ThiesA_wV    | <input type="checkbox"/>            | 1.000000  | 38.000000   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL5    | Ultrasonic | Gill 1 Windvane   | m/s   |               | 0      | GillTemp     | <input checked="" type="checkbox"/> | 81.920000 | -204.800000 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Averaging Time (Minutes) 10 Integration Time (Seconds) 1 Ultrasonic Sensor Protocol 9600bps

### Installing ultrasonic instruments

An independent extra power source is necessary since ultrasonic sensors drain much more power than standard equipment. Use solar charge regulators with load shut down when low battery to avoid damaging the battery because of deep discharge.

Once the settings have been uploaded to the logger and the wires connected, power on the system and check instantaneous readings as with any standard equipment.

You can check the LED indications on the RS485 transceiver. If there is incoming and outgoing data traffic, you should see one second sequences. You should also check the display *status > COM2* the two digits right after the 'Error'. It shows the number of errors in polled anemometers during the last recording interval.

## 9. Checking communications when powering on the logger

### Setting up the logger communications options

Prior to setting up the logger and going to the site for installation you must study which type of communication you can use in the exact location where the logger will be installed. In most of the cases it will be internet communication started from *EOL Manager*® to the logger through its GSM/GPRS connection. Other times it will be through CSD modem, satellite modem or e-mail.

In the preceding chapter there are explanations of the pros and cons of each of the communications options. In many locations and countries many options aren't available. To choose the best available communication option the user takes into account the experience with other loggers in the area from the user or facilitated to Kintech by other users. Ask Kintech Engineering for support.

**We strongly recommend checking communications in the office before going to the site for installation.** Doing so, you make sure that settings on the logger, modem and communication line are properly configured. Even after the tests you may encounter difficulties on site because of signal strength, roaming, differences in the services on the site, etc.

Sometimes, communication companies may alter or suspend some services without prior notice. That is the case of lost accessibility to the public IP's using GPRS, for example. In such a situation, e-mail download is the only remote download option. For cases like that, we recommend filling in all the fields of e-mail download in the logger settings window. After the first successful communication, upload settings disabling sending automatic e-mails. If for whatever reason, a change in the line settings make internet downloads from *EOL Manager*® impossible, you can enable e-mail sending an SMS.

Notice that it is very useful to take to the site an unlocked mobile phone or a mobile phone from the same company of the logger SIM card. So you can check the signal and SIM status using a mobile phone.

### SIM card

The SIM card has to be gently inserted in the SIM card holder on logger front panel. When you insert it properly you can hear a 'click' after a short backward motion. If you can't hear the 'click', then the SIM card orientation is wrong. Flip it and try to insert again until you can hear the 'click'. Do not force the SIM when inserting it. If you feel that there is more force than usual check that the SIM is properly facing the slots of SIM card holder.

If the SIM card is properly inserted but the red LED Light on logger front panel doesn't flash, insert it in a mobile phone that works with the GSM Company of the logger SIM card. After powering on the phone, insert the PIN code configured on logger. For security reasons, you can check only two digits of the PIN code on logger display (Num3, 4). Then, try to make a test call with a conversation during several seconds. Go to display chapter for more details.

## PIN code

If the PIN code set up is wrong, the logger shows a warning message on the displays bottom bar. Disconnect SIM card immediately from logger to avoid SIM card blocking after the logger makes three PIN entering attempts.

If the SIM card is blocked (it happens only if there were three wrong attempts), insert the SIM in a mobile phone. It will ask for the PUK. After that, insert the PIN code that is set up in the logger configuration. If you are not sure of the PIN code that is set up on the logger configuration, after entering the new PIN code on the mobile phone go to security options of the mobile phone and disable asking for PIN code.

## Communications antenna

The antenna must be connected to the GSM connector in the bottom side of the logger enclosure. To avoid interferences, you must not leave loops or wounds of antenna cable close to the anemometer cables. For the same reason, try to put the antenna cable away from the anemometer cables along the tower structure.

Place the antenna in the highest position of the mast that the antenna cable reaches. Place it in upright position (except yagi antennas). To avoid signal loss, the antenna has to be installed in a boom as far from the tower as possible. The direction of the boom affects also to the signal strength. The best orientation of the boom and antenna is pointing to the closest mobile phone repeater. The mast structure reduces the signal just behind it.

Kintech supplies high gain antennas for places with low GSM signal. When the signal is weak or discontinuous it is useful to try different antenna's boom orientations looking at the logger signal indicator in the status > modem display.

## Communications when powering on the logger

When the logger is powered on, it loads the configuration settings from the SD memory. Communication settings are part of the settings of every site. It contains information such as PIN code, APN, SMTP, etc. Once the logger has loaded those settings, it starts logging and setting communications ready for incoming connections. Later, the logger will check that the communications are ready every hour and after every communication. The modem is reset by the logger once every day at 00:00 logger time (UTC+00 if GPS is enabled).

Depending on the communication settings, the logger will follow a different process to be ready for incoming communications. During the process, it will show different indications that are explained in this chapter. At the end of the process, we should see:

- coverage bars on upper right corner (in the place of the arrows)
- red flashing one ON flash every 3 seconds



- ONLINE, SAT or GSM indication depending on the type of communications.

The process, as described in the previous chapter, consists of a series of stages that the logger has to complete one after the following. For instance, the logger has to log on the GPRS network before connecting to the APN. If the logger has some difficulty in one of the stages, then it tries again several times. After several unsuccessful attempts, it gives up trying and stays in standby mode with GSM signal indication in the display.

If the e-mail has been set up in the logger configuration, we should see an envelope icon (✉) while the logger is sending an e-mail. As the logger always sends a short report e-mail at power on, if it is set up in configuration, we should see the icon at the end of the process. You can ask for a downloaded e-mail with data attachment at any time by sending a SMS as described in Remote non programmed e-mail download (requested by SMS)

Another way to make the logger send an e-mail is by changing the date and time to the minute right before when it should be sent.



### Modem red LED on logger front panel:



It shows the hardware status of the built in GSM modems:

|                |   |
|----------------|---|
| OFF            | The modem is powered off  |
| ON             | The modem is powered on but it is either out of GSM signal or the PIN code is incorrect or the frequency band selected in the modem is wrong or voltage drops in power supply |
| Slow flashing  | (1 ON flash every 3 seconds) Modem OK   |
| Slow flashing  | (1 short OFF flash every several seconds) The modem is resetting because of power supply problems or the logger can't understand modem responses                              |
| Quick flashing | (1 ON flash every 3 second) El modem is communicating through CSD   |

### Communication / coverage bars Icon

It shows the signal strength or communication activity:

|   |   |
|---|---|
|  | Signal strength indication: The equipment is waiting for incoming connections. There can be from 5 bars (maximum signal strength) to no bar (no signal). Check antenna if signal is poor. |
|  | Communication in process: the equipment is interchanging information with the modem. It is not ready for new incoming connections.  |

|   |   |
|---|---|
|  | Sending e-mail: The logger is not ready for new incoming connections.   |
|  | The equipment can't access to the communication network. Check SIM card |

## Communication status indications

In the upper right corner of the logger display we can see the coverage bars indication or the communication Arrows. At the left side of them a short text indicates the communication stage.


In addition to this information, in the status menu, modem function, there is more information concerning communication status. The status codes are shown starting with an 'E'. In the table below, you can find a list of those status codes and the explanation:



| Indication | Code   | Status   |
|------------|--------|--|
| X          | E33-37 | Waiting for connection to GSM or satellite network. Enter PIN code if necessary. |
| GSM        | E64-65 | Starting modem internet stack  |
| SAT        | E3-4   | Satellite modem ready, showing signal strength in display                        |
| GPRS       | E66    | Setting up TCP packet size   |
| GPRS       | E67    | Waiting for connection to GPRS network   |
| GPRS       | E68    | Activating GPRS bearer   |
| GPRS       | E69    | Setting APN name   |
| GPRS       | E70    | Setting APN user   |
| GPRS       | E71    | Setting APN password   |
| GPRS       | E72    | Connecting to APN (Access Point Name)  |
| INET       | E73    | Reading IP assigned from the network   |
| INET       | E74    | Starting listening incoming connections  |
| INET       | E75    | Connecting to LNS (Logger Name Server)   |
| INET       | E80    | Sending data to LNS  |
| ONLINE     | E3-4   | IP address has been updated to LNS, showing signal strength in display           |

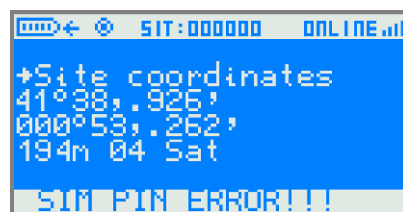
When the logger is powered on, it starts a process to be ready for communications. Depending on the logger communication set-ups, it will follow a specific procedure. The system will show three different types of indications according to the communication progress. At the end of the process we should see the coverage bars, slow flashing on red LED and 'ONLINE', 'SAT' or 'GSM' on upper right corner.

If the e-mail is programmed on the logger, it will follow the following status:

| Indication  | code | Status   |
|---|------|--|
|  | E112 | Connecting to SMTP (outgoing e-mail server)  |
|   | E113 | Receiving data from SMTP and type of authentication  |
|   | E114 | Setting if there is authentication. Maximum status if SMTP uses SSL. Don't use SMTP servers that only work through SSL/TLS.    |
|   | E115 | Setting type of authentication selected  |
|   | E116 | Setting SMTP user  |
|   | E117 | Setting SMTP password  |
|   | E118 | Setting e-mail from. On error check typing. Try adding '<' before and '>' after the e-mail address from and e-mail address to. |
|   | E119 | Setting e-mail to  |
|   | E120 | Starting data session  |
|   | E121 | Sending e-mail text  |
|   | E122 | Sending e-mail attachment  |
|   | E123 | Ending e-mail attachment   |
|   | E124 | Ending e-mail  |
|   | E125 | Closing session with SMTP  |

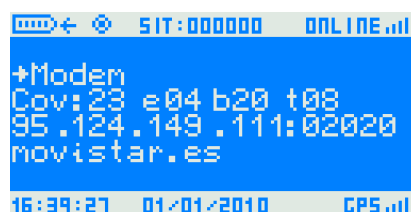
## Indications of changes in status of communications

In lower line of the display, the logger shows messages regarding changes in the communications status. These messages substitute the time, date and GPS indications. These messages are shown for one second.



## Indications on MODEM function in status menu

You can access through logger display to specific information regarding logger Communications status. The display presents the information like the following:



The information showed in the display is described in the display chapter.

### Selection of GSM frequency band:

---

The equipment can communicate in any of the four frequency bands of the GSM/GPRS Networks: 850MHz, 900 MHz, 1800 MHz, and 1900 MHz. The earliest modem versions didn't have automatic frequency band selection. To select the band set the modem type to 255 for European band (900 MHz, 1800 MHz) or set 254 for American band (850MHz, 1900 MHz). Once the modem type is set, the logger configures the modem following a sequence of stages that starts in E95 and ends in E111. Once finished, the logger switches the modem type back to 12 (Kintech GPRS). If there is any problem during the process, the logger switches the modem type back to 12 even though the status doesn't reach E111. Then you can repeat the process.

## 10. Communications troubleshooting

Prior to reading this chapter, we recommend reading carefully the previous communications chapter.

The logger follows a process to be ready for incoming communications. The process, as described in the previous chapter, consists of a series of stages that the logger has to complete one after the other. For instance, the logger has to log on the GPRS network before connecting to the APN. If the logger has some difficulty in one of the stages, then it tries again several times. After several unsuccessful attempts, it gives up trying and stays in standby mode with GSM signal indication in the display.

Each one of the stages described above has one code associated with it. So, if we see on logger display the communication status codes (in *status > modem*) we will see how the communication is progressing along those stages. In case there is some problem with the communications, check the maximum status code. The maximum status code will show the status at which the system couldn't go on the process to be ready for incoming communications. For example, if the logger has wrong APN settings, it can't pass from GPRS to INET, and the maximum status is E72. After showing E72 it will finish the attempts showing the E11 status code.

If the system cannot succeed the communication process, it will not show ONLINE indication on the display upper right corner. Check the following table with possible failure reasons for each communication stage.

| Indication | Action   |
|------------|--|
| X          | Error in SIM card: incorrect PIN code, bad inserted or broken down. Insert the SIM card in unlocked mobile phone and try to make a call. Check that battery wires have sufficient section.   |
| GSM        | If the MODEM LED (red) is not flashing: there is not GSM signal or the frequency band is wrong. Check antenna connection and installation. Set MODEM type to 25X to set up the MODEM. If the modem LED light is flashing there is an internal modem stack error. |
| GPRS       | APN settings are not valid for the GSM line.   |
| INET       | The logger couldn't access to LNS server in Internet.  |

### Communication started from the software

#### Communication problems in the logger

If the logger shows proper communication indications but it is not possible to access to the logger through internet using *EOL Manager*® then the problem would very likely be the GSM line settings. The GPRS network is not providing a public IP address that allows incoming connections. To confirm that this is really the problem, make a ping to the logger IP address. One way to know the logger IP address is by looking at the IP address field when starting a real time connection as it shows the last

known IP address. To make a ping to the logger's IP address go to system shell and type ping<space><Logger IP address><enter>:

```
C:\Documents and Settings>ping 213.99.178.61
Pinging to 213.99.178.61 with 32 data bytes
Answer from 213.99.178.61: bytes=32 time=1374ms TTL=53
Answer from 213.99.178.61: bytes=32 time =707ms TTL=53
Answer from 213.99.178.61: bytes=32 time =657ms TTL=53
Answer from 213.99.178.61: bytes=32 time =676ms TTL=53
Statistical in ping to 213.99.178.61:
    Packets: sent= 4, received= 4, lost= 0
    (0% lost),
C:\Documents and Settings>
```

If the IP address cannot be reached from the Internet you will find an error response like the following:

```
C:\Documents and Settings>ping 27.57.200.71
Pinging to 27.57.200.71 with 32 data bytes
Time out for this request
Time out for this request
Time out for this request
Time out for this request
Statistical in ping to 27.57.200.71:
    Packets: sent= 4, received= 0, lost= 4
    (100% lost),
C:\Documents and Settings>
```

In such a situation the logger is able to start communications to the Internet like updating its IP address to the LNS or communicating with SMTP for sending e-mails but it will not be able to receive incoming connections like real time or downloading.

Sometimes there is a ping response but if we look at the remittent IP address, it is different than the logger's IP address. In those cases, the logger cannot be accessed from internet.

Occasionally the communications work properly after every logger reset but after a while it is not possible to start a communication with the logger or it is not possible to receive an e-mail from the logger. One possible reason is that the system has been logged out of the network. Some GSM networks take the terminals out of the network if they see that there is no communication activity. In such cases programmed automatic downloads and / or e-mail right after the modem daily reset (at 00:00 logger time by default or at your programmed modem power on time).

### **Communication problems in the computer**

In some cases, especially with computers connected to networks of medium-big corporations, there are restrictions to outgoing traffic from the computers inside the network. These restrictions can affect specific ports. So, if you can't connect to your logger try setting up the 443 TCP port (SSL) in



both logger and software. If you still can't connect to the logger ask your system administration for your network proxy settings.

If your logger is working properly and therefore showing the "ONLINE" indication in upper right corner of the display, then check in the software:

1. Check if there is a green color indication in the "*Comm Status*" cell of your site in the main panel of Eol Manager. You can update that information by using the "*Update IP Information*" command in the contextual menu. If you get a green indication, then go to step 3.
2. Go to "*Options*" menu, select "*Application Settings*", and then the "*Software Internet Options*" tag. Select "*Use Proxy Server*" and fill in the fields "*HTTP Proxy*" "*Port*", "*Use Authentication*", "*User Name*" and "*Password*". All this information must be provided by your IT system administration. Then go back to step 1.
3. Once your site "*Comm Status*" cell is green then try to make a real time connection to the logger. Make sure that "*Use LNS*" is enabled. Then start the real time connection and if you are not receiving data please follow the next step.
4. If you are still not getting data, maybe the outgoing traffic is blocked by the system. Go ahead and test the TCP port 443, used by SSL internet traffic of web browsers and e-mail programs. To do this, follow these steps:
  - a. Change the site settings in the PC: with Eol Manager "*Edit Settings*", "*Access*" tag, "*IP Port*" type 443 and save the settings.
  - b. Upload the new settings to the logger with the "*Upload Settings*" tool (either with the memory physically connected to your PC or remotely through a CSD modem.

If you do it remotely then the new settings will be applied after the next modem reset. A modem reset is performed automatically by the logger at least every day at 23:59 logger time.

If you have physical access to your logger, power it off, take the memory out and connect it to the computer, upload the settings to the memory, insert the memory back to the logger while it's powered off and then power it on.

5. At this point, with proper proxy settings and TCP port 443 you should be able to connect to your logger. If you still can't connect to it and your IT people is not giving you a solution, then use a USB internet modem connected to your computer

---

## Communication started from the logger

Read carefully all the chapters related to e-mail communications with special attention to Communication status indications.

If you see that the e-mail fails at status E118, then try again inserting a '<' character before and '>' character after all of the email addresses in the logger settings: sender e-mail address, recipient e-mail address (1), recipient e-mail address (2). Some SMTP servers need that the e-mail address has those separators.

If you can't find the e-mail sent from the logger and the logger indications are that the e-mail was sent OK, then check that the e-mail wasn't moved to the '*spam*' or '*junk e-mail*' folder.

Try different SMTP ports. Some SMTP require the use of port 25, others require port 587. Some SMTP have more restrictive spam fighters in port 25. The port 465 is used for SSL/TLS encrypted connections, so try to use other ports if you see that your logger stops at status e114.

## 11. Downloading data options

The logger records on the memory card the statistical data of the inputs every ten minutes interval. The data is stored in a position of the memory –address- just after the previous recording. There are several ways to download the data contained in the memory card.

Once the download is finished, the logger will record the data in a location of the memory that depends on the download procedure that was followed. So we can choose if we want to leave copy of historical data on logger memory or we want just the last recording interval data stored on memory.

The advantage of keeping the data history in the logger is having a data back up in the logger memory. As the data is encrypted and password protected, the data can't be retrieved 'by others'. In case you need to recover the data history, ask to Kintech technical support.

### Downloading by memory card reading

You can release the memory card from the logger at any time. This will not stop any logger task. No data recording will be lost unless the memory is not inserted for more than one recording interval (10 minutes).

Notice that the logger settings are also stored in the SD memory, in addition to the input channel statistical information.

When the logger detects that the memory has been released from its memory holder, it shows on display the steps to start a new storage cycle. A new storage cycle means that the logger will record the future data from the beginning of the memory, overwriting the existing data of the previous storage cycle. The old storage cycle data will no longer be available.

The procedure consists basically on following the key sequence that is displayed step by step on the logger. If you don't want to start a new storage cycle just don't follow the key sequence. By doing that, the logger will go on with the previous storage cycle and the data will be available for future downloads by reading the memory card as if the logger memory wouldn't be read before.

After reading the memory with *EOL Manager*®, you can insert a memory back in the logger. If you chose to start a new storage cycle, the logger will store its settings in the 'new' inserted memory. As a consequence, it doesn't matter what information the new memory has. All previous data and configuration in the memory will be overwritten.

Notice that all stored information in the memory is hidden and encrypted. You can't use the Windows® explorer to see any information (both configuration and data). You must use the *Eol Manager*® software to access to any information. If you use any other tool all information can be lost.

If you take the SD memory out for a period equal or more than two recordings (20 minutes), then depending on firmware version:

- Newer firmware versions (\*1): after 2 recordings without memory, the logger starts to store data in internal memory (emergency eeprom) until next download.
- Older firmware versions (\*1): recordings are lost until you insert the SD memory

(\*1): Contact Kintech technical support for detailed information about any specific firmware version.

If a logger is working with the emergency EEPROM, it will switch back to the SD card under two conditions:

1. there is a working SD card inserted
2. one of the following:
  - there is an automatic download
  - there is a download without 'do not include this data on the next download' option
  - the same SD card is inserted back to the logger
  - There is a logger reset.

In this case, the data in the emergency EEPROM downloaded afterwards with the specific eeprom option might not be decoded properly, if there is a change in the logger settings and a logger reset, as the logger stores its current settings in the emergency eeprom after every logger reset.

There is an additional debug mode on site eeprom download procedure. Please consider this method only when there is no other alternative. By setting mode to 12X eeprom contain will be copied to SD card. Please if you do so, take into account that copying eeprom to SD card can take more than a minute. A display message will indicate the end of the process.

## Remote download

As explained before, the logger can accept incoming connection for data downloading and / or start connections for downloading data as an e-mail attachment. Kintech Engineering doesn't recommend downloading through e-mail unless there is no other possible communication procedure.

The *EOL Manager*® software lets the user program the automatic periodic download for any site. Every time the software completes an automatic download, the recordings that have been received will not be sent in future downloads even though, depending on the download overwriting option, the data remains in the logger memory. In addition to the automatic downloads, the software lets the user download at any time.

The *EOL Manager*® lets the user specify whether the downloaded data remains in the logger memory or downloaded data is overwritten with new recordings after a successful download.

### ***Remote programmed download in EOL Manager®***

As explained before, data sent after a successful programmed download will not be sent again in future downloads. There are three options when programming the automatic downloads:

- The equipment will store next recordings in the beginning of the memory –overwriting stored data- after all programmed downloads
- The equipment will store next recordings following to the last downloaded recording – keeping all historical data- after all programmed downloads. Afterwards, all history data can be retrieved by reading the memory through memory card reader.
- The equipment will store next recordings in the beginning of the memory –overwriting stored data- after every several programmed downloads, as indicated in the software.

### ***Remote not programmed download in EOL Manager®***

There are three options when doing a non programmed download (download after user request):

- The downloaded data will be sent again in the next download 'as if they would never be downloaded'. We refer to this option as a 'query' download in *EOL Manager®*.
- After the download, the equipment will store next recordings in the beginning of the memory, overwriting previously stored data.
- The equipment will store the next recording following to the last downloaded recording, keeping historical data after that download. Afterwards, all history data can be retrieved by reading the memory through memory card reader.

### ***Remote programmed e-mail download***

Every time the equipment finishes a successful complete e-mail download, next recordings are stored following to the last downloaded recording. The data sent in the previous e-mail will not be sent in the next e-mails. Afterwards, all history data can be retrieved by reading the memory through memory card reader.

E-mail downloads don't have as good performance as point to point downloads have. There are many different agents in the chain of communications that can affect to the results. Examples of them are the hosting provider, the antispam filters, the ISP, antivirus, etc. If there is no other way to download than e-mail we recommend setting two e-mail recipients with two different e-mail servers.

### ***Remote non programmed e-mail download (requested by SMS)***

As explained in the chapter How to get the proper GPRS settings from the GSM operator, unfortunately, not all GSM lines and GSM operators allow reception of incoming connections from the internet. In other words, they don't allow devices connected to internet through their APN to work as a server. In such conditions the assigned IP address that the equipment updates to the LNS is not a public IP. There is no response to ping commands or the peer IP that responds to the ping command doesn't correspond to the equipment.

Some GSM operators require ordering specific Internet contracts that allow public IP and Internet incoming connections. Sometimes the service that matches the necessities also includes static IP assignment which isn't really necessary. Other GSM operators offer IPsec to VPN's. Ask our technical support to learn more about contracts in your country.

See also the chapter How to get the proper GPRS settings from the GSM operator.

You can send requests to the logger by SMS at any time, sending an e-mail with download data attachment. When the logger receives the SMS, it replies to the sender with another SMS and then it sends an e-mail to the set up recipients with the data not sent by e-mail before. The data sent in the requested e-mail will not be sent in future e-mails.

### How to access to the logger from different computers

---

Any software installed in any computer provided with the access passwords and the serial number for accesses by internet or the telephone number for accesses by CSD can access to the logger.

There has to be only one installed *EOL Manager*® software that downloads the data with automatic programmed download. Other software installations in other computers must always leave the 'include these data in future downloads' option so they can't program automatic downloads. It is possible to program automatic data forwarding from the software to a recipient after automatic programmed downloads.

If a logger is downloaded by e-mail, the data sent in the e-mails will be sent again if the logger is downloaded by other procedures like CSD, internet, com port or memory card.



## 12. Software Installation

One single file installs both the *EOL Manager*® and *EOL Charting Tool* on your pc.

With *EOL Manager*® you can do the following:

- Download all the wind data from your wind assessment masts. Either by telemetry or with a SD memory card reader
- Decode the password and encrypted RAW wind data that you have downloaded
- Configure all the settings in the *Eol Zenith*® either by telemetry or by directly inserting the SD card from the logger into your pc
- Connect in real time to all your wind assessment masts, by either a CSD, Internet or Satellite connection
- Administrate all your wind data and all the reports from all your wind assessment sites

*Eol Charting Tool*® is a tool to thoroughly perform verification tests on all the sensors utilizing the built in graphics feature (e.g. wind rose, Weibull distribution, turbulence intensity etc.)

### System Requirements

*EOL Manager*® is supported by Windows XP with a .NET framework version 3.5 SP3 or later, as well as Windows 7. It is important that you have the latest update of your Windows version.

With a SD memory card reader the user can both read the wind data from the SD card and save the configuration from the PC to the SD card.

You need the software Google Earth installed on your pc, if you want to see your wind assessment masts using the software

A modem connection via telephone or internet connection if you wish to communicate with your logger.

### Executing the installer

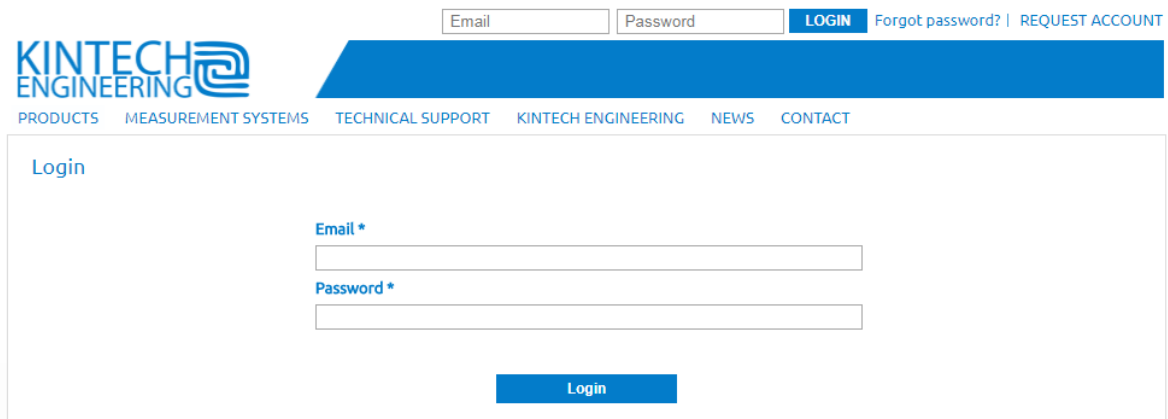
In case you do not already have an online user account, please follow these steps to get started:

- Go to our website [www.Kintech-engineering.com](http://www.Kintech-engineering.com) and click the "Request Account" button (located in the upper right corner).
- Wait a little bit until our operators accept your request.
- You then receive an email with your username and password to your user account.

To download the latest version of Eol Manager® software go to the following web page:

[https://www.Kintech-engineering.com/hm/en/admin\\_customers/login.htm](https://www.Kintech-engineering.com/hm/en/admin_customers/login.htm)

To access to the download area use your login details that you have received via email.



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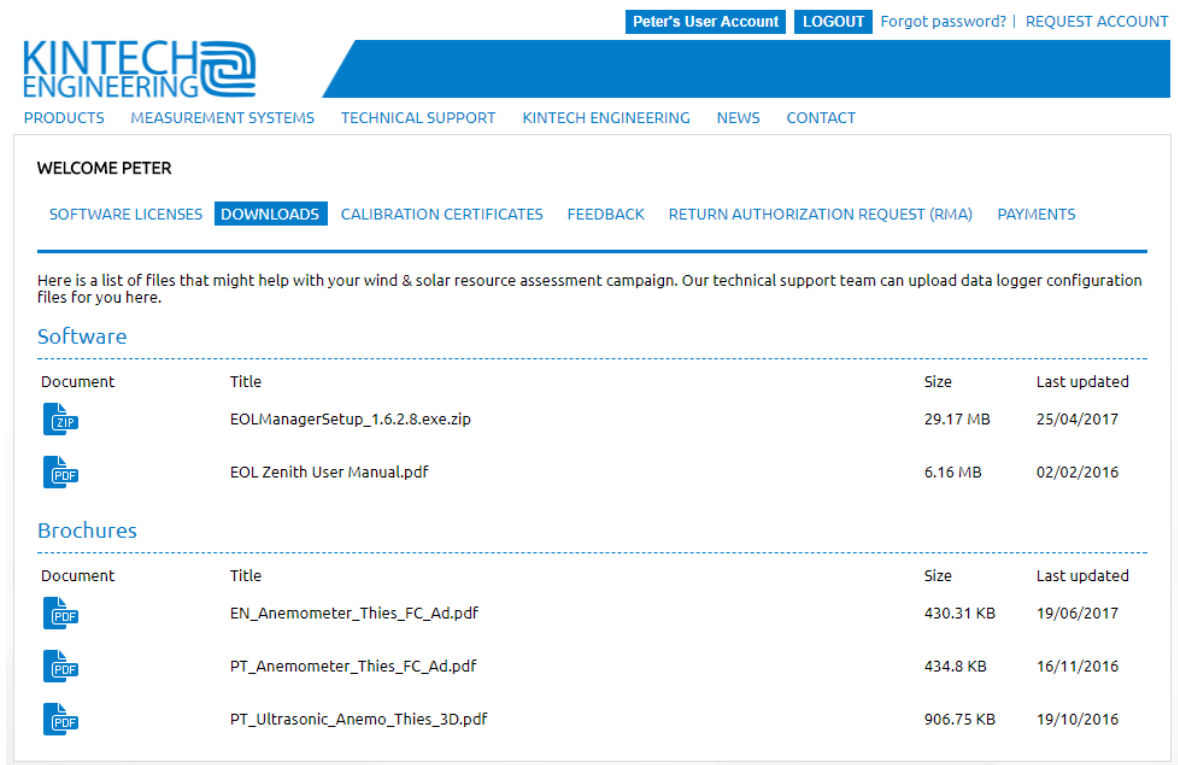
Login

Email \*

Password \*

Login

Click the 'Login' button and then click the tab 'Downloads'



Peter's User Account LOGOUT Forgot password? | REQUEST ACCOUNT

KINTECH ENGINEERING



PRODUCTS MEASUREMENT SYSTEMS TECHNICAL SUPPORT KINTECH ENGINEERING NEWS CONTACT

WELCOME PETER




SOFTWARE LICENSES **DOWNLOADS** CALIBRATION CERTIFICATES FEEDBACK RETURN AUTHORIZATION REQUEST (RMA) PAYMENTS

Here is a list of files that might help with your wind & solar resource assessment campaign. Our technical support team can upload data logger configuration files for you here.

Software

| Document  | Title                           | Size     | Last updated |
|---|---------------------------------|----------|--------------|
|  | EOLManagerSetup_1.6.2.8.exe.zip | 29.17 MB | 25/04/2017   |
|  | EOL Zenith User Manual.pdf      | 6.16 MB  | 02/02/2016   |

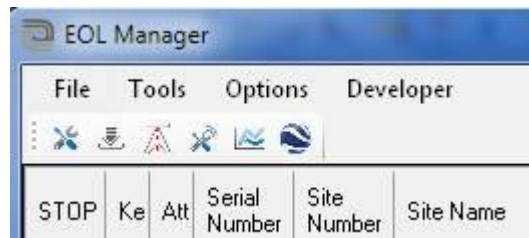
Brochures

| Document  | Title                            | Size      | Last updated |
|---|----------------------------------|-----------|--------------|
|  | EN_Anemometer_Thies_FC_Ad.pdf    | 430.31 KB | 19/06/2017   |
|  | PT_Anemometer_Thies_FC_Ad.pdf    | 434.8 KB  | 16/11/2016   |
|  | PT_Ultrasonic_Anemo_Thies_3D.pdf | 906.75 KB | 19/10/2016   |

Now click the most recent software version of EOL Manager by clicking "EOLManagerSetup"

After downloading the software, install it. The first time you run the software, it will ask for the folder you wish all the data files to be located. That folder will contain all other folders associated with all sites.

In the Eol Manager® main window go to 'Options' > 'License Information' and fill in your license data



Once entered your license information, press 'Apply' and exit the software by the Menu or by right click on the notification area.



## Updating the software

To update the software, first uninstall your current Eol Manager version, and then proceed similarly to installing it for the first time. When uninstalling or updating the software, ALL DATA REMAINS IN THE COMPUTER, including data files, data base, logger settings, programmed downloads, etc. Don't worry about existing files, database and configuration, as they will keep the same after updating the software. Similarly, all programmed task will be performed as they did before updating the software. If you experienced any problem after updating the software try uninstalling it before running the installation file.

## Related Accessories

### **MMC card reader:**

All regular card readers, that create a visible unit in your operating system, can be used.

### **CSD MODEM:**

Before installing the GSM modem, a GSM account must be activated by a telephone company. The SIM card must be installed within the GSM modem before the unit can transmit

information.

The connection between the modem and the PC can be by any means that creates a COM port accessible by the system. Such is the usual case of the PC serial port, Bluetooth or USB cable.

### ***Satellite modem:***

Before the installation of the satellite telemetry module, an account must be activated by the telecommunications network company. Please contact Kintech Engineering (info@Kintech-engineering.com) to establish your account.

### ***Internet connection:***

If you are connecting directly to computers on the Internet you must have a direct Internet connection. The use of Proxy's, Firewalls and the like could restrict communications.

## 13. EOL Manager®

To use the EOL Manager® you need a valid license. To obtain the license contact Kintech Engineering using the following email account [support@Kintech-engineering.com](mailto:support@Kintech-engineering.com)

Once you obtain a license in the main window go to Options → License Information and type in your given License number

### Main window

In the main window, you get a quick overview of the status of all your meteorological towers.

Each row in this display represents a weather station (data logger), and each column represents a variable of the weather station (serial number, date of last download, next download date, country etc.). You can click and drag the names of the column fields to change the order. Clicking the left mouse button in any field will sort the rows (stations) upstream of the field. Repeating that click management is downward. Clicking the right edge of a field can increase or decrease the width of the field.

Color labels represent the status of sensors, battery, or the development of automatic downloads. These colorful labels will be updated whenever the data loggers are downloaded. The blue circle label is displayed when there has been a change in the status of sensors or battery since the last download. An icon of a red hand is shown if somebody manually has accessed the panel on the logger.

| STOP | Keyb | Atten | Site Number | Site Name         | Last Download Attempt | Next Download Date | Atten Numb | Signal Streng | Latitude    | Com1 Status | Dvld Status | Logger Status | Configura | Anemometers | Wind Vanes | Analog Inputs |
|------|------|-------|-------------|-------------------|-----------------------|--------------------|------------|---------------|-------------|-------------|-------------|---------------|-----------|-------------|------------|---------------|
|      |      |       | 000001      | Kulathuyam        | 20/07/2010 10:11      |                    | 2          | 22            | 10.7245...  |             |             | BAT           |           |             |            |               |
|      |      |       | 345002      | EDN AFON REC1     | 28/05/2010 18:19      |                    | 4          | 23            | 41.7304...  |             |             |               |           |             |            |               |
|      |      |       | 004100      | of pru lheraza    | 03/05/2010 9:06       |                    | 1          | 20            | 41.6491...  |             |             |               |           |             |            |               |
|      |      |       | 340390      | Llanos Luquillo   | 28/09/2010 9:19       |                    | 1          | 27            | 37.4960...  |             |             |               |           |             |            |               |
|      |      |       | 340433      | Almudej           | 25/08/2010 13:55      |                    | 1          | 22            | 42.1386...  |             |             |               |           |             |            |               |
|      |      |       | 340209      | Uiraca Jiel       | 29/09/2010 9:09       |                    | 1          | 22            | 40.6295...  |             |             |               |           |             |            |               |
|      |      |       | 340280      | Veguilla          | 03/08/2010 9:41       |                    | 1          | 27            | 40.0826...  |             |             |               |           |             |            |               |
|      |      |       | 344401      | Granja fn         | 05/10/2010 9:19       | 06/10/2010 9:10    | 1          | 89            | 0           |             |             |               |           |             |            |               |
|      |      |       | 990002      | Lorente Jth 1     | 04/10/2010 19:18      | E-mail             | 1          | -1            | 41.6537...  |             |             |               |           |             |            |               |
|      |      |       | 340451      | La Torn           | 24/08/2010 18:17      |                    | 1          | 27            | 41.6207...  |             |             |               |           |             |            |               |
|      |      |       | 340282      | Quebrá            | 03/08/2010 9:41       |                    | 2          | 29            | 40.2102...  |             |             |               |           |             |            |               |
|      |      |       | 340371      | Cerro G           | 16/09/2010 9:27       |                    | 1          | 25            | 37.01725... |             |             |               |           |             |            |               |
|      |      |       | 000001      | PRESS TON         |                       |                    | 0          |               | 53.8616...  |             |             |               |           |             |            |               |
|      |      |       | 000002      | STE GIL 2         |                       |                    | 0          |               | 45.9022...  |             |             |               |           |             |            |               |
|      |      |       | 340210      | San Juan la Nueva | 30/09/2010 12:49      |                    | 1          | 25            | 40.5147...  |             |             |               |           |             |            |               |
|      |      |       | 980103      | Altajarin 2       | 20/08/2010 10:06      |                    | 1          | 24            | 41.6537...  |             |             |               |           |             |            |               |
|      |      |       | 340303      | Zujar             | 20/08/2010 11:56      |                    | 1          | 28            | 37.5342...  |             |             |               |           |             |            |               |
|      |      |       | 340336      | Guadac            | 04/10/2010 10:03      |                    | 2          | 25            | 36.2292...  |             |             |               |           |             |            |               |
|      |      |       | 990003      | Lorente Jth 2     | 05/10/2010 9:19       | 06/10/2010 8:05    | 1          | 28            | 41.65374... |             |             |               |           |             |            |               |
|      |      |       | 000002      | FRANC D'EOL 2 - 2 |                       |                    | 0          |               | 44.0820...  |             |             |               |           |             |            |               |
|      |      |       | 340204      | Canalzi           | 04/10/2010 10:03      |                    | 1          | 26            | 42.7276...  |             |             |               |           |             |            |               |
|      |      |       | 340393      | Cabeza            | 24/08/2010 19:28      |                    | 1          | 27            | 37.5087...  |             |             |               |           |             |            |               |
|      |      |       | 340259      | Coral d'arga      | 04/10/2010 9:32       |                    | 1          | 24            | 42.0552...  |             |             |               |           |             |            |               |
|      |      |       | 340265      | Los Mojillos      | 05/10/2010 9:46       |                    | 1          | 30            | 42.1872...  |             |             |               |           |             |            |               |
|      |      |       | 340388      | Conto Gas         | 12/08/2010 9:14       |                    | 1          | 29            | 37.5716...  |             |             |               |           |             |            |               |
|      |      |       | 340322      | El Toro           | 30/09/2010 17:19      |                    | 1          | 25            | 36.2814...  |             |             |               |           |             |            |               |

### 1. Main window in EOL Manager®

If you want to change the settings in the main window (e.g. colors) go to Options → Settings → Main Screen Settings.

When selecting a weather station you have the possibility to access all the necessary tools for communication or for data visualization, using the context menu shown when pressing the right mouse button or using the icons shown in the top of the main screen. You can also access all the tools offered by EOL Manager<sup>®</sup> using the Tools menu.

## Color Codes

### *Communication Status*

This box is marked green if there has been an internet connection to the data-logger in the last 24 hours. If not, are marked in red.

### *Download Status*

When the last attempt to download has been successful this box is marked in green. If the last download has proved unsuccessful, and it will make another attempt to download this box is marked in yellow. If you have already completed five download attempts, this box is marked in red.

### *Battery Status*

The label will vary in color from green, if all data from the battery is correct, yellow if any of the received data from the battery is less than 12.3V, and red if the last downloaded shows a battery voltage less than 11.8V.

### *Logger Status*

These fields represent the internal state of the data logger, such as the GPS, memory card ...

### *Configuration*

If the existing configuration in the data logger and the existing settings in the software are different this box is marked in red, if not this box is marked in green.

### *Anemometers*

EOL Manager<sup>®</sup> makes a comparison of all the data from the anemometers. If any erroneous data is found this check box is marked yellow, if the last data received is wrong this box is marked in red, and if there are no erroneous data the box is marked in green.

### *Wind Vanes*

EOL Manager<sup>®</sup> makes a comparison of all the data from the wind vanes. If any erroneous data is found this check box is marked yellow, if the last data received is wrong this box is marked in red, and if there are no erroneous data the box is marked in green.

### *Analog Inputs*

EOL Manager<sup>®</sup> makes a comparison of all the data from the analog inputs. If any erroneous data is found this check box is marked yellow, if the last data received is wrong this box is marked in red, and if there are no erroneous data the box is marked in green.

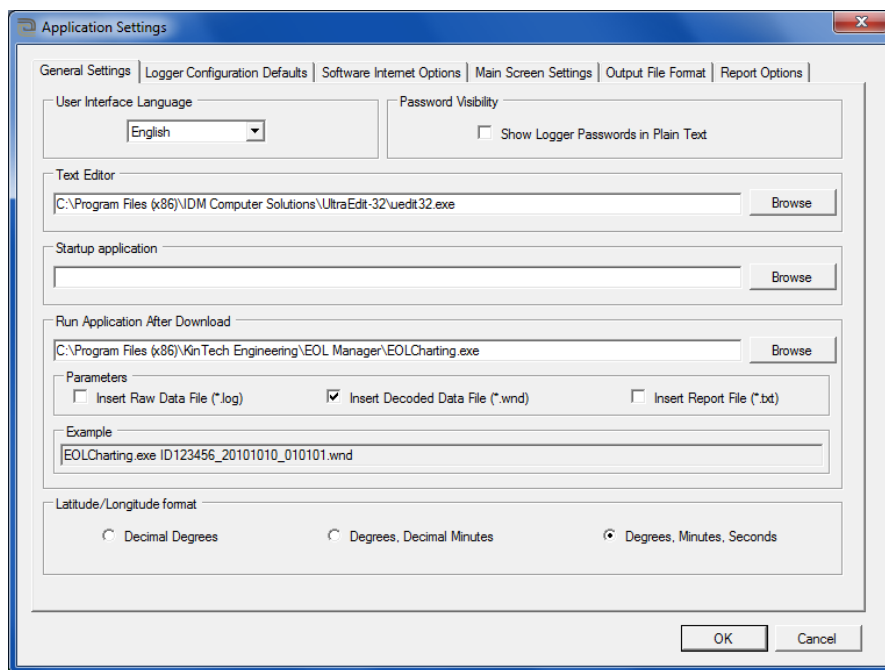


## EOL Manager® Settings

All the settings for the *EOL Manager®* can be found under *Options*→*Applications Settings*. Here you will find the following:

### General settings:

- Text editor: Set the text editor you want to use to view the data files and their related reports. Some editors limit the maximum line length. Typically Notepad.exe or Wordpad.exe is used.
- Start up application: when you run Eol Manager before loading the application it executes another application, typically a batch file. It is very useful if you have to change the O.S. environment or settings like permissions, routing rules, etc. Example *routeGSM2usb.bat* contains the commands `route DELETE 0.0.0.0`, `route ADD 0.0.0.0 MASK 0.0.0.0 192.168.1.1`, `route ADD 172.16.70.* MASK 255.255.255.0 172.16.70.1`
- Run application after download: In the screenshot below launch the chart always after automatics downloads. Use batch files for more complex necessities.



## 2. EOL Manager® Settings I

### Default Logger Configuration

- Set the options you want to have by default, when configuring new data loggers.

This information can be, for example, passwords for access to the data logger, the language or settings for your internet connection.

**Application Settings**

General Settings | **Logger Configuration Defaults** | Software Internet Options | Main Screen Settings | Output File Format | Report Options

**Default Logger Password**

☐ Use Download Protection Password  
 Download Protection Password (Max. 10 chars)   
 Retype Password

☐ Use Real Time Data Protection Password  
 Real Time Data Protection Password (Max. 10 chars)   
 Retype Password

**Default Logger Language**  
 English

**GPRS Defaults**

APN Name   
 APN User Name   
 APN Password

**Option for Sending Emails from Logger (SMTP Server)**

Sender Address   
 Recipient (1)   
 Recipient (2)   
 Server Name   
 Port   
 User Name   
 Password   
☐ Use SSL/TLS

**Options for Reading Email Send by Logger (POP3 Server)**

Server Name   
 Port   
 User Name   
 Password   
☐ Use SSL

OK Cancel

### 3. EOL Manager® Settings II

#### Internet Options

Set the options to enable EOL Manager® to connect via Internet, for example, to send emails when downloads are performed automatically.

**Application Settings**

General Settings | Logger Configuration Defaults | **Software Internet Options** | Main Screen Settings | Output File Format | Report Options

**Options for Sending Emails from Software (SMTP server)**

Sender Address   
 Recipient   
 Server Name   
 Port   
 User Name   
 Password   
☐ Use SSL/TLS

**Proxy Options**

☐ Use Proxy Server  
 HTTP Proxy  Port   
☒ Use this proxy server for all Protocols  
 SSL Proxy  Port

☐ Use Authentication  
 User Name   
 Password

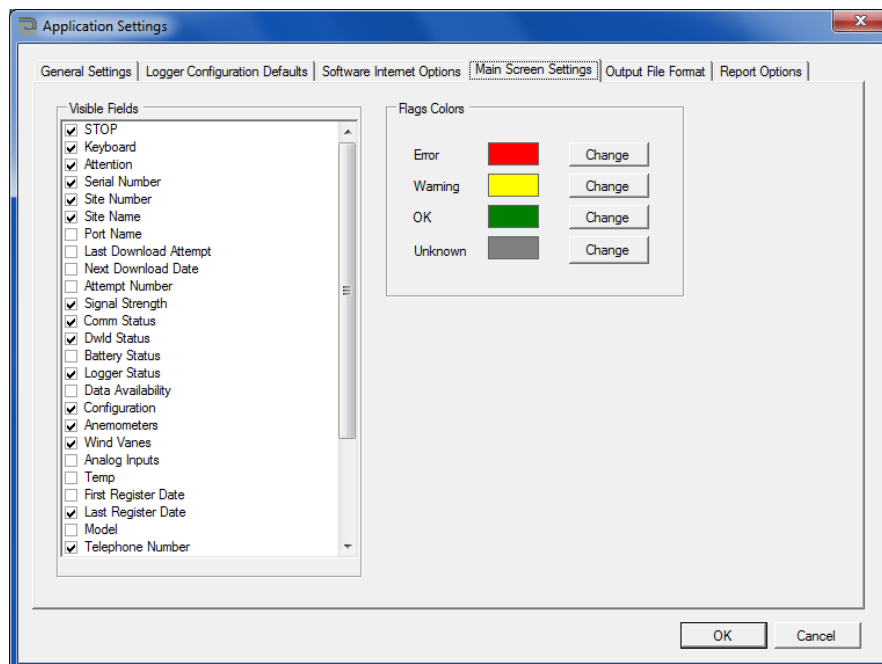
OK Cancel

### 4. EOL Manager® Settings III

#### Main Screen Settings

Configure the settings you want displayed on the main screen of the EOL Manager®.

Setting these options, the user can see the current state of all the wind assessment masts on one single screen.

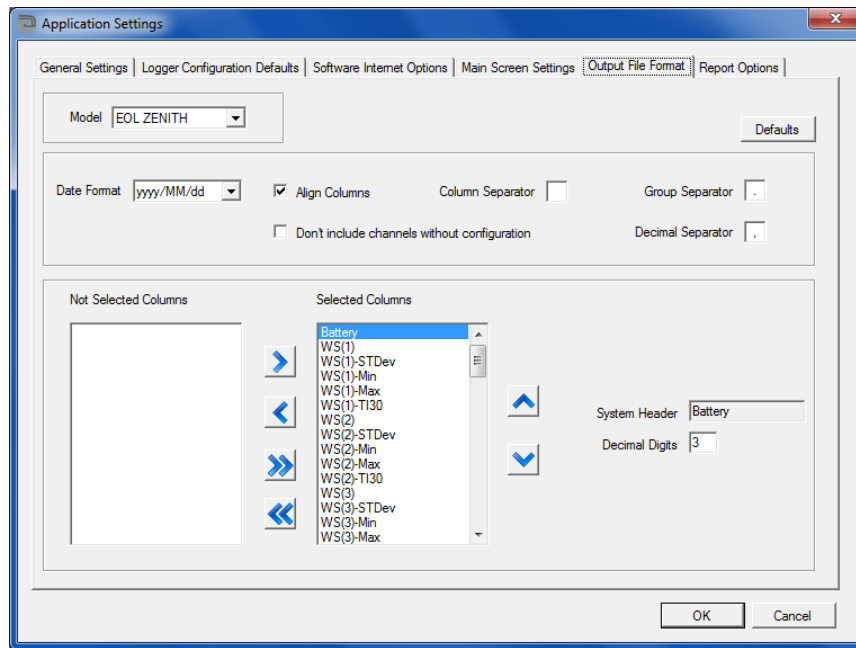


### 5. EOL Manager® Settings IV

#### Output File Format

Configure the settings for the downloaded wind data files. We recommend not changing these default settings.

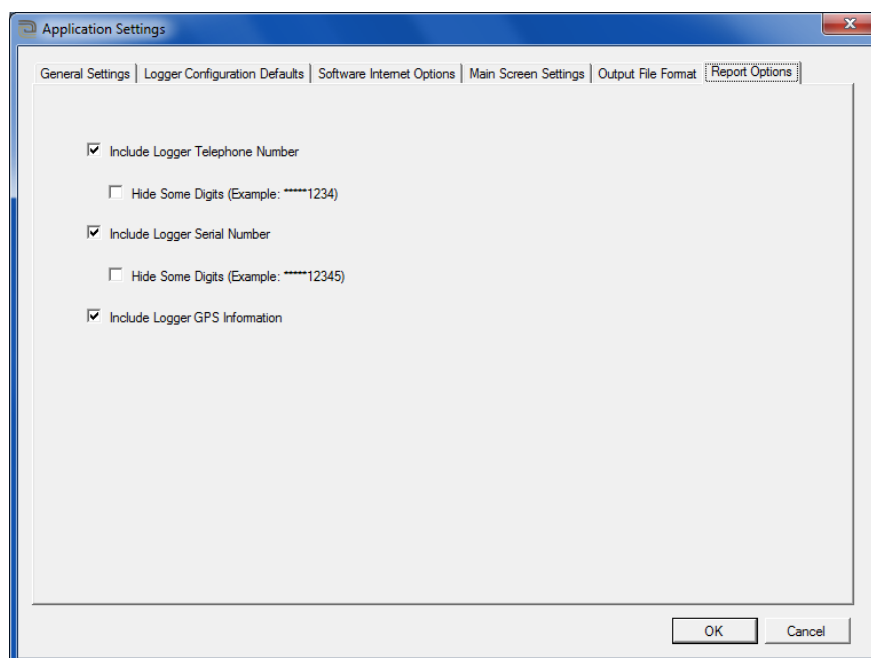
The user can select, for example, the order of the data columns, the date format and decimal separator. This will help the user to process subsequent data processing. The information that is not included in the output files will not be displayed on the charts. To make the complete graphics you will need to include all the files with their corresponding date and time.



## 6. EOL Manager® Settings V

### Report Options

This is where you configure the settings for reports related to each download.



## 7. EOL Manager® Settings VI

### Configuring the modem

Connect the GSM modem or satellite modem to a communications port on your computer and go to **Tools → Modem Tool**. This way you can connect to all your wind data loggers remotely.

Using the Auto Search, EOL Manager® searches all communication devices connected to your computer. Select the device you wish to use when connecting remotely to your wind data loggers, and configure the parameters in the section "Site Number Port Configuration" with the following values.

|                  |             |
|------------------|-------------|
| <b>Baud Rate</b> | <b>9600</b> |
| <b>Handshake</b> | <b>None</b> |
| <b>Data Bits</b> | <b>8</b>    |
| <b>Parity</b>    | <b>None</b> |
| <b>Stop Bits</b> | <b>One</b>  |

The parameters in the section "ModemGSM Info" are taken directly from the modem itself and are filled in automatically.

The parameters in the section "Configuration Commands" are automatically filled with standard commands, if the manufacturer of your modem has informed you with different parameters, you should use these parameters specified by the manufacturer.

|                        |             |
|------------------------|-------------|
| <b>Dial Command</b>    | <b>ATDT</b> |
| <b>Hang-up Command</b> | <b>ATH0</b> |

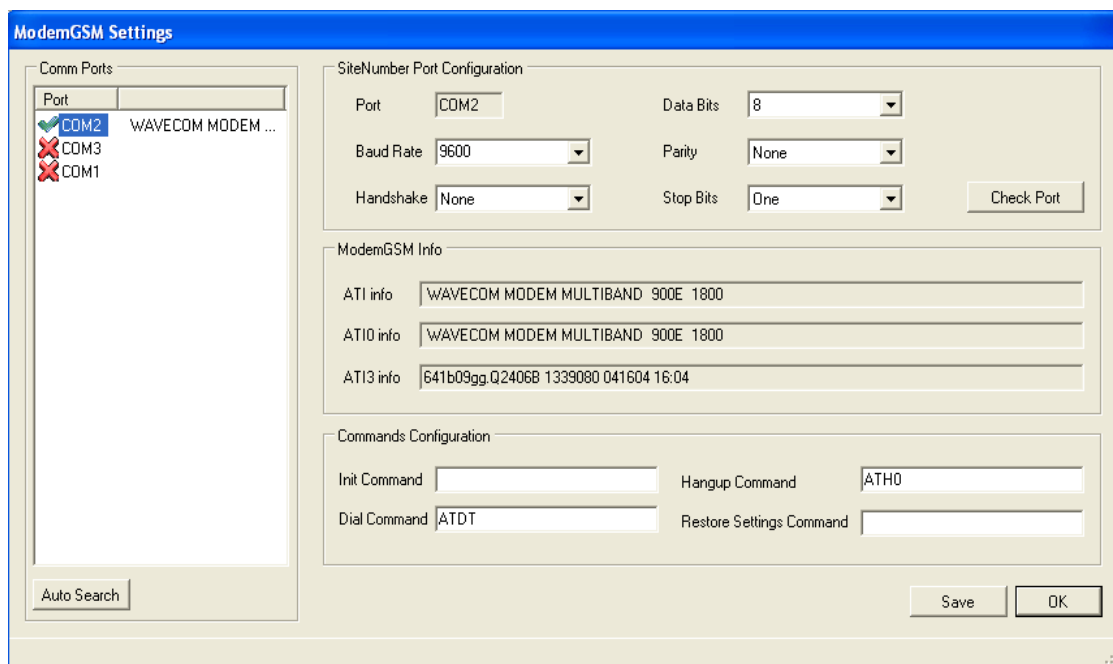
The table "Init Command" allows you to schedule the sending of commands to the modem port when opening the port. Can be useful to type in a PIN for example:

|                     |                     |
|---------------------|---------------------|
| <b>Init Command</b> | <b>AT+CPIN=1234</b> |
|---------------------|---------------------|

The table "Restore Settings Command" allows you to schedule the sending of commands to the modem. This will leave the modem in a configuration mode so it is useful for other applications as soon as it finishes communicating with EOL Manager.

When you are done changing the setting, press the "save" button.

When you start communication through the CSD modem, you have to select the COM port you configured.



## 8. MODEM Settings

### Create a new site configuration (setting up a new data logger)

EOL Manager<sup>®</sup> is able to manage multiple weather stations (data loggers) at the same time. When you purchase a new data logger Eol Zenith<sup>®</sup>, create a new record in the database by going to the following path File → New Logger. You will now see a screen where you can configure all the settings of your new data logger.

Some of the information you enter in the software for each data logger is not used by the logger and is not even recorded in it, for example, the country fields or telephone number.

To achieve an optimal configuration, please follow these steps:

#### Site Info tag

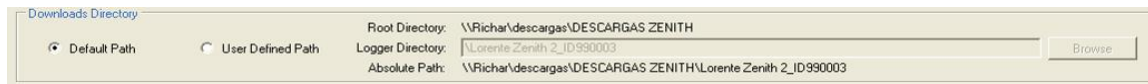
1. Copy the serial number of your device (it is indicated on the outside of the box). There can not be two data loggers in the database with the same serial number.
2. Select the number of site (Site Number). A typical way of working is that the six-digit number consists of the two first figures correspond to the country where the data logger is installed, the following two figures for the province, and the last two figures for the number of local site. In this way, all your data loggers are nicely organized
3. Choose a name for the location representative of the place where the logger is installed. There can not be two locations in the data base with the same number and name. The maximum length of this field is 20 characters.
4. Select your preferred language for the display in the Eol Zenith<sup>®</sup>.



5. Select a folder on your hard drive where you want, all the wind data from this wind data logger, to be stored. This includes automatic downloads, connections in real time, reports etc.

You can choose a default option that will create a folder with a name composed from the Site Name and Site Number. Or you can name your folders with country, company etc. Thus, the user may have folders organized by country, company.

All folders should be located in this directory when the software is opened up for the first time.



6. The firmware field is automatically updated each time a remote connection is made to this logger. (Either real time data, or an automatic download).
7. Fill in the following fields: company, city, province and country. Filling in these boxes will let you organize your entire list of data loggers accordingly in the main EOL Manager window.
8. At each real time connection and/or download the information about the GPS position will be updated. Using the "Google Earth" you can access Google Earth and see the exact position of the weather station. (You must have previously installed the Google Earth software).
9. If you want to manually configure the GPS coordinates, uncheck "GPS enabled". This way you can configure the GPS coordinates. Subsequently, re-check the option "GPS enabled" if you want the logger to log on to the GPS. You should be aware that each time you communicate with the logger, the GPS coordinates will be updated automatically.
10. Add comments appropriate for the weather station. It is advisable to record any incident that occurred at the station with the corresponding date.

## 9. Eol Zenith I Settings

### 'Inputs tag':

11. Configure all the sensors, adjusting the slope and offset for each sensor. We recommend filling in the fields "Serial Number", "Height" and "Sensor Name" to have as much information on the sensors as possible. Subsequently, the height data and sensor name will be used in Eol Charting Tool<sup>®</sup>.

Make sure to input the calibration data of your instruments for every channel. All data in the output files (wnd) will be calculated according to the calibration in the current site. If you still don't have the calibration for your instruments you can enable the "Std Cal" checkbox that will fill in the blanks the standard values.

In case you are using analog inputs it is necessary to select the type of sensor connected (temperature sensor, pressure sensor ...). If you want to install another type of analog sensor than those mentioned in the list, select the type Voltmeter "and then set the slope and the offset needed for the sensor.

12. Set the integration time with which you want to calculate the maximum and minimum speeds, i.e. the time interval in seconds during which the averages are calculated with a maximum and minimum speed. The IEC61400 recommendation (year 2005) is 3 seconds.
13. Select the variables you want to be recorded for each sensor. Keep in mind that when selecting variables to be registered, the download time will increase with each variable.

An approximation of the time needed to download is shown in the bottom of the window.

**EOL Zenith Logger Settings - El Garfiero (340005)**

Site Info | **Inputs** | Access | Modbus

**Anemometers/Frequency**

| Channel | Type       | Model              | Units | Serial Number | Height | User Name          | Std Cal                  | Slope    | Offset   | Std Dev                             | Max                                 | Min                                 |
|---------|------------|--------------------|-------|---------------|--------|--------------------|--------------------------|----------|----------|-------------------------------------|-------------------------------------|-------------------------------------|
| ANE1    | Anemometer | ORNYTION 107       | m/s   | 107A0S011115  | 80     | Anemo1_Ornytion    | <input type="checkbox"/> | 0,622870 | 0,251000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE2    | Anemometer | THIES FIRST CLA... | m/s   | 11102659      | 80     | Anemo2_ThiesFir... | <input type="checkbox"/> | 0,045910 | 0,245000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE3    | Anemometer | ORNYTION 107       | m/s   | 107A0S004408  | 60     | Anemo3_Ornytion    | <input type="checkbox"/> | 0,622980 | 0,179620 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE4    | Anemometer | VECTOR A100L2/...  | m/s   | 5362          | 60     | Anemo4_VectorA...  | <input type="checkbox"/> | 0,049810 | 0,190560 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE5    | Anemometer | ORNYTION 107       | m/s   | 107A0S004409  | 40     | Anemo5_Ornytion    | <input type="checkbox"/> | 0,622630 | 0,235770 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE6    | Anemometer | NRG 40/40H         | m/s   | MW 040        | 40     | Anemo6_NRG40       | <input type="checkbox"/> | 0,762460 | 0,336450 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE7    | Anemometer | ORNYTION 107       | m/s   | 107A0S004410  | 20     | Anemo7_Ornytion    | <input type="checkbox"/> | 0,622240 | 0,200460 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANE8    | Anemometer | -----              | m/s   |               | 0      | Anemo8             | <input type="checkbox"/> |          |          | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE9    | Anemometer | -----              | m/s   |               | 0      | Anemo9             | <input type="checkbox"/> |          |          | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANE10   | Anemometer | -----              | m/s   |               | 0      | Anemo10            | <input type="checkbox"/> |          |          | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |

**Wind Vanes**

| Channel | Type     | Model        | Units | Serial Number | Height | User Name         | Std Cal                             | Slope    | Offset   | Std Dev                             | Max                                 | Min                                 |
|---------|----------|--------------|-------|---------------|--------|-------------------|-------------------------------------|----------|----------|-------------------------------------|-------------------------------------|-------------------------------------|
| D1      | Windvane | ORNYTION 207 | °     | 207P0S304815  | 76     | Windvane1_Ormy... | <input checked="" type="checkbox"/> | 1,000000 | 0,000000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| D2      | Windvane | THIES 2K     | °     | 11100539      | 56     | Windvane2_Thies   | <input checked="" type="checkbox"/> | 1,000000 | 0,000000 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

**Analog Inputs**

| Channel | Type          | Model           | Units | Serial Number | Height | User Name          | Std Cal                             | Slope      | Offset     | Std Dev                             | Max                                 | Min                                 |
|---------|---------------|-----------------|-------|---------------|--------|--------------------|-------------------------------------|------------|------------|-------------------------------------|-------------------------------------|-------------------------------------|
| ANL1    | Windvane      | THIES 2K        | °     |               | 0      | Analog1_thies_c... | <input checked="" type="checkbox"/> | 1,000000   | 0,000000   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ANL2    | Temperature   | GALLTEC KPC 1/5 | °C    | 92710         | 80     | Analog2_TempG...   | <input checked="" type="checkbox"/> | 100,000000 | -30,000000 | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANL3    | Rel. Humidity | GALLTEC KPC 1/5 | %     | 92710         | 80     | Analog3_HumdG...   | <input checked="" type="checkbox"/> | 100,000000 | 0,000000   | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANL4    | Temperature   | GALLTEC KPC 1/5 | °C    | 92711         | 2      | Analog4_TempG...   | <input checked="" type="checkbox"/> | 100,000000 | -30,000000 | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| ANL5    | Rel. Humidity | GALLTEC KPC 1/5 | %     | 92711         | 2      | Analog5_HumdG...   | <input checked="" type="checkbox"/> | 100,000000 | 0,000000   | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |

Averaging Time (Minutes): 10    Gust Integration Time (Seconds): 3    Ultrasonic Sensor Protocol:

KBytes/Day: 11    Minutes/Month (GPRS): 12-22    Minutes/Month (Satellite): 63    Minutes/Month (CSD): 28    \* Required Field   

## 10. Eol Zenith II Settings

### 'Access tag':

14. In the "Download" section, if you are going to download the data logger automatically select "Auto Download", and then set the date and time of the next download. The frequency in between each download is represented in days, and what type of connection you are going to use to connect to the data logger (CSD, Internet, and Cable RS232). We recommend to perform automatic downloads every 7 days.

15. In the section "Remove Data from Logger Memory", choose whether you want to start over-writing data in the memory, never, or whenever you download data from the data logger, or whenever a certain number of downloads has been made.

It is common practice to set this parameter to a period of a month. That is, if you set the download every 7 days. In that case you must select to remove data from logger memory every 4 downloads.

16. Select the type of communication which will make the connection to the data logger from your computer.

If the download will be done via the Internet, you must configure the TCP port (it is advisable to use a TCP port such as 2020, not associated with frequent applications or services). If the

SIM card in the data logger has a static IP number you can check the "Static IP" and fill in the "IP" with the IP number that you have been provided by your telephone company.

If the download is done through a CSD modem or through a RS232 cable you have to indicate at what port these devices are found (using the button "Modems" you get a list of pre-configured modems). The modems shall be configured previously. To configure the modem go to the main screen and select the Tools and then Modem Tool. You can find more information about how to configure the modem under the "Modem Settings" in this manual.

17. In the "Modem" section, select the type of modem you have installed in the Eol Zenith<sup>®</sup>, and indicate the number of your SIM card installed in the logger with the prefixes needed to call from the modem in the office. The EOL data loggers support the use of a PIN code for SIM security. Type in the PIN code so that when the modem is turned, the logger knows the PIN code. Using a PIN code will prevent making calls (in the case of theft of the SIM).
18. If you want your Eol Zenith<sup>®</sup> to connect to the Internet check the box "GPRS modem Enabled", and fill in the parameters with the parameters you have been provided by your telephone company. These parameters allow the data logger to connect to the Internet. If the download is going to be made using the Internet, the box "GPRS Modem Enabled" should be selected.

For more information about the benefits and settings of this option, please see the corresponding section in this manual and/or contact our technical support on [support@Kintech-engineering.com](mailto:support@Kintech-engineering.com).

19. You can program a time window for the internal modem in the logger to turn on and off, using the "Modem Power Saving." You also have the option that the logger will turn on /off the modem only when the battery charge is lower 11.8V. Note that the time for the on/off schedule is the time in the logger, if it is updated by the GPS, the time is UTC.
20. If you have set up the software to automatically download, you have the option to send an email to a list of e-mail recipients when a download has been done. To do this follow these following steps:
  - The EOL Manager<sup>®</sup>, will start communicating with the logger at the time set by you. If the downloading time is at minute 00, the software will delay it five minutes to let the logger do its hourly checking.
  - Once all the raw data have been downloaded, decrypted and decoded, the data is stored in the destination directory. If the option "Forward Data after Download" is checked, EOL Manager<sup>®</sup> will send an email to the addresses specified with the file attachments that the user has deemed appropriate.

You can select the option "Only if Error". In this case the email will be sent only when there is some error or warning on any of the flags that can be displayed on the main panel. We do recommend having this option checked on, because the user will be informed at every time there is something wrong in the status of any logger.

For EOL Manager ® to perform this function, the EOL Manager ® must have configured the e-mail settings. To configure these parameters go to the main window go to Options → Application Settings and select the tab "Internet Options".

21. The Eol Zenith ® updates its internal clock to UTC (Universal Time Coordinated) using the GPS. If the user wants to add an offset to decode the data downloaded, you must select the "Time Zone". When managing a large number of data loggers it is a good practice to have all the data loggers with the same time zone.

22. Fill in the passwords:

- Password protection for data downloading: With this password the user can perform all the communication options available, real-time data, data download, firmware update etc.
- Password protection for Real time data: The person who only has this type of password can connect to the logger in real-time, however he can not perform other communication options, such as downloading the wind data, updating firmware etc. It is typically provided to installer/maintenance teams e.g. to let them review any maintenance performed at the station.

There is an option of having a default password for all data loggers. This password can be set up in Options → Software Setting → Logger Configuration Defaults.

If you wish to change the passwords of a specific logger go to *Tools → Change Logger Passwords*. In the main window you can not change the password protection.

23. If direct communication with the data logger is not available because of the type of GSM operator, it is possible to program the logger to send an **e-mail** with the data. This data is sent directly from the logger. We recommend that this download option is only used when the operator does not allow direct communication with the data logger. To activate this option of sending data check the "Auto Email" box and fill in the sections, mail account that sends the mail, one or two email accounts to which you want to send the data, and the server access parameters e-mail.

The logger will send an email with an .elog file attachment to it. To decode this file go to "File Decryption Section" in this manual.

We do not recommend to download data using both the software and at the same time receiving emails from the logger because information will be most likely be duplicated and misunderstandings will eventually occur.

If your GSM provider lets you communicate directly with the data logger by using EOL Manager ® we strongly discourage you to download data via email. The download of data with a direct communication is simpler and more reliable.



## 11. Eol Zenith III Settings

### Change already existing settings

Select the weather station and using the "Edit Settings" menu or using the icon "Edit Settings" you can access the configuration window where you can make the necessary changes.

EOL Manager ® will keep the old configuration of sensors in a database of the weather station, if desired. In this way the user can decode data with these old configurations in the future.

If changes are made that affect the measurement of the sensors or communications architecture, the new configuration should be sent by telemetry to the data logger or recorded in a new report which was subsequently installed in the data logger. For more information about configuring memory see "Uploading settings to the logger" of this manual.

### Uploading settings to the logger

After editing a configuration for a logger, this configuration must be stored in the SD memory card. Go to *Tools* → *Upload Settings Tool* or right click on the logger you have just configured and select "Upload settings".



Notice that all stored information in the memory is hidden and encrypted. You can't use the Windows® explorer to see any information (both configuration and data). You must use the Eol Manager® software to access to any information. If you use any other tool all information can be lost.

There are several ways to save the settings to the memory card, depending on whether the memory card is connected to the PC or installed in the logger Eol Zenith®:

### ***SD Memory Connected to PC:***

Insert your SD memory card into your card reader, this card reader can be internal or connected to your computer via a USB cable. In the main window of the EOL Manager® software find the logger you have finished configuring and then right click the mouse button and select the "Upload Settings" options in the menu shown.

A popup window will open up. Select the "Memory Connected to PC" option at the top right corner. Press the "Start" button and a new window opens up. You must select the logical drive assigned by the operating system to its SD memory card or MMC. (E.g. F:, G: etc)

If you use Windows 7, Windows Vista or some XP configurations, you must run the program with administrative privileges to be able to write in the SD memory. To do so, right click on the program icon, go to properties, compatibility tab and enable the check box to run the program as administrator:

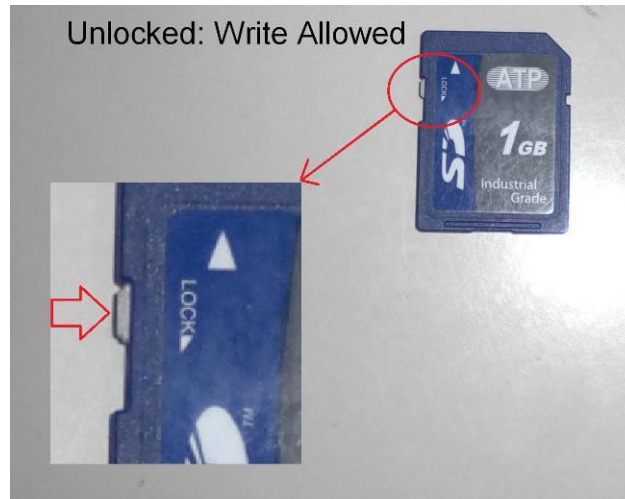


### **IMPORTANT NOTICE:**

Setting up the memory in this way will **DELETE ALL EXISTING DATA** on the SD memory card (all wind data not downloaded from the card beforehand will be deleted)

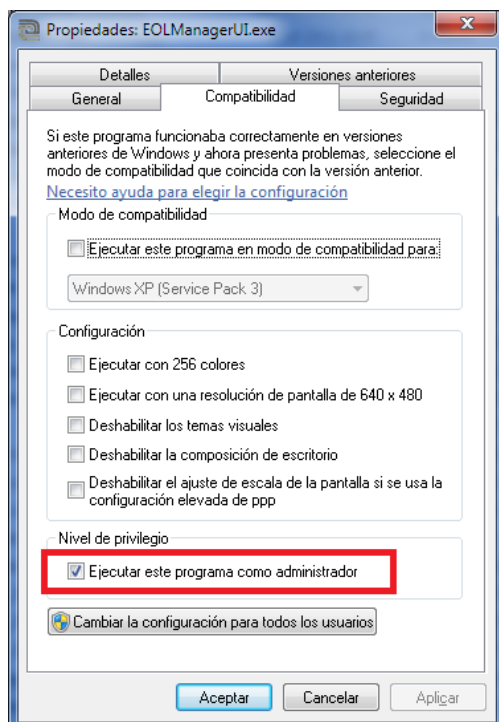
To set up the memory this way, the memory card must have been inserted in the logger, turned on, for at least 1 min.

Please, check the memory card protection before start the procedure

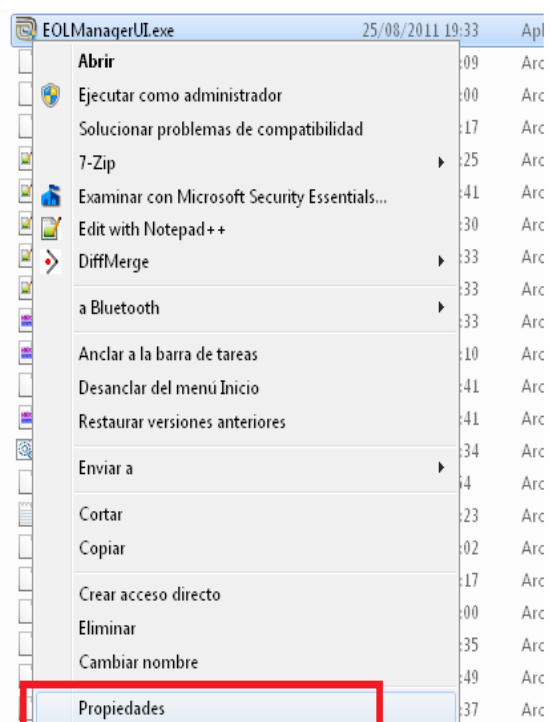


### 1- Configure Eol Manager for running with "Administrative Privilege"

- a) Right click on Eol Manager UI icon, and click properties
- b) Select Compatibility Tab and check the checkbox, "Run As Administrator"



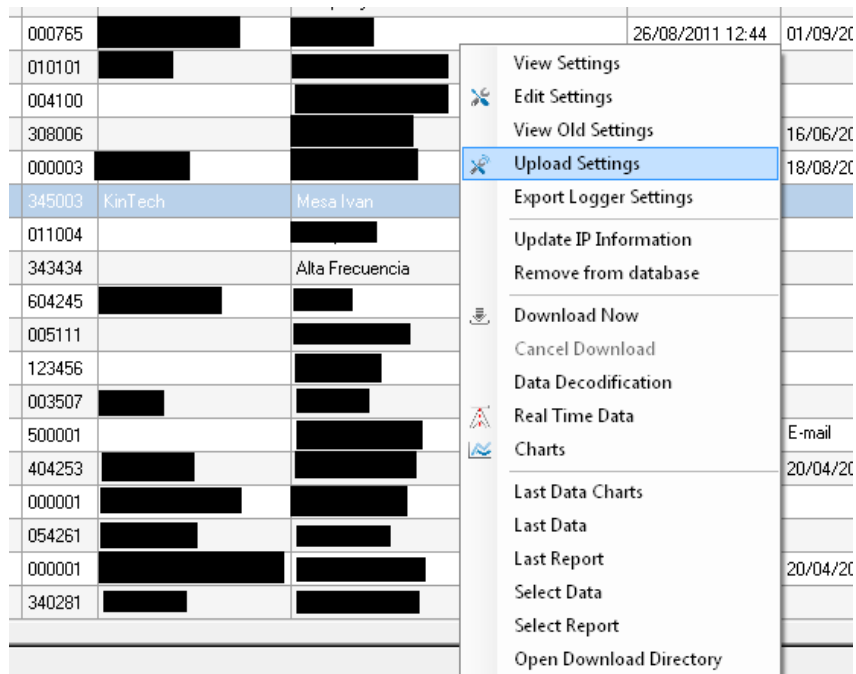
a



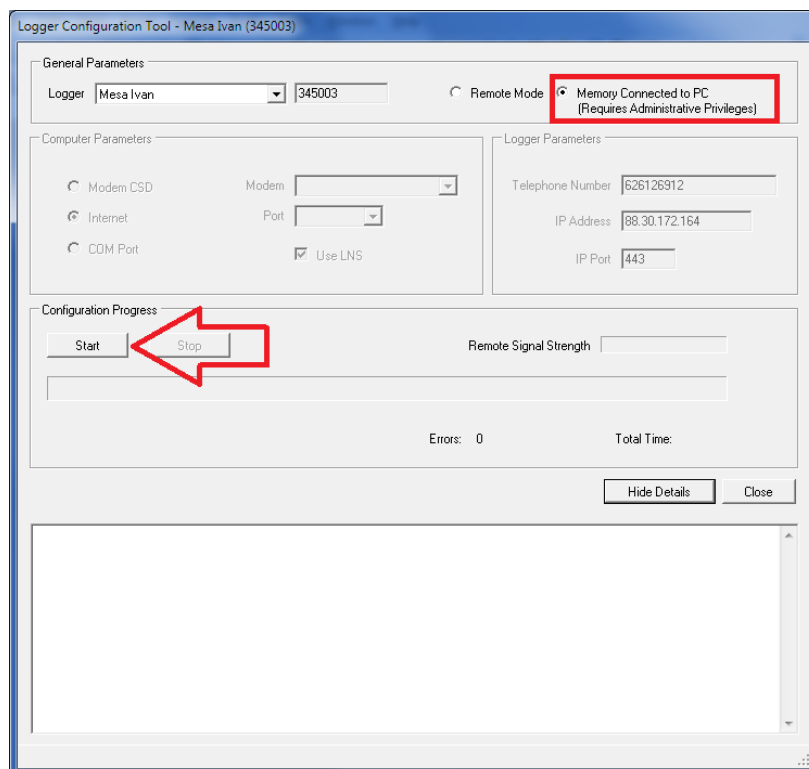
b

2- Start the Eol Manager software, if prompted by a window, then click on Yes to apply permission to allow the program to run with full permission as an administrator.

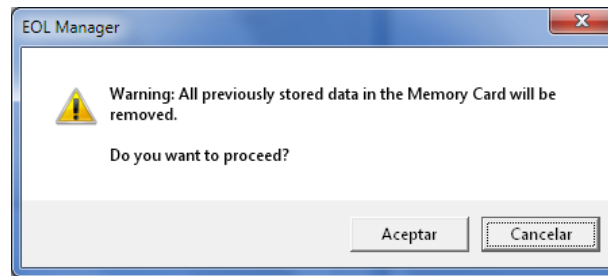
3- Right click over the logger where to you want to upload setting to the memory, and select "Upload Settings".



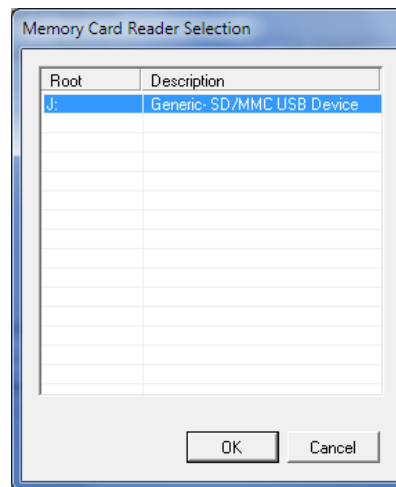
4- Put the memory card into the PC Card Reader, and click "Start" button.



5 - If the software prompts you with a new window, please, read the message carefully and click the "OK" button if you are sure you don't need the data stored previously in memory card

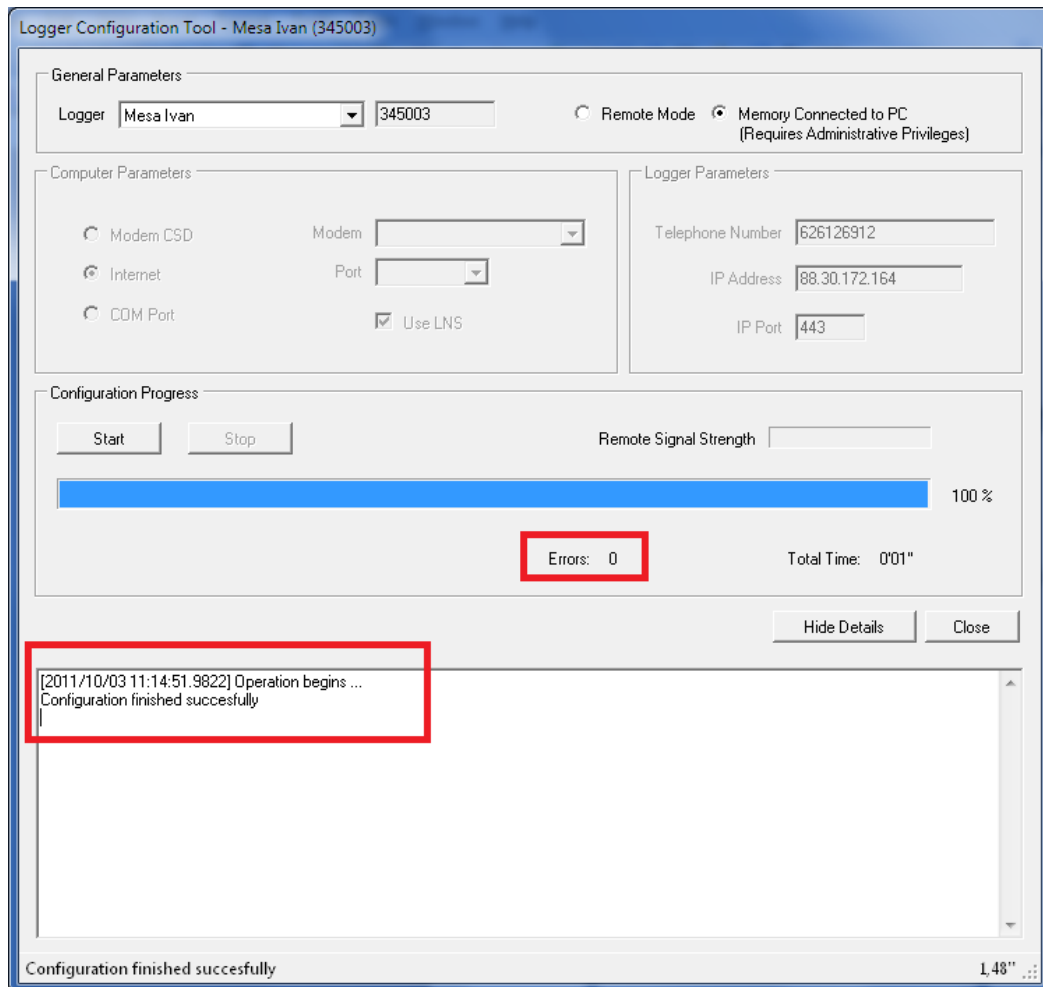


6- In the next window, select your card unit from the list and click "OK"



7- The configuration procedure will now start , and finish within a few seconds with "**Errors:0**" and the following message:

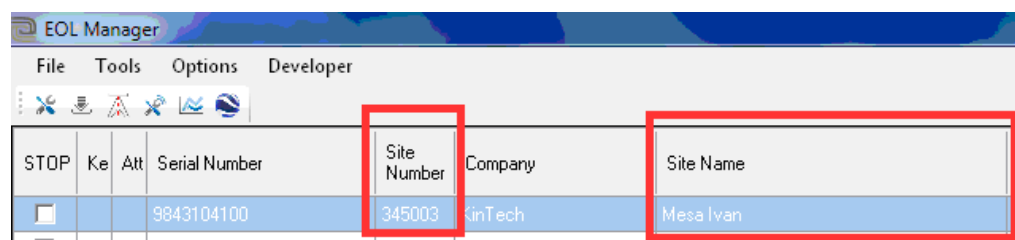
*[2011/10/03 11:14:51.9822] Operation begins ...  
Configuration finished successfully*

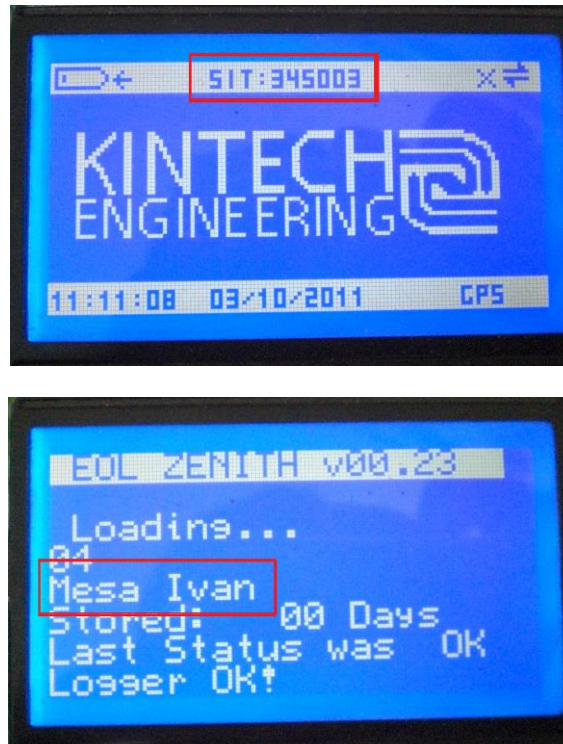


8- Take out the memory card from the PC Card Reader

9- Switch off the Eol Zenith data logger

10- Insert the memory card into the data logger card reader slot and then switch on the data logger. Check that the "Site Name" and "Site Number" match the values you configured in the software.





### *Memory installed in the Eol Zenith®:*

Before you upload new settings to a data logger remotely please check if there are any differences between the settings currently stored in the logger and the setting you have setup for that data logger in your configuration on your PC. You can check this by connecting to the data logger in real time. During the real time connection you should check for red warning indicators in all the tags of a real time connection. These red warning indicators will tell you if there are differences. Once you have done this you can go ahead and upload your new settings to the data logger.

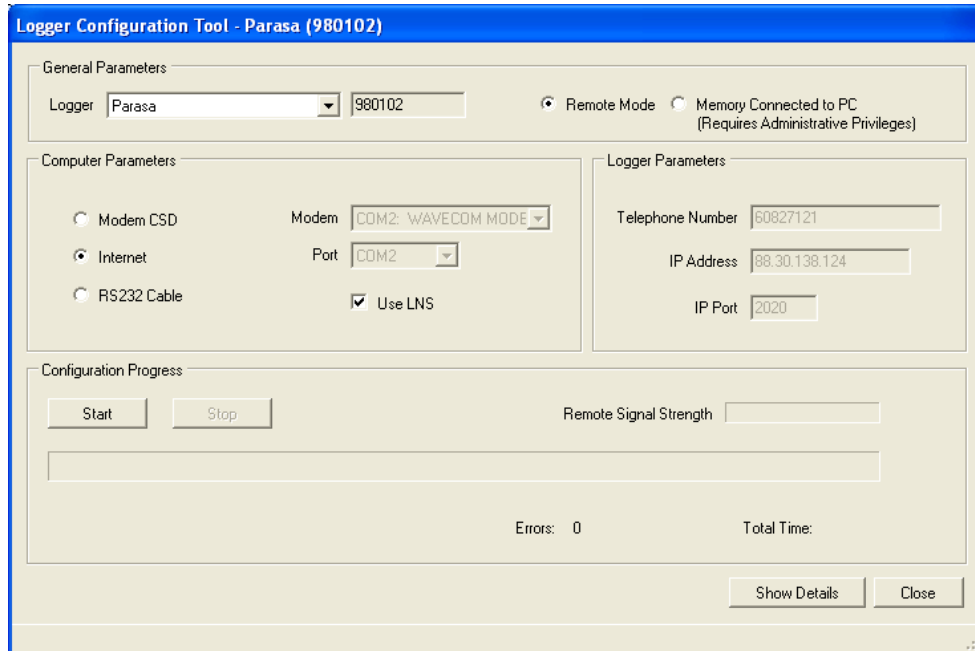
In the Main window right click the mouse on top of the data logger to be configured, then select "Upload Settings" from the drop down menu. In the popup window, (in the upper right corner) select "Remote Mode" and then select the type of communication you want to use to upload the settings wirelessly to the logger. (If you wish to use the CSD modem option, you must select the COM port to the modem). Click "Start" to start the communication. You need the password to update the configuration this way.

Notice that, there are several settings that cannot be uploaded in the same routine that general settings:

- **Logger passwords:** unless the logger have the passwords fields empty -no password yet programmed-, logger passwords will not be changed remotely. To change passwords you have to use the logger password tool.
- The **SIM PIN code** is never changed remotely. The system will ask for confirmation if other telemetry settings like APN mismatch current logger settings.



- **TCP port:** if you change the TCP port for incoming connections, this change will not be applied until the next modem reset, that is performed automatically by the logger at least every day at 23:59.



## 12. Configuration Tool

### Export and Import configurations

To make the exchange of information on the configurations of each data logger as easy as possible, EOL Manager<sup>®</sup> allows the user to export and import these configurations.

To export an already existing configuration (data logger setting) from a data logger go to *File* → *Export Logger Settings* and then select where you want to save this file. This configuration will be exported as a file with extension ". Sit."

To import a Logger Setting, go to *File* → *Import Logger Settings* and select the file extension. "Sit" you want to import.

Keep in mind that EOL Manager<sup>®</sup> does not allow two configurations with the same ID values. If this happens EOL Manager<sup>®</sup> will ask you to change a value of identification.

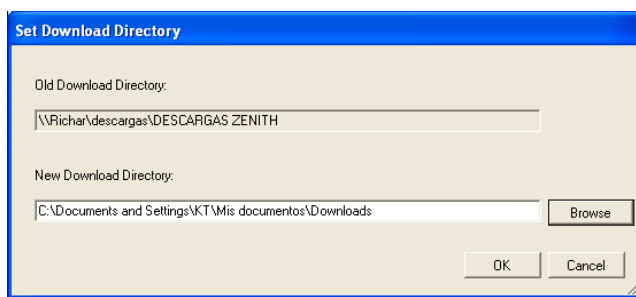
None of the passwords (download and/or real time connection password) will not be exported or imported.

## Where to save all the wind data

When you first start EOL Manager ®, you will be requested to select a storage directory. In this directory the EOL Manager ® will automatically save all information concerning weather stations such as downloading data, reports etc.

The EOL Manager creates one folder per weather station in the download directory. Every folder may be contained in other subfolders, with any folder structure allowed by the operative system. There must be one end folder in the download directory with only one site. Inside each folder for each weather station all the wind data, the reports generated, etc. will be stored. Also within the folders there are subfolders created relating to monitoring data, or temporary data downloads.

If you wish to change this directory please go to *Options* → *Set Download Directory*. When you make a change in the directory with EOL Manager ®, it offers the ability to copy all the information from the old directory to the new.



### 13. Changing where to save all the data on you computer

In the event that during the process of storing data, the download directory is not accessible, EOL Manager ® will store the data in the folder "Temp" inside the EOL Manager ® installation folder. This error may occur, for example, when working with servers.

## Downloading wind data

Every time that there is an automatic download, the software creates three files:

- “.log”: It is the raw encrypted binary data with its hash code.
- “.wnd”: it is the output wind data in ASCII code
- “.txt”: it is the report of configuration and events in the storage cycle.

These files are saved in a folder dedicated to the meteorological station in the download folder. Windows® don't show known file extensions. Since the three download files have the same name and the only difference is in the extension, they are shown with the same name. We recommend modifying the option in the operating system

### Automatic Download

EOL Manager ® enables you to schedule download of data from weather stations. To do this select the weather station and edit the settings under the tab called access. It is advisable to put a

frequency period of approximately 7 days. For more information read the text related to the automatic download in the "Create New Configuration" of this manual.

## 14. Automatic Download Settings

Automatic download telemetry is performed using a CSD modem, Internet or a RS232 cable. If you want to temporarily stop the automatic download you can check the box in the main screen marked with STOP. When you turn off that box, the automatic downloads will be reactivated. If at the scheduled time to download automatically, the software cannot access the logger and download the wind data, EOL Manager ® will try again in five minutes, if this second attempt to download is not successful there will be a retry again within fifteen minutes, if this attempt is not satisfactory, will attempt an hour, and then the next attempt is postponed to the next day.

Scheduled downloads at exactly (e.g. 11, 12, 13 o'clock) will be purposely be delayed 5 minutes to avoid potential interference with communications between the logger and the modem. If during the download, the communication is cut, it will save a file with the information downloaded into the folder "Temp". Later, when you restart the download, it will resume the download from where it was last cut in the previous download attempt.

If you are downloading wind data with the automatic emails from the Eol Zenith ®, please read carefully the section Configuring the SMTP and POP3 which explains the protocol for downloading e-mails from the Eol Zenith ®, and displays a POP3 port configuration.

Once the download of the data has been completed, the data will be decoded, and three files will be generated. log file (the raw data), wnd file with the wind data from the station and .txt with the report of the site.

These files are saved in a folder dedicated to the meteorological station in the download directory. You can set the software to download all the loggers you have at the same time. The software will automatically download them all in a row.

### *Manual download of wind data*

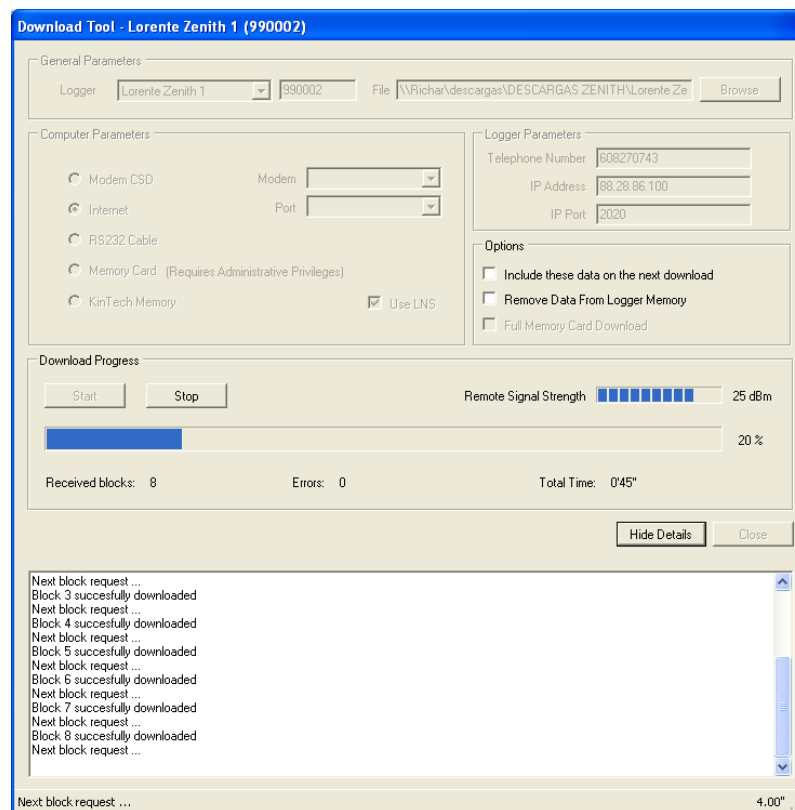
It is possible to download data whenever you want. Using the drop down menu (right mouse button) or download icon located on the top, the user can access the data download tool.

With this tool you have to select the way you want to download. Download via telemetry using a CSD modem, downloading using the Internet or downloading the data from a SD memory card connected directly to the computer.

If you want the data that you have just downloaded to be available in the next download you should enabled the option "Include the data on the next download." If instead you do not want the data to be re-downloaded the next time you download from this logger you should disable this option. If in

addition to not wanting to download the data again next time, you want to delete the data from the data logger memory select the "Remove Data Logger from Memory."

If during the download, the communication is cut, it will save a file with the information downloaded so far into the folder "Temp". Later, when you restart the download, it will resume the download from where it was last cut in the previous download attempt.



## 15. Manual Download

If you are downloading a memory card connected to the computer, you can only download data that has not been previously downloaded or download all the data stored in memory (previously downloaded or not). For a complete download of the memory then select "Memory Card Full Download."

Once the download of the data has been completed, the data will be decoded, and three files will be generated.

1. .Log file (the raw data)
2. .Wnd file with the wind data from the station
3. .Txt with the report of the site. (for more information about this report go to the Wind data report section)

These files are saved in a folder dedicated to the meteorological station in the download directory.

### **Downloading data by receiving an email coming directly from the Eol Zenith®**

Automatic Download by Email: Eol Zenith® has the ability to send data via an email directly from the data logger. This option should only be used when you can not communicate directly with the data logger because of GSM operator problems.

To send data by email you must configure the mail server through which to send the emails. This email will be sent to the address or the two email addresses that have been typed in the "recipient email address (1)" and (2).

There is an example of how to configure the SMTP server under the "Configuring the SMTP and POP3 port" section. The person receiving the mail from the data logger can perform the decryption of the .elog file as is detailed in the "File Decryption" section.

**16. Automatic e-mail from logger**

## **Previous data recovery tool**

The system keeps by default in the logger SD card the whole history from the last time the settings where uploaded to SD card reader. It is possible to download data from a recording interval previous to the last downloaded data. The previous data recovery tool asks for the boundary downloaded files, i.e., the .log download file before and the .log file after the data to be recovered. If no preceding file is selected, data from the beginning of the SD card will be sent. If no subsequent file is selected, data till the last recording will be sent.

## **Configuring the SMTP and POP3 servers**

### **Setting up the SMTP server**

For the logger to be able to send emails, you have to configure the SMTP Server.

This SMTP server can be your own email account, or you can create a new account for the exclusive use of the logger. Do not use TSL/SSL servers as logger SMTP server. If you do it you will see E114 as the maximum e-mail status.

Verify that the parameters have been entered correctly by clicking on "Send Test Email." A test email will be sent to all recipients.

Notice that the SMTP server used by the software to forward e-mails is not necessarily the same than the one used by the logger. So the restriction to non SSL/TLS SMTP servers doesn't apply to the server used by Eol Manager Software. The SMTP used by the software is set up in Options menu, *Application Settings* function > *Software Internet Options* tag.

### Configuring the POP3 server

EOL Manager<sup>®</sup> can be configured to automatically download emails coming from the Eol Zenith<sup>®</sup>. In this way you do not have to worry about downloading the emails from the data logger, save attachments to your computer, and then import them into EOL Manager<sup>®</sup>.

**NOTE:** Keep in mind that for EOL Manager to download the emails (sent by the logger to the email server) the emails **have to be on the server**. Meaning that you can not use your normal outlook account where you download the emails from the mail server everyday. This will remove the emails from the server, and EOL Manager can not download them again (since they have already been downloaded):

**To avoid this issue do the following:**

Create a new Gmail account only for Eol Manager. In this way the Eol Manager software downloads the emails send by the loggers to your Gmail account and automatically deletes them.

Here is an example of how to setup a Gmail account:

- POP3 Server: pop.gmail.com
- Port: 995
- Use SSL: Yes
- User Name: [zenith@gmail.com](mailto:zenith@gmail.com) (email address)
- Password: zenith (Gmail access password)

This specific example email account would look like this setup in the Eol Manager

### 17. Automatic download by E-mail.

Verify that the parameters have been entered correctly by clicking on "Check Server". For the email to be downloaded correctly the following conditions must be fulfilled:

- The auto-download check box must be checked with the option "Read Emails from Logger" of the data logger.
- The email header has both SiteName and yyyyMMdd.
- The email has the following displayed: Sit SiteNumber.
- Have an attachment with the file extension ".elog"



- The correct and specific pop server for this email account must be used.

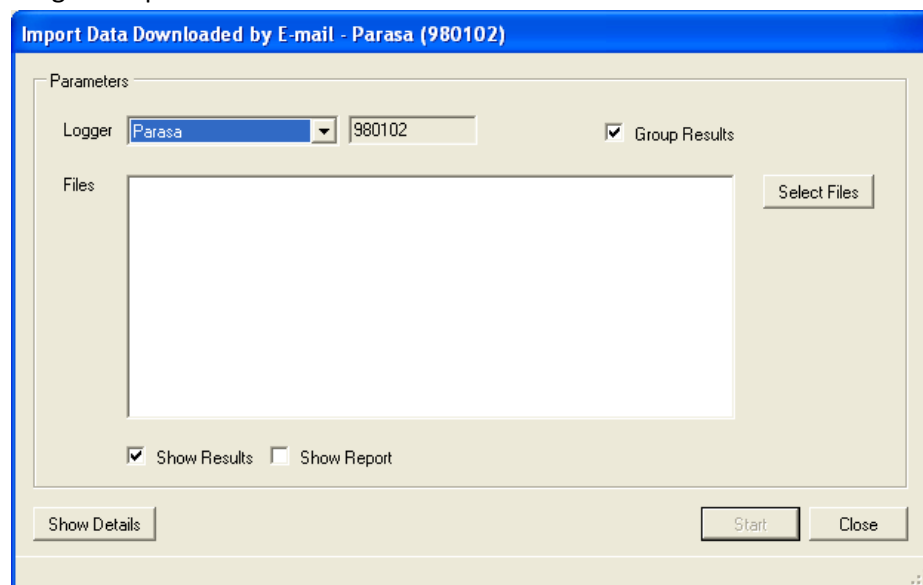
Every hour EOL Manager ® will check all the POP3 servers programmed for automatic download via email.

## How to decode the .elog file

As explained before, the EolManager can automatically retrieve from POP servers all data sent by the loggers as an e-mail attachment. But if for whichever reason, you want to do it manually you can follow the instructions described in this chapter. The file **.elog** is the file attached in the e-mails from the data logger. This file contains the raw data and is therefore encrypted.

To decrypt and decode the data, follow these steps:

1. Save the .elog file in the folder dedicated to the weather station.
2. In the EOL Manager ® go to the main window to a Tools → Import Data Downloaded by Email
3. In the top left corner select the weather station you want to decode the data downloaded by email.
4. Select the files you wish to decode using the "Select Files".
5. If you want to decode several .elog files at the same time and to get the result in one single file, select the "Group Results." Option.
6. Press Start to start the decryption and decoding. If you do not have the password to download data, decoding is not possible.



## 20. Importing data from an email

Once the decoding of the data has been completed, three files will be generated.

1. .Log file (the raw data)
2. .wnd file with the wind data from the station
3. .Txt with the report of the site.

These files are saved in a folder dedicated to the meteorological station in the download directory.

The generated files are included in the historical data downloaded from the main database.

### Decoding raw wind data

---

Kintech loggers never use calibration parameters on raw recordings, i.e. the log files store hertz and volts. The calibration is applied at decodification time, affecting only the .wnd file. So, if you for some reason have worked with wrong or unknown calibrations during a period of time, all you need to do is to decode the .log files again with the proper calibrations now inserted in the .sit file.

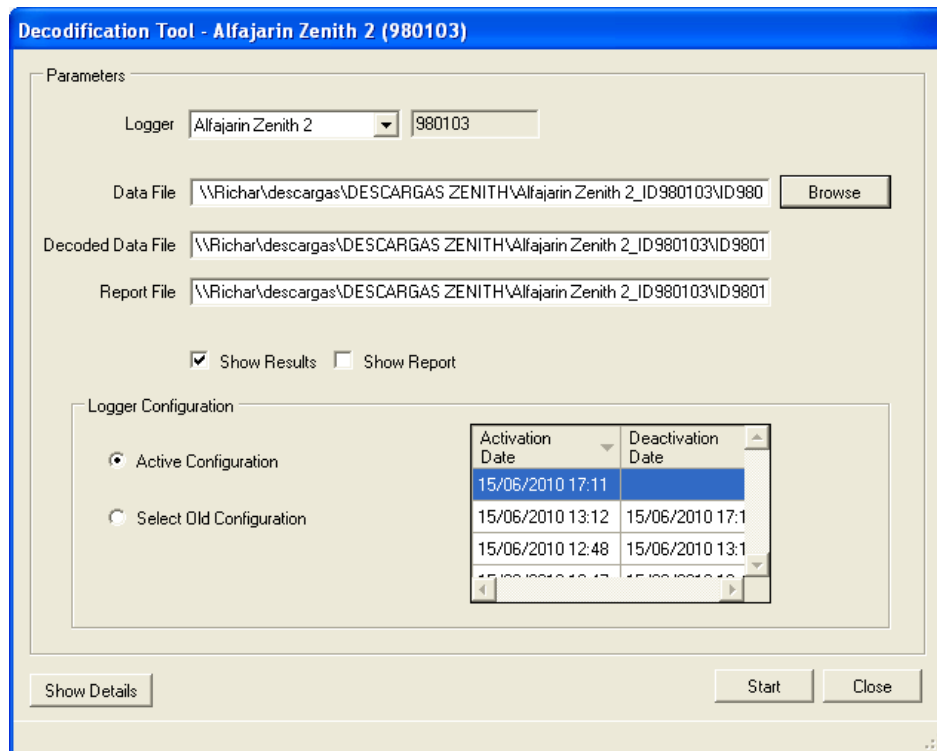
Each time you perform a download, the decryption and decoding of data downloaded is done accordingly to the currently active configuration of this logger. However, raw data files downloaded (.log and .elog) can be decoded again with different calibrations for the sensors.

To decode a .log file again go to the main screen and select the weather station (do a right click on top of the logger), and in the drop down menu select "Data Decodification." Select the .log file you want to decode, and in the bottom of the window, select whether to perform decoding with the running configuration, or with an old configuration. On the right of the screen you can select an old configuration.

After selecting the .log files and what configuration to use, the decoding will begin. Press the "Start" button, so that the decoding starts. 3 files will be generated:

1. .Log file (the raw data)
2. .Wnd file with the wind data from the station
3. .Txt with the report of the site.

For decoding it is important to know that you can select multiple .log files at the same time. This requires that these .log files are all in the same folder.



### 18. Decoding old data

## Wind data report

Together with the wind data file there will be generated a report (**the .txt file**) for that specific recording period.

The report contains the following information:

- The configuration of sensors with the data file (**.wnd**) has been calculated. It will show if there are any discrepancies between the configuration in the data logger and the configuration that has been used to decode the raw data.
- General information: Identifies the data-logger and the location of the data files. Provides the first and the last recorded data and data availability for the period calculated compared to the period between the first data and the latest data.
- Download Information: Includes the exact date of the PC on which the download of the wind data has been done. Specifies whether the download was performed automatically by the system or done manually by the user. It reports whether the data now has been deleted on the memory or it will be re-downloaded at the next scheduled download. It also specifies the procedure at which the data were obtained: memory card reader, remote download by Internet or by modem or file e-mail attachment.
- Logger configuration: model, firmware and hardware version of the logger, the name and location number configured in the logger and the integration period for the calculation of max and min set the logger.

- **Sensor configuration:** Displays the configuration of sensors with which it has calculated the wind data file (**.wnd**) including the calibrations that have been used to decode the data. Shows possible discrepancies between the configuration in the data logger and the configuration that have been used to decode the data. It shows all changes in the configuration of the logger as well.
- **Changes in the status of the logger:** If there has been any change in the "logger status" it is indicated with both the date and time when it occurred. If for example the logger goes low on battery for a few hours during the night, the system will indicate the exact moment when, and when it stopped because it recovered its battery tension level.
- **Access to the data-logger:** All typed of access will be registered. This includes real time data connections, downloads, and even manual access to the data logger menu (on site) using the keyboard.
- **Resets:** All resets occurred are recorded indicating whether it was a power off/on or a reset due to a firmware update (watchdog reset).
- **Sensor error analysis:** A basic error analysis is carried out on all the sensors. It will indicate the number of readings in which such an error is detected. Furthermore the average standard deviation of the wind vanes is included during the ten-minute recording period.

### Advanced post processing open source platform

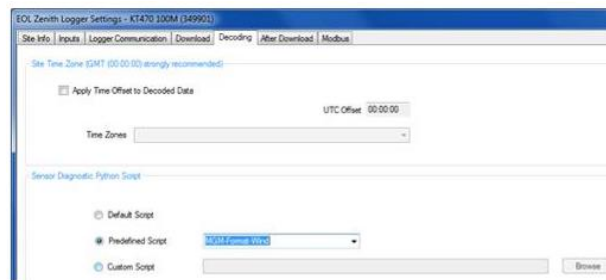
Eol Manager includes an ADP tool (Advanced Post-processing Tool). This is a Python programmed open source platform provided with a lot of tools for data filtering, validation, recalculation, etc. The platform is intended for two different purposes:

- modify the constants and or criteria on data plausibility algorithm
- insert additional code to perform anything with the data.

Eol Manager launches the ADP after downloading data. Every stored data are available in the tool as a database. It is possible to feed back to Eol Manager main panel, reports, etc. Eol Manager currently includes four sample codes for different applications and organizations criteria. The output data file .wnd cannot be modified with this tool.

You can choose a different script for every site. There are currently four different scripts delivered together with Eol Manager, each for a different application and/or institution criteria.

The predefined scripts are located on the installation folder / Python scripts directory.



You can find below a portion of a script to let you have an idea on the flexibility of programming:

```
#####
# LABELS, ERROR CODES AND RELATED FUNCTIONS
#####

PERCENTAGE_OF_BAD_RECORDINGS_TO_LEVEL1 = 20
NUMBER_OF_BAD_RECORDINGS_TO_LEVEL1 = 15
PERCENTAGE_OF_BAD_RECORDINGS_TO_LEVEL2 = 5
NUMBER_OF_BAD_RECORDINGS_TO_LEVEL2 = 15
PERCENTAGE_OF_BAD_RECORDINGS_TO_LEVEL3 = 0.5
NUMBER_OF_ERRORS_TO_LEVEL4 = 1

# Error codes
CODE_OK = 0           # Plausible sensor
CODE_ERROR = 1        # Sensor failure
CODE_WARNING_1 = 2     # Possible sensor failure
CODE_WARNING_2 = 3     # Possible sensor failure
CODE_WARNING_3 = 4     # Possible but unlikely sensor failure

def getErrorLevel(numberOfBadRecordings, numberOfErrors, numberOfRecordings):
    if numberOfRecordings != 0:
        percent = 100.0 * numberOfBadRecordings / numberOfRecordings
    else:
        percent = 0
    if percent > PERCENTAGE_OF_BAD_RECORDINGS_TO_LEVEL1:
        if numberOfBadRecordings > NUMBER_OF_BAD_RECORDINGS_TO_LEVEL1:
            return CODE_ERROR
        else:
            return CODE_WARNING_1
    elif percent > PERCENTAGE_OF_BAD_RECORDINGS_TO_LEVEL2:
        if numberOfBadRecordings > NUMBER_OF_BAD_RECORDINGS_TO_LEVEL2:
            return CODE_WARNING_2
        else:
            return CODE_WARNING_3
    elif percent > PERCENTAGE_OF_BAD_RECORDINGS_TO_LEVEL3:
        return CODE_WARNING_3
    elif numberOfErrors > NUMBER_OF_ERRORS_TO_LEVEL4:
        return CODE_WARNING_3
    else:
        return CODE_OK

def getDiagnosisResult(errorCode):
    if errorCode == CODE_ERROR:
        return SENSOR_DIAGNOSIS_ERROR
    elif errorCode == CODE_WARNING_1:
        return SENSOR_DIAGNOSIS_WARNING
    elif errorCode == CODE_WARNING_2:
        return SENSOR_DIAGNOSIS_WARNING
    elif errorCode == CODE_WARNING_3:
        return SENSOR_DIAGNOSIS_WARNING
    elif errorCode == CODE_OK:
        return SENSOR_DIAGNOSIS_OK
    else:
        return SENSOR_DIAGNOSIS_UNKNOWN
```

## Linking and exporting data files

Eol Manager can link data files creating additional files corresponding to periods of time specified by the user, typically monthly files. To do so go to File > Link Data Files, then select the files that contain the information for the desired period of time. Then choose the time period you want the new file to have:



In the File menu, you can find a tool to export the .wnd data files to csv format (compatible with Microsoft Excel format).

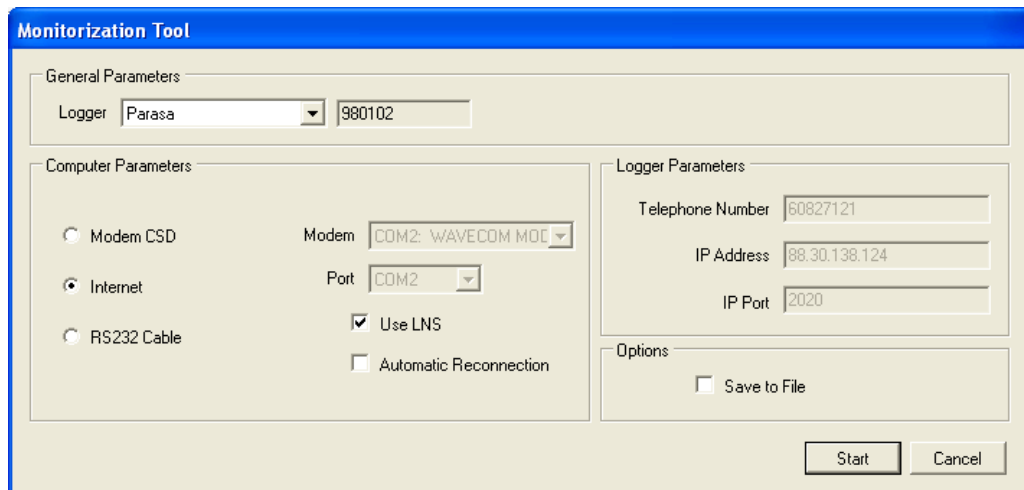
## Real time data connection

EOL Manager ® enables you to review the status of all the sensors by communicating with the data logger in real time. This communication can be done by either a CSD modem, Internet or via a RS232 cable.

To initiate the real time connection, select the weather station you want to connect to, right click it and select "Real Time Data" in the drop down menu. You can also select the weather station, and click on the icon of "Real Time Data." Either way, you will get a menu like the one shown in the figure below.

EOL Manager ® lets you save the data received during the real-time connection by using the "Save to File." These data will be stored in the "Moni" folder related to that specific data logger.





### 19. Real time connection tool

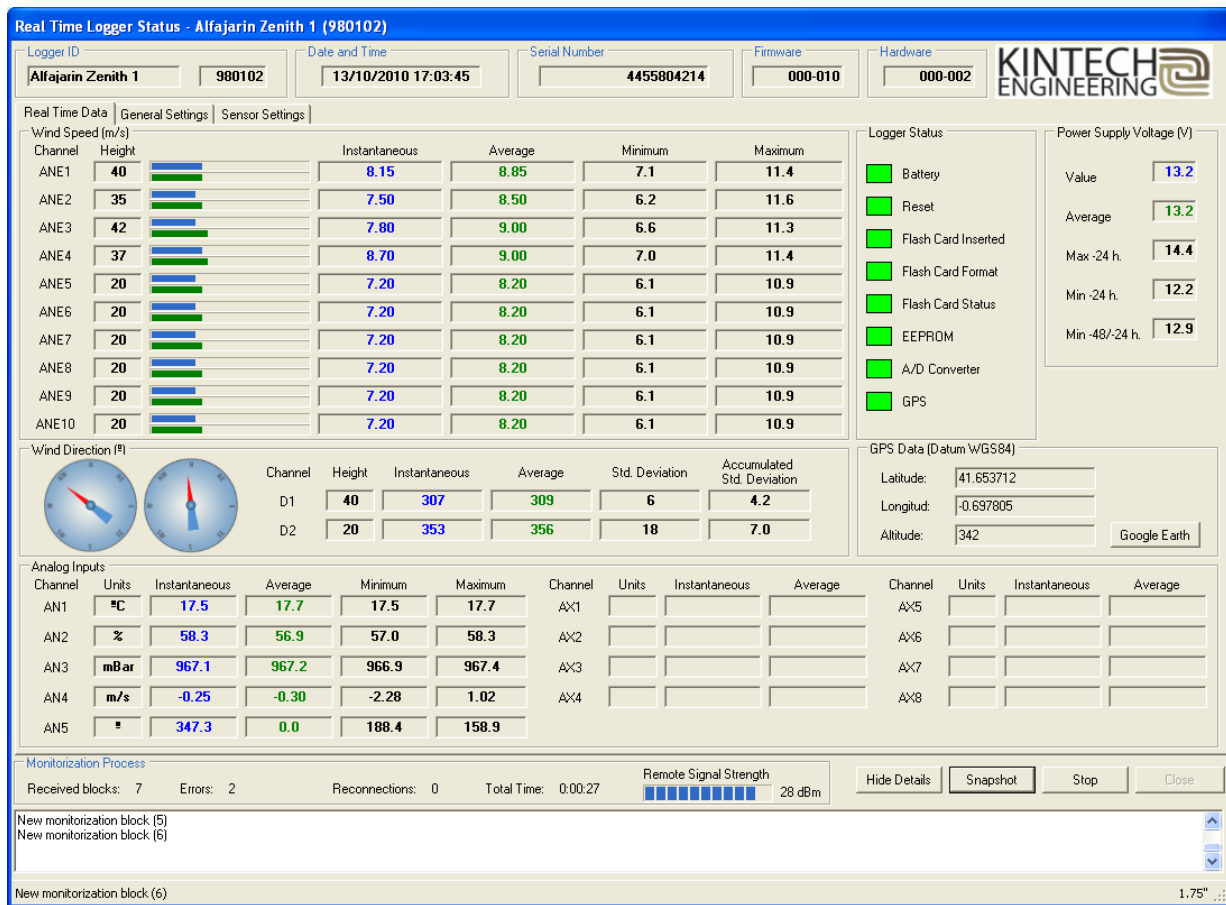
During a real time connection, you can see information about the status of the data logger, such as battery status, as well as the instantaneous readings on all the sensors connected to data logger.

To check the status of the battery, the user should check the maximum and minimum voltage of the battery in the last 48 hours. Using the maximum and minimum voltage levels for the last 48 hours you can find the state of the battery during the night, which is the worst period for the battery. We recommend if any of the minimum values of the battery is less than 11V, the battery should be replaced.

Following, you can find instantaneous, average, minimum, maximum and accumulated standard deviation of the input channels that have that information available.. The values shown in a real time connection are calculated using the configuration in EOL Manager from raw data sent by the logger using the current calibration in the site configuration.

The exact GPS position of this data logger (mast) is displayed on the right side of the screen. You can access Google Earth using the "Google Earth" button next to the coordinates.

Using the "Snapshot", button the user can take snapshots during a real time connection. This image will be saved in the folder "Moni" folder in the download directory, related to this specific meteorological station.



## 20. Real time connection to logger

### Updating the firmware

#### Remote firmware update

Eol Zenith® lets you update the firmware wirelessly. This firmware is exclusively distributed by Kintech Engineering:

To upgrade the firmware start the firmware update tool. Go-to Tools → Firmware Update Tool. In the upper left corner select the logger you want to update and select the new .BIN file given to you by Kintech Engineering.

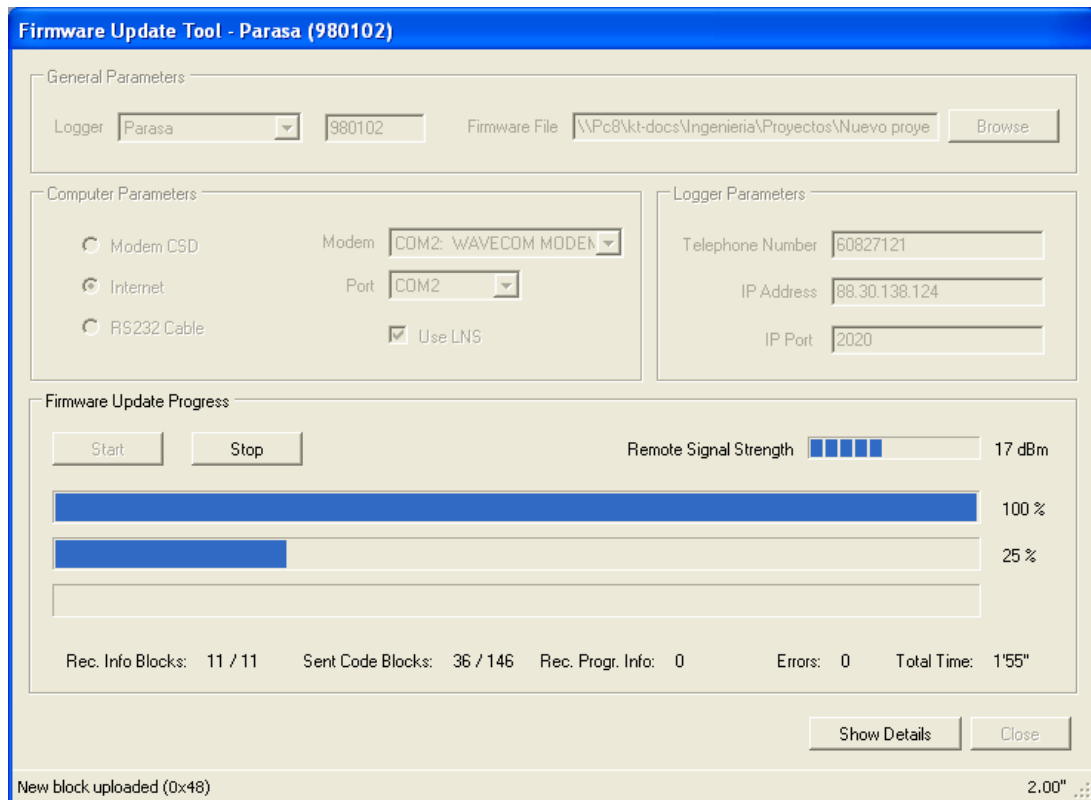
Now select in what way you want to connect to the logger and press “start”.

Updating the firmware exists of three steps:

1. In the first step the logger tests what firmware is presently installed in the data logger. If the firmware that you are going to install in the logger is newer than the firmware currently installed in the logger you can proceed to next step, if not the communication with the logger will stop.
2. In the second step EOL Manager proceeds to update the firmware that is currently installed in the logger.

3. In the third step the logger will be checked and reprogrammed, and the communication with the logger ends. Shortly after the data logger will reset itself. Please do not use the data logger during this resetting process.

It is required to have the download password to the logger to update the firmware.



## 21. Update firmware tool

### *Eol Zenith Firmware update from SD card*

1. Run Eol Manager and check that the fw version in the 'about Eol Manager' window is the desired one:



2. Upload settings to SD card with any file \*.sit (it will upload firmware also to SD card)
3. Power off the Eol Zenith
4. Insert SD card in the logger
5. While pressing up and down keys, power on the Zenith. Check that the screen keeps in blue with no letter and the CPU green LED follows a two flashes sequence. Make sure that the power supply will not be disconnected during the reprogramming process
6. Press left + right: the logger will start self-programming firmware from SD card. The CPU LED will blink quickly. At the end of the process the logger will restart automatically.

## Access Password

With the *Eol Zenith*® you can configure two different passwords:

**Data Download Password:** The password is for downloading data as well as being able to perform all the communication options available, real-time data connection, data download, firmware update etc....

Even if the SD memory card is connected to the computer, the wind data can only be downloaded if the user has this password.

**Password for real time data:** With this password you can monitor the data logger in real-time (E.g. to review maintenance performed at the station) however you can not perform other communication options, such as downloading etc.

There is an option of having a default password. This password can be set in *Options* → *Software Setting* → *Logger Configuration Defaults*.

To set these passwords for the first time go to the edit settings of the logger you want to change. Any changes to the configuration must be saved to the memory card in the data logger. Saving this configuration to the memory card can be done remotely or with the memory card connected to the PC. Once you have configured the memory card it is only possible to initiate communications with the weather station if you have the correct password.

### Changing the password

To change the passwords of a data logger you have to use the logger password change tool. The tool "Change Logger Password" is located in the Tools menu of the main window.

In the popup window you have to enter the current password to download data and then the new password you want to configure. Press Ok, you now have to select how to update the memory card with this new password. You can do this remotely or with the SD memory card connected to the PC.



#### 22. Change password tool

### How to access the Charting Tool®

To access the Eol Charting Tool® from EOL Manager® go to *Tools* → *Chart Tool* and select the data logger (weather station) you want and the period of time you want to see in the charts.

You can also access the charting tool, by right clicking on the data logger in the main screen and select "Chart" from the drop down menu.

## 14. Eol Charting Tool®

*Eol Charting Tool®* is a versatile tool for studying wind data from your sites and helps in the sensor failure detection. By using the graphs users can perform maintenance reports or preliminary wind resource evaluations.

Just right-clicking on the graph the context menu will open showing printing or saving options.

On the left side of the screen there are controls for adding left graph axis variables. There are also controls for data filtering according to the date, wind direction, minimum speed etc.

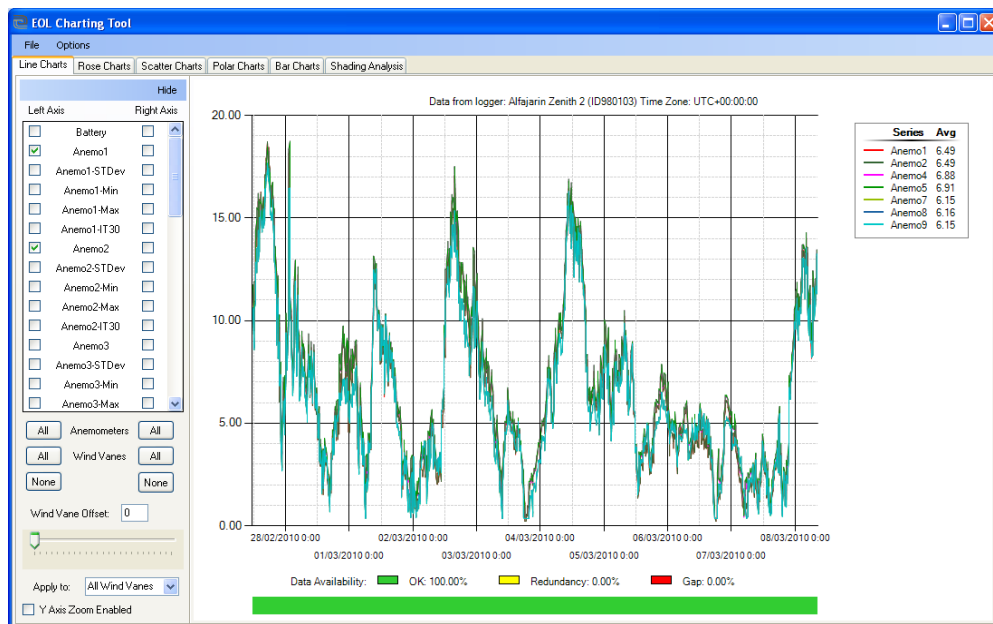
A different control allows applying different colors according to the time for not temporary time representations.

### Time Series

With “*Time Series*” user can represent the stored data, studying speed data, direction, temperature, pressure or even battery.

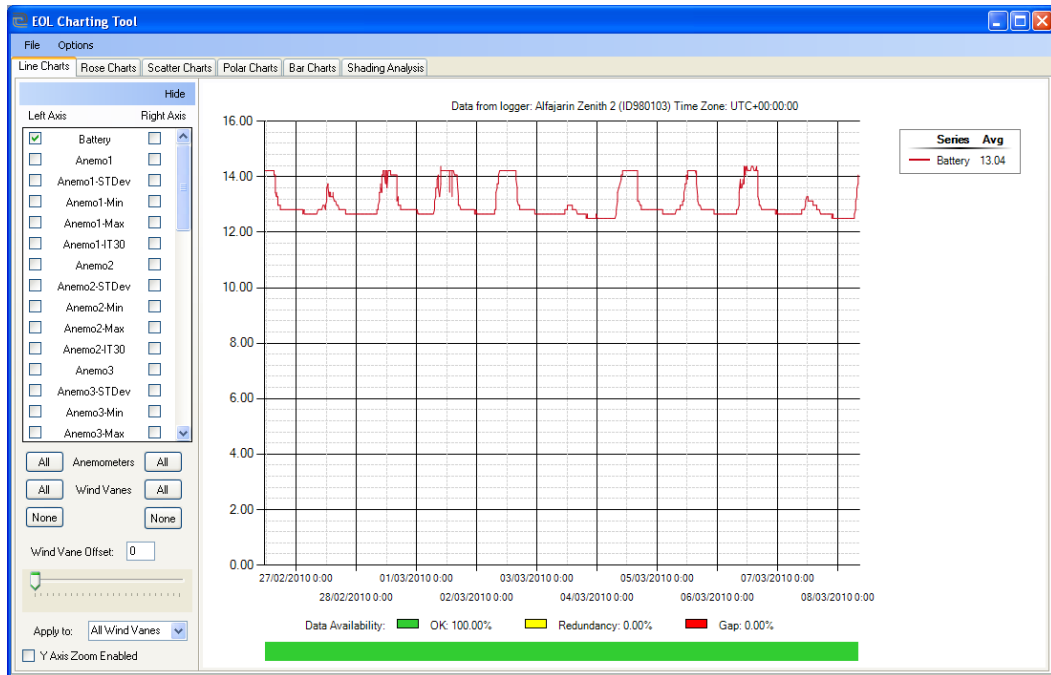
Data availability is shown in the “availability bar” located in the bottom.

Click and drag the graph (horizontal axis) to expand a selected period. If “vertical zoom” option is enabled in the window lower left corner, you can also zoom in that axis.



23. Time Series I, Eol Charting Tool®





## 24. Time Series II, Eol Charting Tool®

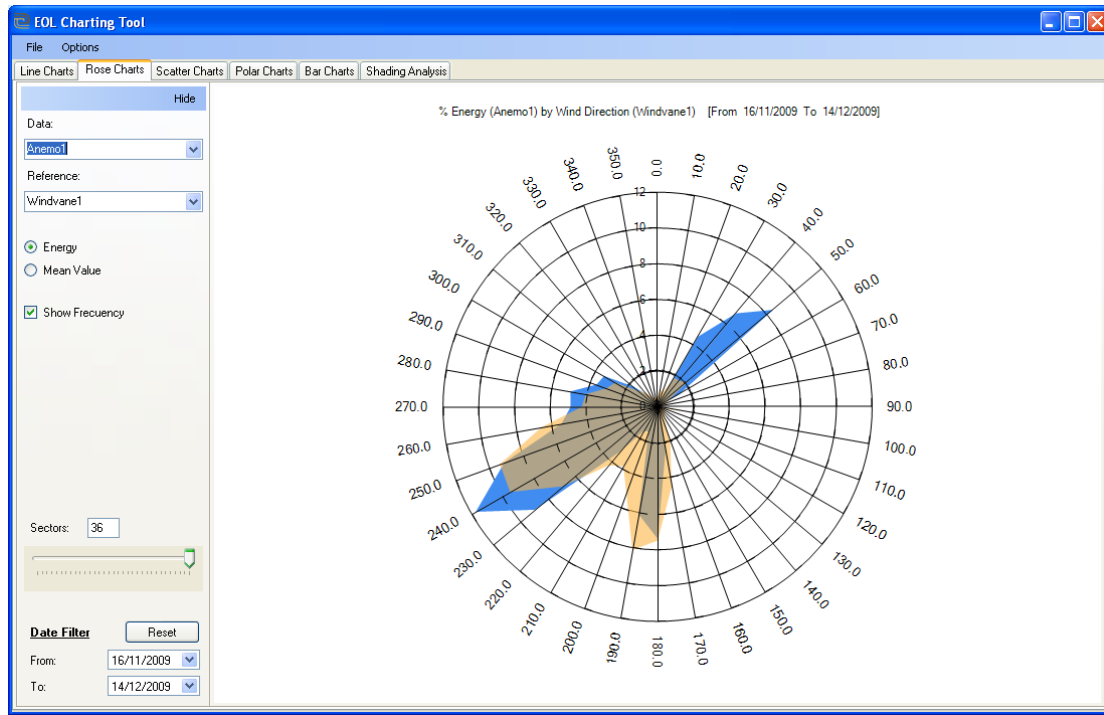
Adding an Offset to the direction values you can easily study the wind rose. Adding an offset to just one wind vane is possible to detect an offset between top and bottom wind vanes produced during the installation.



## 25. Time Series III, Eol Charting Tool®

## Wind Roses

“Wind Roses” helps to know the percentage of time when the wind comes from a specific direction or the percentage of energy/ average wind speed of that wind.



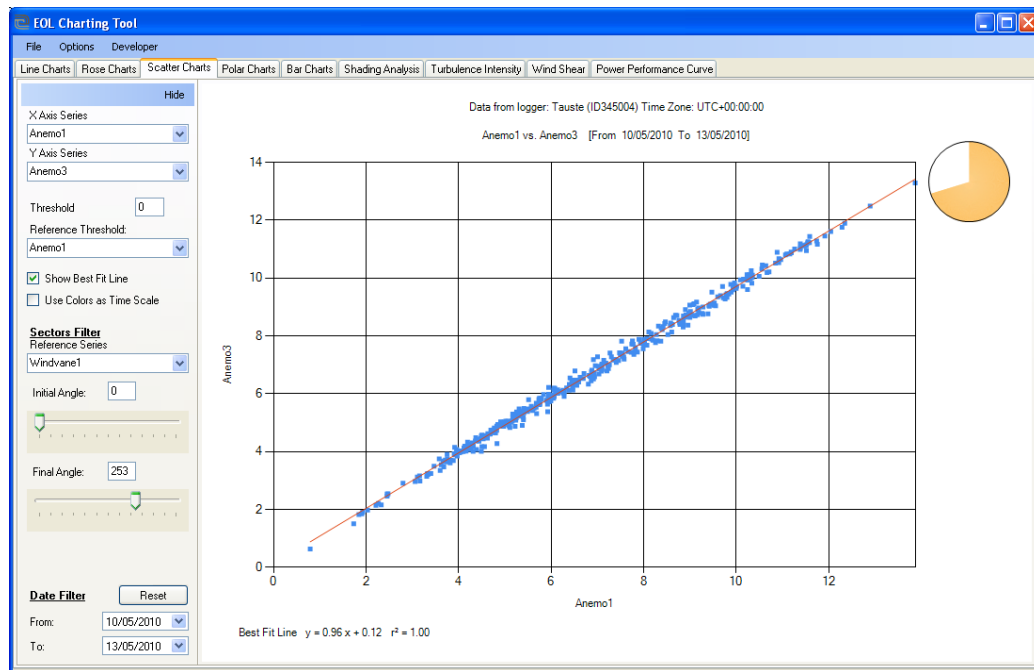
26. Wind Roses, Eol Charting Tool®

## Correlations

“Correlations” allows perform comparisons between different sensors to detect failures (damaged sensors or broken connections).

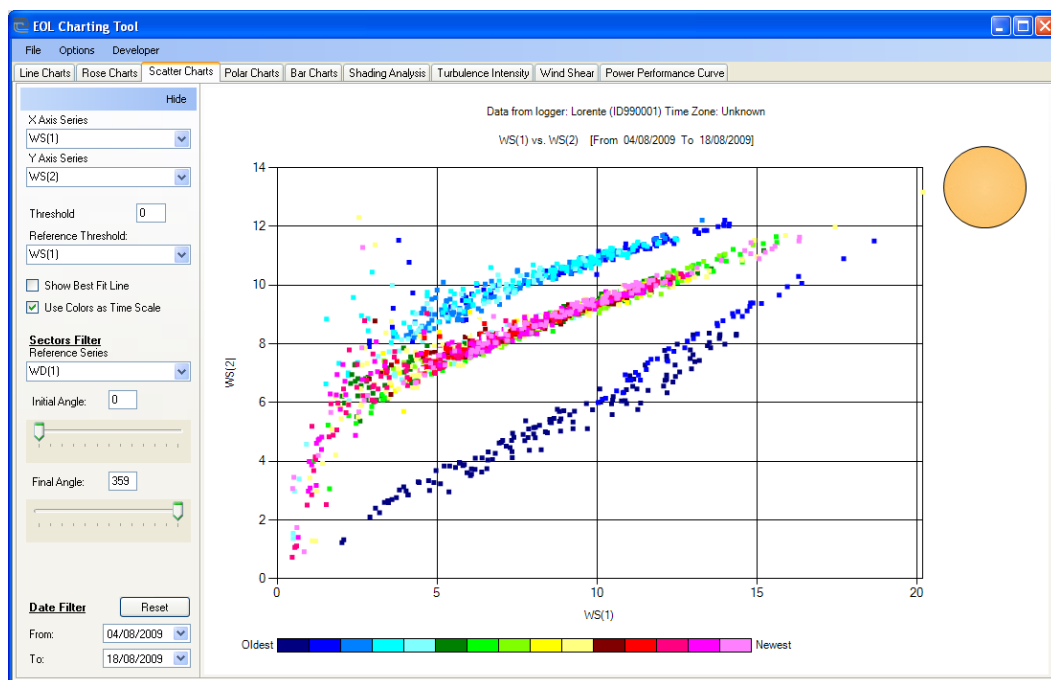
To avoid conclusions misrepresenting due to low wind you can configure a “Threshold”. When selected, data of wind speeds below a limit will not be processed (filter also available for wind direction).

User can visualize the data correlation graph with different colors according the time; this way there will be a specific color pattern when correlations are present. .



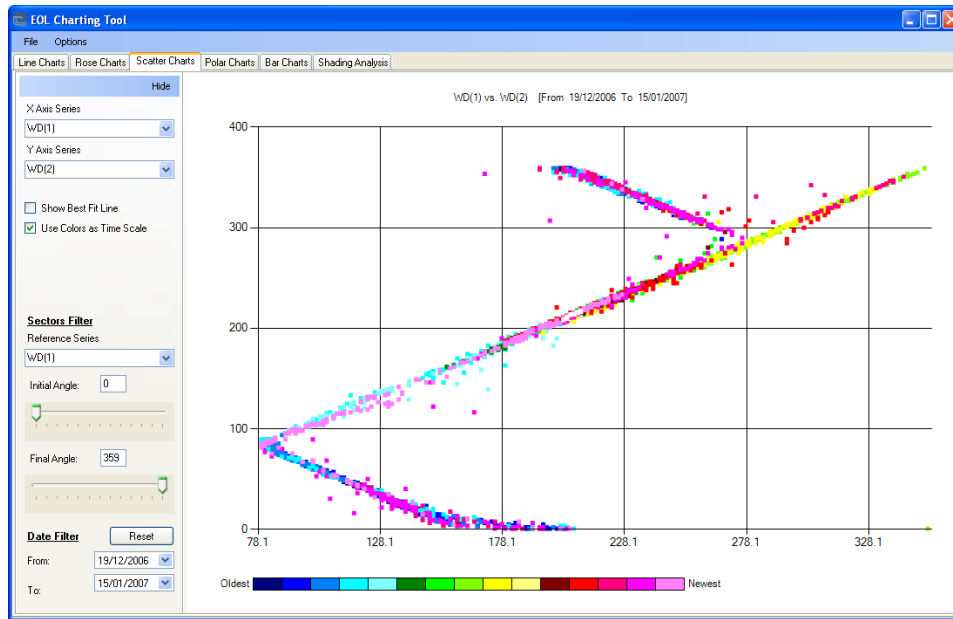
## 27. Correlations I, Eol Charting Tool®

In the figure 28 you can see the coupling of the signal of a high frequency anemometer into the signal of a low frequency anemometer (for lack of wire shield).



## 28. Correlations II, Eol Charting Tool®

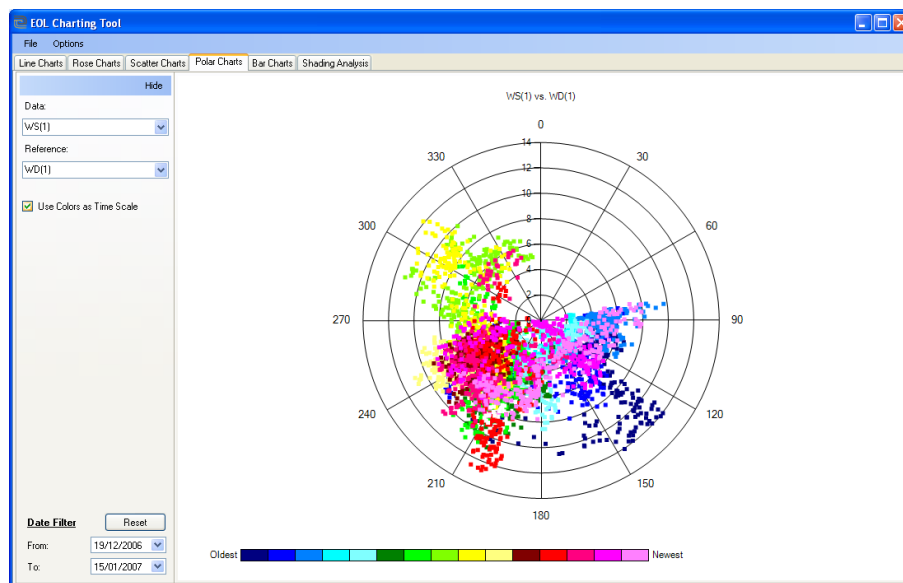
In the figure 29, there is the signal of a Grey Code Wind vane with 2 wires interchanged.



29. Correlations III, Eol Charting Tool®

## Polar Charts

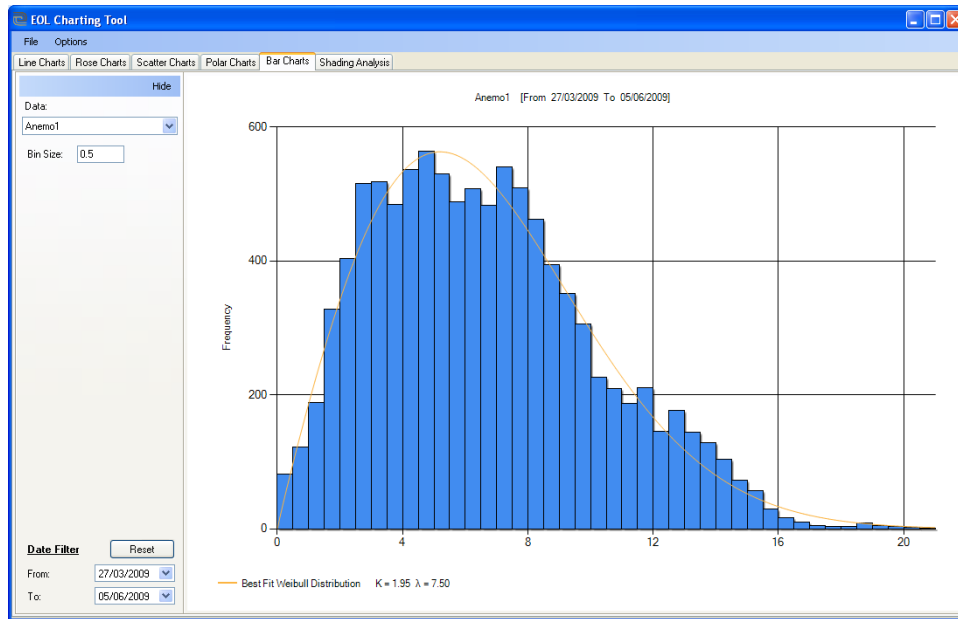
Data has different colors according the direction (using a color time scale).



30. Polar Chart, Eol Charting Tool®

## Distribution

Get the Weibull distribution by clicking "Distribution". Bin size is adjustable.



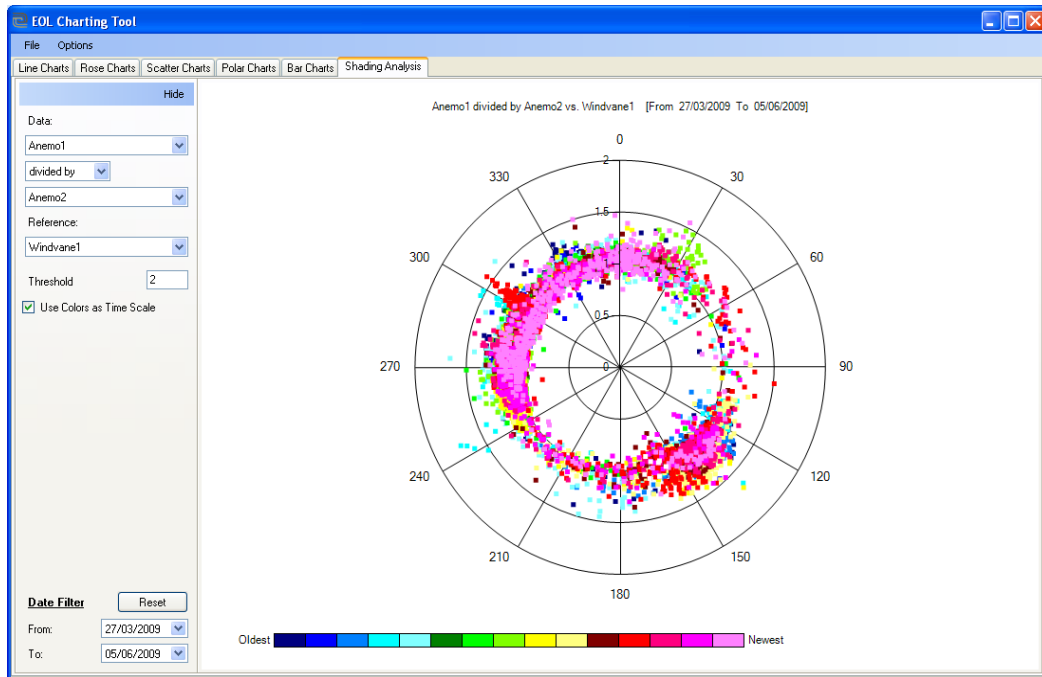
**31. Bar Chart, Eol Charting Tool®**

## Directional Analysis

“Directional Analysis” allows finding alterations between the relations of different variables according to a wind direction. Alterations can be originated by tower’ shade or changes in the wind speed vertical profile according to the direction.

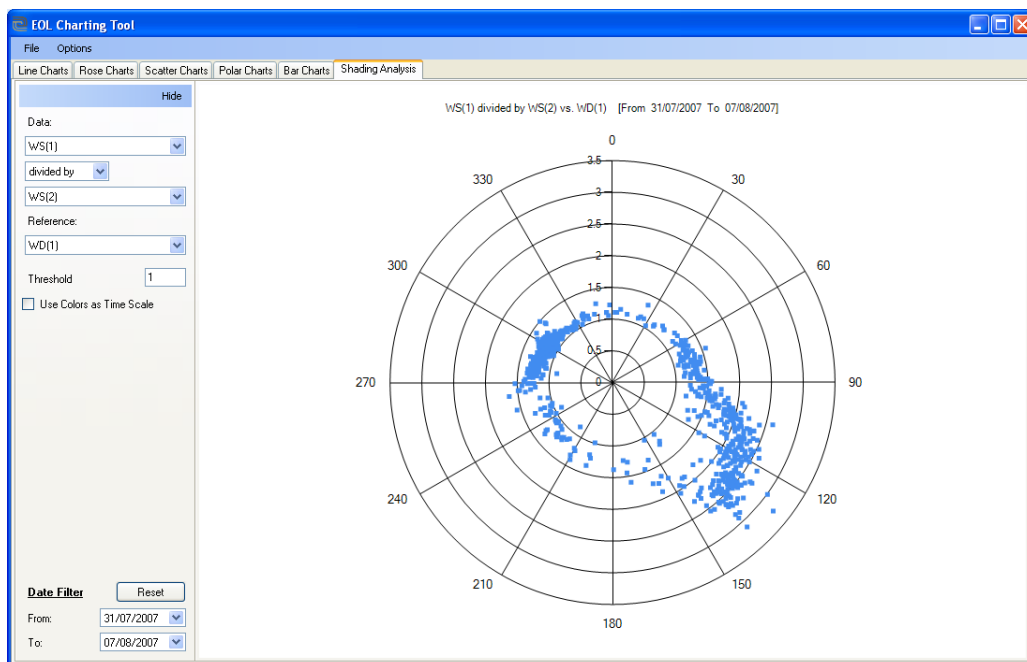
The normal result after dividing speed values from two anemometers installed at the same height should be as close as possible to 1, when the result is not closet o one probably one of the sensors is under the effect.

We recommend applying a “Threshold” to avoid interferences created for low wind speeds.



### 32. Directional Analysis I, Eol Charting Tool®

In the figure 33, the graphs shows values of an anemometer that is shaded by the tower when wind comes from a specific direction (caused probably for using a boom too short).



### 33. Directional Analysis II, Eol Charting Tool®

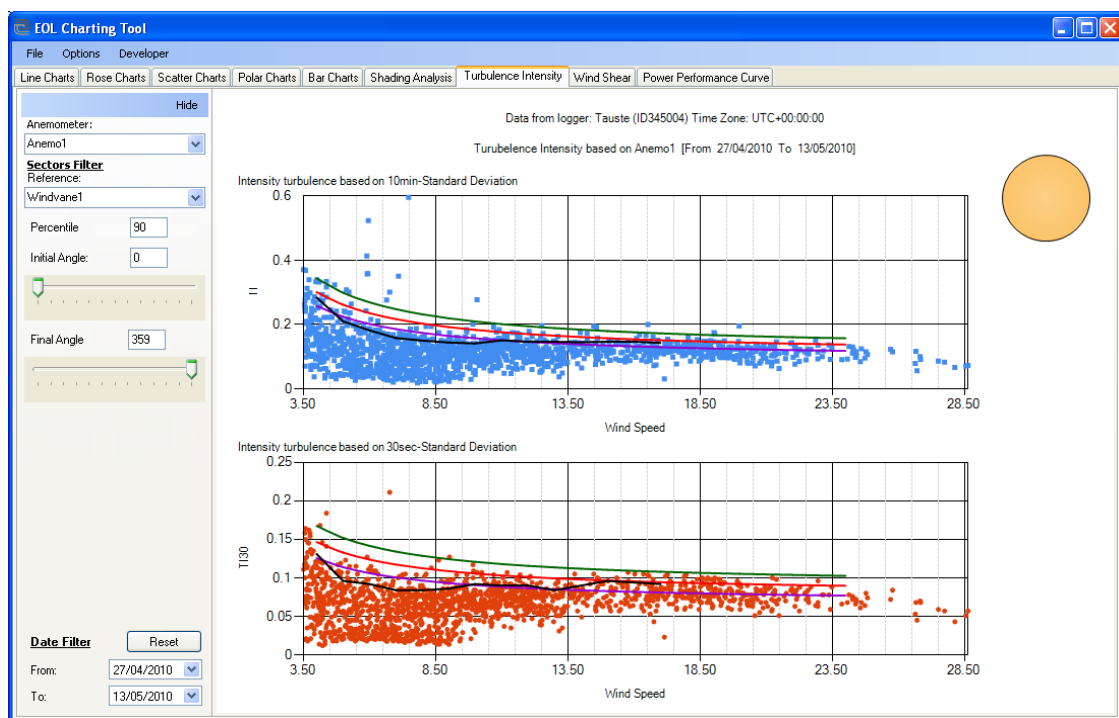


## Turbulence Intensity

This graph offers a preliminary study of the site turbulence. The turbulence intensity is based on the standard deviation for 10 minutes periods (IEC standard, top of the graph) and in 30 second periods (Kintech standard, located down).

Using the 30 second method the user can differentiate between winds dominated by high frequencies of the wind and low frequencies. For additional information on the IT30 please contact: [wresource@Kintech-engineering.com](mailto:wresource@Kintech-engineering.com).

By designating a percentile, user can study the turbulence representative value for every speed bin.



34. Turbulence Intensity Chart, Eol Charting Tool®

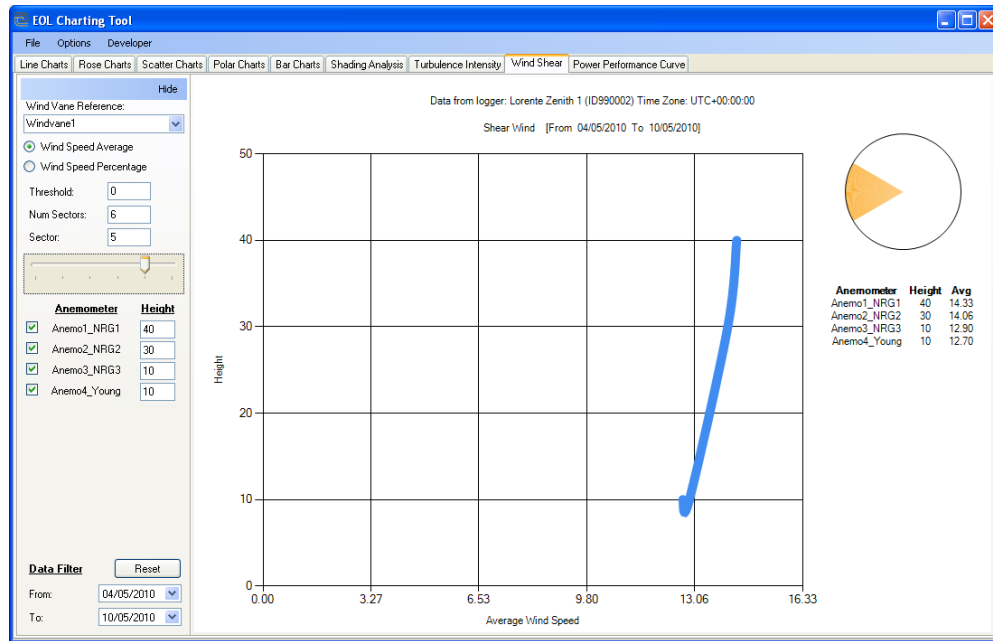
## Wind Shear

User can easily study the wind profile for every direction range.

The wind profile can be shown by average wind speed or by % according to the first anemometer.

To extract an anemometer from the calculation deactivate the checkbox on the left (for anemometers frozen, broken or vertical).

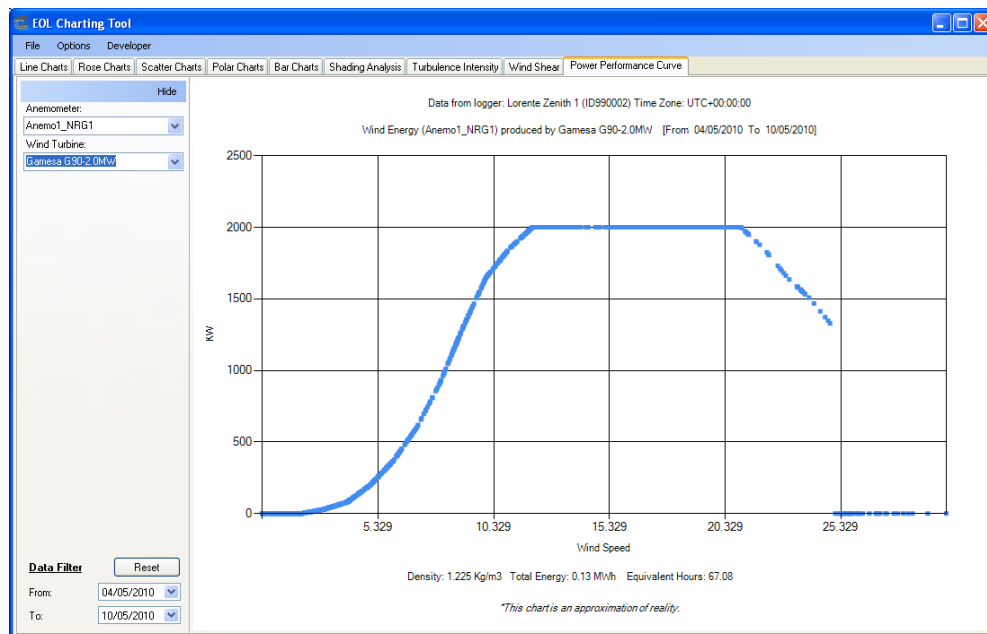
Applying a "Threshold" is also possible.



35. Shear Wind Chart, Eol Charting Tool®

## Energy Output

“Energy Output” shows the equivalent power output according to density, turbine and power curve selected.



36. Energy Output Chart, Eol Charting Tool®

## TECHNICAL SPECIFICATIONS

The *Eol Zenith*® data-logger has been designed for wind resource assessment and follows IEC 61400-12 standards as well as MeasNet, RISO or DEWI recommendations.

The *Eol Zenith* has 10 anemometer channels calculating the true wind speed average every second. 2 wind vane channels, 13 analog and 2 digital buses make a physical reading of the magnitude every second. With those values the data-logger calculates the standard deviation of the data collection as well as the min and max value of that 10 minutes interval. Then records the average values with the time and date when the interval ends.

The logger has its own OS. The logger configuration, 10 minute information and asynchronous event recordings are recorded in the MMC card. Part of that information is also recorded as backup in the logger non volatile EEPROM memory. The OS organizes and activates the configuration, runs the communication interface, display, keyboard and recordings. Asynchronous recordings provide user information when downloaded about incoming calls, system alarms, changes in configuration, manual keyboard access and more. The *Eol Zenith*® is almost fully configurable via keyboard; however telemetry options allow operating every feature in real time: this why we recommend using telemetry reducing so travel expenses and saving time.

### Operative specifications:

| Logger                  |                               |  |
|-------------------------|-------------------------------|--|
| Inputs                  | Anemometers                   | 10 anemometers (synchronous generator, push-pull, reed contact or hall effect)                                 |
|                         | Wind vanes                    | 2 + 5 analog (potentiometer) and 2 digital   |
|                         | Analog                        | 13 inputs (Temperature, humidity, pressure, radiation, up flow wind anemometers...)                            |
| Outputs                 | Digital outputs               | 3 outputs  |
| Data processing         | Integration Time              | 1 second (according to IEC 61400-12)   |
|                         | Recording interval            | 10 minutes   |
|                         | Time accuracy                 | GPS precision, always sync   |
|                         | Recorded parameters / channel | Every 10 minutes: average, standard deviation (configurable), min (configurable), max (configurable)           |
|                         | Turbulence and gusts          | Turbulence Intensity 30 seconds (anemometer channels 1 and 2), Standard deviation 10 minutes, max and min gust |
|                         | Geographical coordinates      | Records the site coordinates according to the GPS  |
| Resolution and accuracy | Speed resolution              | 16 bits (< 0.01 m/s)   |
|                         | Gust Precision                | 0.05 m/s   |
|                         | Standard deviation Precision  | 0.01   |
|                         | Wind vane Resolution          | 8 bits (1.4°)  |
|                         | Analog Resolution             | 12 bit (1.22 mV)   |
| Power                   | Voltage                       | 5-30 V DC Reverse polarity protection. Solar power supply available.   |
|                         | Modem power                   | User configurable smart management by logger to reduce power consumption when necessary                        |
| Recorded data           | Memory card                   | SD/MMC card 2GB  |

|   |                               |   |
|---|-------------------------------|---|
|   | Storage period                | > 5 years   |
| Guaranty                                | 2 years                       | 2 years against manufacturing defects and material flaws  |
| Norm                                    | IEC                           | IEC 61400   |
| <b>User interface and configuration</b> |                               |   |
| Front panel                             | Screen                        | LCD w/ 64x128 resolution  |
|   | Keyboard                      | 6 buttons keyboard  |
|   | Communication slots           | 2 serial ports  |
|   | Memory slots                  | 2 memory slots  |
|   | LEDS                          | LED GPS   |
|   |                               | LED GSM   |
|   |                               | LED CPU   |
|   | Sensor configuration          | Via keyboard  |
|   |                               | Via telemetry   |
|   |                               | By inserting a configured MMC memory  |
|   | Firmware configuration        | Configurable via telemetry and by MMC insertion   |
|   | Display activity register     | Every time a technician press a key and turns on the display, the event is registered and recorded in the MMC memory with time and date |
| Data download                           | Download options              | Telemetry   |
|   |                               | MMC reading   |
|   |                               | Direct data cable   |
|   | Data encryption               | All data is encrypted and password secured (configurable)   |
|   | Output file format            | *.txt, MS-Excel y data column number configurable   |
|   |                               | Regional configuration for the data file output is customizable (decimal symbol, etc)   |
|   |                               | Generation of several type of files (raw data, decoded data and download report)  |
|   | Digital signature             | By geographical coordinates   |
|   |                               | For data modification prevention  |
| <b>EOL Manager®</b><br>software         | Compatible OS                 | Windows XP + Windows 7  |
|   | Real time connections         | CSD, SMS, Internet (GPRS), CDMA, Satellite and RS232 cable.   |
|   |                               | SCADA compatible with MODBUS protocol   |
|   |                               | Password protected  |
|   | Data download                 | CSD, SMS, Internet (GPRS), CDMA, Satellite and RS232 cable and MMC card.  |
|   |                               | e-mail  |
|   |                               | Automatic data download programmable  |
|   |                               | Password protected  |
|   | Reports by graphs: Eol Charts | Wind rose, Weibull distribution, IT, wake analysis...   |
|   |                               | Failure detection   |
| Telemetry                               | Communication system          | CSD, SMS, Internet (GPRS), CDMA, Satellite and RS232 cable.   |
|   | Connection register           | All telemetry connections + keyboard access are registered with date and time of the event  |
|   | Antennas                      | GSM   |
|   |                               | GPS   |

| Physical information |                   |  |
|----------------------|-------------------|--|
| Connections          | Terminals         | plugs  |
|                      | Memory card       | SD/MMC 2GB   |
|                      | MODEM             | GSM/GPRS/GPS quad band internal modem                |
| Physical dimensions  | Dimensions        | 241 x 194 x 116 mm                                   |
|                      | Weight            | 1.5 kg   |
|                      | Waterproof        | IP55   |
|                      | Temperature range | -40, +70 °C  |
| Materials            | Box               | PVC w/ 2 hinges, shock proof, transparent view cover |
|                      | Front panel       | Stainless steel with polycarbonate hood              |

## Electrical specifications

| Terminal                       | I/O | PARAMETER |                         | VALUE | UNIT |
|--------------------------------|-----|-----------|-------------------------|-------|------|
| BAT                            | IN  | Vi max    | Input Maximum voltage   | 30    | V    |
|                                |     | Vin       | Input max voltage       | 12    | V    |
| ANE 1-10                       | IN  | Vi max    | Input Max voltage       | 5     | V    |
|                                |     | F max     | Input max frequency     | 2     | KHz  |
| DIR 1-2<br>ANL 1-5<br>XANL 1-8 | IN  | Vi max    | Input max voltage       | 5     | V    |
|                                |     | F         | Reading frequency       | 1     | Hz   |
| DIG IN 1-2                     | IN  | Vi max    | Maximum tension when ON | 6     | V    |
|                                |     | ViH       | Min Tension when ON     | 3.5   | V    |
|                                |     | ViL       | Max tension when OFF    | 1.35  | V    |
|                                |     | F         | Reading frequency       | 1     | Hz   |
| 5V                             | OUT | Vo max    | Output max voltage      | 5.1   | V    |
|                                |     | Io max    | Output max current      | 6     | mA   |
| +                              | OUT | Vo max    | Output max voltage      | 5.1   | V    |
|                                |     | Io max    | Output max current      | 6     | mA   |
|                                |     | Fn        | Rated frequency         | 1     | Hz   |
| 2.5V                           | OUT | Vn        | Nominal voltage         | 2.5   | V    |
|                                |     | Io max    | Output max current      | 20    | mA   |
| OUT 1-6                        | OUT | Vo max    | Output max voltage      | Vbat  | V    |
|                                |     | Io max    | Output max current      | 3.7   | A    |



## SENSOR MODELS

Both in the software and on the display of the logger there is a list of different sensor models that can be connected to the Eol Zenith®. This list includes most of the sensors known in the wind energy sector. However, if you are planning to connect sensors to the data logger not already listed in our software or on the display of the logger, please contact our technical support department for validation of the sensor you are trying to connect.

Most sensors that can be connected to the logger do not require any specific interface card or extra hardware to connect it.

### Anemometers

There are 10 channels for frequency anemometers and several different types and models (synchronous, push-pull, reed contact or Hall Effect):

NRG:

- 40
- 40H
- ICEFREE
- ORNYTION:
  - o 107
  - o 107H
- YOUNG:
  - o 3102
  - o 05103
- VECTOR:
  - o A100R
  - o A100S
  - o A100L2
  - o A100LK
- RISO:
  - o P2456
- THIES:
  - o P6137
  - o FIRST CLASS / COMPACT
- Rain gauge:
  - o PLUVIO 0.2MM
  - o PLUVIO 0.1MM
- VAISALA WAA252
- MET ONE
- 

### Wind vanes

There are two specific channels for wind vanes with potentiometer, two digital wind vanes and 5 channels configured for wind vanes.

- NRG 200P

- ORNYTION 207
- YOUNG:
  - o 03001
  - o 05103
- VECTOR W200P
- RISO
- THIES:
  - o FIRST CLASS
  - o COMPACT
  - o GRAY CODE 7 or 8 BITS (DIGITAL WINDVANE)
- VAISALA
- METONE
- FRIEDRICHS
- CLIMATRONICS
- GENERICA

## Analog Sensors

There are 5 analog channels, and 8 extra analog channels to connect different types of sensors with an analog signal. (E.g. temperature, humidity, pressure, etc.) These channels supply a voltage between 0 and 5 volt. The logger has the following sensors pre selected:

Voltage type sensors: The logger can store tensions between 0 and 5 volt.

Temperature sensors:

- o EOL 307
- o YOUNG 41342
- o NRG 110S
- o GALLTEC
- o VAISALA HMP45A
- o ROTRONIC

Wind vanes:

- Here you can declare up to 5 wind vanes (all the above mentioned models, except the Gray code)
- - o NRG 200P
  - o ORNYTION 207
  - o YOUNG:
    - 03001
    - 05103
  - o VECTOR W200P
  - o RISO
  - o THIES:
    - FIRST CLASS
    - COMPACT
  - o VAISALA
  - o METONE
  - o FRIEDRICHS
  - o CLIMATRONICS
  - o GENERICA

- Analog anemometers: For example vertical wind speed anemometers like the Young Propeller 27105T and 27106T, that gives you a frequency signal proportional to the wind speed.
  - o YOUNG Propeller 27106
  - o YOUNG Propeller 27105
  - o THIES ULTRASONIC:
    - COMPONENTE X
    - COMPONENTE Y
    - COMPONENTE Z
- Pressure sensors:
  - o SETRA 276 (800-1100 MB, VOUT:0.1-5.1V)
  - o VAISALA
  - o NRG BP20
- Humidity sensors:
  - o GALLTEC
  - o VAISALA HMP45HR
  - o ROTRONIC
- Solar radiation:
  - o KIPP & ZONNEN:
    - CM6B
    - CM3
  - o DAVIS 7821
- Noise:
  - o CESVA
  - o BRUEL KJAER
- Pollution:
  - o BIELER LANG

## Glossary

|                                |  |
|--------------------------------|--|
| <b>Aerodynamic</b>             | Aerodynamics is a branch of dynamics concerned with studying the motion of air, particularly when it interacts with a moving object  |
| <b>Wind turbine</b>            | A wind turbine is a rotary device that extracts energy from the wind.  |
| <b>AFA</b>                     | Update Firmware Wirelessly. You can update the firmware in the data logger through telemetry.  |
| <b>Anemometer</b>              | An anemometer is a device for measuring wind speed, and is a common weather station instrument.  |
| <b>Dead band</b>               | Electrically the linear potentiometer element in a wind vane does not cover a full 360°. This "open" area is the dead band of the wind vane.   |
| <b>APN</b>                     | Access Point Name: is the link between the GPRS and the Internet. This is the access point so the data logger can be ONLINE.   |
| <b>Area</b>                    | Field where you should define the area code of where the data logger has been installed. (E.g. SIT301201)  |
| <b>Buffer</b>                  | Buffer for the Exchange of data between two devices  |
| <b>CDMA</b>                    | Code division multiple access (CDMA) is a channel access method used by various radio communication technologies. It is used in mobile communications using the U.S. standard (IS 95) in the frequency range between 800 and 1,900 MHz |
| <b>Decrypt</b>                 | Encryption is the process of transforming information using an algorithm to make it unreadable to anyone except those possessing a special password.   |
| <b>Coverage</b>                | Numerical value that indicates the quality of the network coverage. It ranges from 0 to 33dB in GSM modems and 0 to 5db on Satellite Modems.   |
| <b>Gray code</b>               | Binary code or Gray code is a binary numeral system where two successive values differ in only one of its digits.  |
| <b>Satellite communication</b> | In satellite communications, electromagnetic waves are transmitted through the satellites placed in orbit around the Earth. This allows for full coverage without the GSM networks.  |
| <b>A/D converter</b>           | Device for translating an analog signal into a digital signal for further processing.  |
| <b>CPU</b>                     | The central processing unit (CPU) is the portion of a computer system that carries out the instructions of a computer program, and is the primary element carrying out the computer's functions  |
| <b>CSD</b>                     | Circuit Switched Data: Service circuit switched data is used in the GSM networks. Using CSD connection allocates transmission space during the time of connection, whether or not data is sent   |
| <b>Power Curve</b>             | The power curve of a wind turbine is a chart showing what the electrical power output for the turbine is at different wind speeds.   |
| <b>Data logger</b>             | A system for acquiring data  |
| <b>Decode</b>                  | Restore data from a coded state into a decoded state using a password.   |
| <b>Standard Deviation</b>      | Statistical parameter used to calculate the turbulence intensity.  |
| <b>EEPROM</b>                  | Electrically-Erasable Programmable Read-Only Memory: It is a type of ROM   |

|                                  |  |
|----------------------------------|--|
|                                  | memory that can be programmed, erased and reprogrammed electrically  |
| <b>Hall effect</b>               | The Hall effect is the production of a voltage difference (the Hall voltage) across an electrical conductor, transverse to an electric current in the conductor and a magnetic field perpendicular to the current. Examples of a sensor with Hall Effect is NRG 40H and the Ornytion 107H                                  |
| <b>Encryption</b>                | Procedure to encode information in a way so it can be transmitted without danger of being intercepted or altered before it reaches its destination.  |
| <b>Wind Energy</b>               | Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity.   |
| <b>Fiber Optics</b>              | Optical fiber is a transmission medium commonly used in data networks, a very fine line of transparent material, glass or plastics, through which are sent light pulses representing data.   |
| <b>Firmware</b>                  | This is the program or set of instructions, which manages the operation of an electronic device through a microprocessor.  |
| <b>FIX</b>                       | Valid coverage by GPS.   |
| <b>Synchronous generator</b>     | The synchronous generator is a type of rotating electric machine capable of transforming mechanical energy (in the form of rotation) into electrical energy. Examples of this type of synchronous generators are NRG40 anemometers and the Ornytion107.  |
| <b>GPRS</b>                      | General Packet Radio Service. Communication system using a packet switching network that operates in the GSM infrastructure.   |
| <b>GPS</b>                       | Global Positioning System  |
| <b>GSM</b>                       | Global System Mobile. It is the most popular standard for mobile telephony systems in the world.   |
| <b>IEC61400</b>                  | International Standard with recommendations on wind assessment procedures  |
| <b>Turbulence Intensity (TI)</b> | The turbulence in the wind, as in any other fluid, are the variations of speed and direction in flow in a time scale due to the influence of obstacles on the ground, buildings, forests, terrain and soil warming. The turbulence intensity is calculated by dividing the standard deviation with the average wind speed. |
| <b>INET</b>                      | The logger has connected through the use of an APN.  |
| <b>IP</b>                        | IP Internet Protocol   |
| <b>LNS</b>                       | Logger Name Server   |
| <b>Location</b>                  | Field where you should define the area code of where the data logger has been installed. (E.g. SIT301201)  |
| <b>MMC</b>                       | Multi Media Card: A type of memory card  |
| <b>MODBUS</b>                    | Modbus / TCP is a communication protocol designed to allow industrial equipments such as programmable logic controllers (PLCs), computers, motors, sensors, devices and other physical input / output to communicate over a network. It is a protocol used in most SCADA systems.  |
| <b>MODEM</b>                     | A modem is a device used to send a signal and allows communication between devices.  |
| <b>ONLINE</b>                    | The logger has now connected to the LNS (Logger Name Server)   |
| <b>Pyranometer</b>               | Sensor used to measure the solar radiation.  |

|                           |  |
|---------------------------|--|
| <b>Potentiometer</b>      | A resistor whose resistance value can be adjusted. Thus, indirectly, you can control the intensity of current flowing through a circuit when connected in parallel   |
| <b>Precision</b>          | Ability of an instrument to give the same result in different measurements performed on the same terms.  |
| <b>Push-pull</b>          | A push-pull output is a type of electronic circuit that can drive a positive or negative electric current. Examples of such are the Thies First Class anemometer and the Vector A100LK.  |
| <b>Reed contact</b>       | This is an electrical switch activated by a magnetic field. Examples are the RISO P2456 and the Vector A100R.  |
| <b>Resolution</b>         | The resolution of a sensor is the smallest change in input variable that can be seen in the output variable. However, the accuracy is the maximum expected error on the average.   |
| <b>Wind rose</b>          | A graphical representation used to show the prevailing wind directions at the sites.   |
| <b>RS-232 serial port</b> | RS-232 (Recommended Standard 232, also known as Electronic Industries Alliance RS-232C) is an interface that sets a standard for serial binary data interchange between a DTE (Data Terminal Equipment) and DCE (Data Communication Equipment)   |
| <b>Digital Output</b>     | Programmable outputs in the logger to activate or deactivate certain external devices.   |
| <b>SCADA</b>              | This system acts as a 'nerve centre' for the project. It connects the individual turbines, the substation and meteorological stations to a central computer. This computer and the associated communication system allow the operator to supervise the behavior of all the wind turbines and also the wind farm as a whole.  |
| <b>Sensor</b>             | A sensor is transforming physical measures into electrical signals.  |
| <b>SMS</b>                | Short Message System: Service available in the GSM network that allows the exchange of written messages between terminals.   |
| <b>TCP/IP</b>             | TCP/IP Transmission Control Protocol / Internet Protocol.  |
| <b>Sampling time</b>      | This is the time duration associated to every element -sample- of the set of readings used to calculate and record the standard deviation. The Eol Zenith samples are one second average for anemometers and one second samples for analog sensors. This affects to turbulence calculations. The IEC Standard sets minimum sampling time at 1 second. ( $\geq 1$ Hz) |
| <b>Time out</b>           | Length of time set as the limit for a particular transaction.  |
| <b>Turbulence</b>         | In fluid dynamics, turbulence or turbulent flow is a fluid regime characterized by chaotic, stochastic property changes  |
| <b>Ultrasonic</b>         | Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor.   |
| <b>UTC</b>                | Coordinated Universal Time: s a time standard based on International Atomic Time.  |
| <b>Wind vane</b>          | A weather vane is an instrument for showing the direction of the wind.   |
| <b>Weibull</b>            | Used to calculate a general pattern of variations in wind speed. In probability  |



theory and statistics, the Weibull distribution is a continuous probability distribution.

**Wind farm**

This is a communication module for the logger, letting you access the data in the logger directly from a SCADA system (MODBUS).



## WARRANTY

There is a warranty on defects in materials and workmanship. This warranty is valid for a period of 24 months from the date of delivery. The products will be repaired or replaced if found defective during the warranty period. The warranty will not apply if the equipment has been modified or altered without authorization from Kintech Engineering or if the equipment has been used with negligence, if there has been improper use, or it has been subjected to excessive mechanical stress. Nor will the warranty cover if the logger has suffered high voltage tensions (Either lightning as a natural phenomena or electrical charges from improper handling or connection of the equipment) that may have damaged the equipment or any of its channels. Kintech Engineering does not reimburse expenses incurred for the repair or the reinstallation of the equipment and do not accept any responsibility for any damage caused by the above mentioned points.

All loggers are thoroughly tested before shipping and are subject to a thorough quality control of all its channels. The data logger is subject to stringent quality controls at various stages of the manufacturing process. This quality test is automated which provides extra reliability.

For any questions, please contact us on one of the below mentioned email address, or by phone. Contact details can also be found on our website [www.Kintech-engineering.com](http://www.Kintech-engineering.com)

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Email: [support@Kintech-engineering.com](mailto:support@Kintech-engineering.com)

Tel. +34 976 221 789

Fax. +34 976 158 079

## QUALITY CONTROL INSPECTION

The datalogger manufacturing process is performed under strict quality control procedures. In addition every logger is inspected before shipment. The inspection covers all input channels, power supply terminals for sensors, communications, GPS positioning, external memory, display and keypad.

The individual inspection of every logger covers the following features:

- The logger connects to the LNS servers through internet
- GPS positioning indication on display according to logger coordinates
- Logger indicates "Power ON reset" as the only faulty status
- Check instant readings for individual anemometer channels (1-10) at 0 Hz, 1.2 Hz, 12 Hz, 31 Hz, 59 Hz and 98 Hz
- Check threshold pulse voltage for every anemometer input at 80mV
- Check individual wind vane channels (1, 2) instant readings at 0°, 72°, 180°, 288° and 356°
- Check individual analog channels (anl1-5, anx1-8) instant readings at 0V, 1 V, 2.5V, 4V and 5V
- Check individual digital channels (1, 2) instant readings at 256 and 231

Every time a logger is sent to Kintech for service, it is inspected according to the previous procedure before shipping.



# EC Declaration of Conformity

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Address: C/Marceliano Isabal, 3 50004 Zaragoza SPAIN

Tel +34 976 221 789 · e-mail: sales@Kintech-engineering.com

Type of equipment: Information technology equipment (data logger)

Model: EOL ZENITH

The undersigned does hereby declare that the equipment complies with the following Directives

**-IEC 60950-1 : 2007 - Information technology equipment – Safety part 1: general requirements**

**-ETSI EN 301489-1V1.8.1 Electromagnetic compatibility and Radio Spectrum Matters (ERM);Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.**



Inigo Vazquez  
Technical Manager  
Kintech Ingenieria SL

29<sup>th</sup> July 2010



# USER'S GUIDE

EOL ZENITH DATA LOGGER, EOL MANAGER, EOL CHARTING



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