



USER GUIDE

ORBIT 360

Index

Index	1
List of figures	9
List of acronyms	16
1 General user information	17
1.1 Contact information.....	17
1.2 Warranty and liability.....	18
1.3 About this user manual	19
1.4 Product disposal	19
1.5 Getting help	19
2 Introduction.....	21
2.1 About Orbit 360	22
2.1.1 Orbit 360 Basic Plus.....	23
2.1.2 Orbit 360 Premium	23
2.2 Order options and accessories	24
2.2.1 Data loggers.....	25
2.2.2 Kintech SIM cards	26
3 Quick start	28
3.1 How to get an Atlas license / Atlas software	28
3.2 System requirements.....	28
3.3 How to setup your Orbit data logger.....	28
3.3.1 Main dashboard.....	28

3.3.2	General settings.....	29
3.3.3	Channels settings	29
3.3.4	Communication settings.....	29
3.3.5	Scheduled download settings	29
3.4	Upload settings	29
3.4.1	SD memory card inserted into the PC	30
3.4.2	SD card inserted into the data logger.....	30
3.5	How to operate Orbit data logger in field	31
3.6	How to download data from an Orbit data logger	31
4	System overview	33
4.1	General aspects.....	34
4.1.1	Sampling rate	34
4.1.2	Averaging period and timestamp	34
4.1.3	Basics about data management for Kintech loggers.....	34
4.1.4	Configuration changes becoming effective	35
4.1.5	Logger reset.....	36
4.1.6	Internal tilt sensor	36
4.1.7	Thirty-second turbulence Intensity calculation (TI30)	36
4.1.8	Working with digital serial instruments	38
4.2	Component map	40
4.2.1	Display	40
4.2.2	Keypad	40

4.2.3	LED indicators.....	41
4.2.3.1	Modem (red LED).....	41
4.2.3.2	CPU (green LED)	41
4.2.3.3	GPS (blue LED).....	41
4.2.4	External battery	41
4.2.5	Grounding terminal.....	42
4.2.6	Modem	42
4.2.7	GPS.....	44
4.2.8	RTC.....	44
4.2.9	TCP connector	44
4.2.10	MMC card slot	45
4.2.11	SIM card slot	45
4.3	Logger terminals	45
4.4	Alarms and actuators.....	54
4.5	Atlas desktop software	56
4.5.1	Atlas Free	56
4.5.2	Atlas Professional.....	56
4.5.3	Atlas Enterprise	57
5	Technical specifications	58
5.1	Operation conditions.....	58
5.2	Absolute maximum ratings.....	58
5.3	Technical specifications: outputs.....	60

5.4	Technical specifications: input channels	62
5.4.1	Frequency / Counters channels	62
5.4.2	Analog channels	65
5.5	Communication / Protocols	67
5.6	Data collection and storage	69
5.7	One-second data and FTP	70
5.7.1	Requirements	70
5.7.2	FTP	71
5.7.3	Data access	71
5.7.4	Python script	71
5.7.5	Download speed	72
5.7.6	Display/Atlas Realtime	72
5.7.7	Reports	73
5.7.8	Storage structure	73
5.7.9	Data format	73
5.7.10	Ethernet board firmware update	74
5.8	Emergency power saving mode	75
5.9	Internal backup batteries	77
5.10	Physical characteristics	79
6	Installation	80
6.1	Preparation	81
6.2	Configuration	82

6.3	Grounding.....	82
6.4	Antennas.....	84
6.5	Sensor connection	85
6.6	Powering on the logger.....	85
7	On-site operations	87
7.1	Using the keypad.....	87
7.2	Turning off the logger	88
7.3	Using the display	88
7.3.1	Upper information bar	89
7.3.2	Lower information bar	91
7.4	Parameter edit mode	92
7.5	Navigation menus on logger display	93
7.5.1	QUICK VIEW.....	95
7.5.2	FREQUENCY 1-16	95
7.5.3	ANALOG 1-8.....	96
7.5.4	ANALOG 9-23.....	96
7.5.5	STATUS	97
7.5.5.1	Logger status	97
7.5.5.2	Modem.....	100
7.5.5.3	Serial channels	101
7.5.5.4	Modbus	101
7.5.5.5	GPS location	102

7.5.5.6	Power supply	103
7.5.5.7	System info	104
7.5.6	CONFIGURATION	106
7.5.6.1	Modem type	106
7.5.6.2	Modbus RTU	107
7.5.6.3	Area number	108
7.5.6.4	Location number	109
7.5.6.5	Tower number	110
7.5.6.6	Num 1 2	110
7.5.6.7	Num 3 4	111
7.5.6.8	Language	111
7.5.6.9	Flags configuration	112
7.5.6.10	Mode	112
7.5.7	SENSOR MODEL	112
7.5.8	TIME & DATE	117
7.6	On-site logger configuration via SD card	118
7.7	Changing the SIM card (PIN code)	119
7.8	Sensor replacement	120
7.9	Downloading from SD card	121
8	Data security	124
8.1	Orbit passwords	124
8.2	Atlas passwords	124

9 Communication options	125
9.1 GSM/GPRS	125
9.1.1 Internet	125
9.1.1.1 Logger Name Server (LNS)	126
9.1.1.2 Kintech Global Internet SIM cards	127
9.1.2 Modem call (CSD)	128
9.1.3 SMS	129
9.1.4 Email	131
9.2 Satellite	133
9.2.1 Iridium	133
9.2.1.1 Characteristics	134
9.2.1.2 Installation (logger side)	135
9.2.1.3 Installation (office side)	137
9.2.2 BGAN	137
9.2.2.1 Characteristics:	138
9.2.2.2 Installation (logger side)	139
9.2.2.3 Installation (office side)	140
9.3 Direct COM	140
9.4 Troubleshooting	141
9.5 Internet troubleshooting	141
9.5.1 Selection of GSM frequency band	145
9.6 Satellite troubleshooting	145

9.7 Email troubleshooting	146
10 SCADA.....	148
10.1 Modbus configuration.....	148
10.2 Modbus RTU troubleshooting	154
10.3 Modbus types	156
10.4 Modbus TCP.....	159
11 Atlas Charting Tool	160
11.1 Overview	160
11.2 Time Series	161
11.3 Wind Roses	163
11.4 Correlations.....	164
11.5 Polar Charts.....	164
11.6 Distribution.....	165
11.7 Directional Analysis.....	166
11.8 Turbulence Intensity.....	166
11.9 Wind shear.....	167
11.10 Energy Output	168
12 Regulatory Compliances.....	169
12.1 Applicable European Directives	169
12.2 FCC Compliance	169

List of figures

Fig. 1.	Included items along with the Orbit 360 data logger	25
Fig. 2.	Global Internet SIM Card	27
Fig. 3.	Where to find Orbit 360 serial number	33
Fig. 4.	Understanding the data management system	35
Fig. 5.	Turbulence Intensity by the classic Standard 61400-12.....	37
Fig. 6.	Turbulence Standard by the new model.....	38
Fig. 7.	Example of serial instrument mapping	39
Fig. 8.	Orbit 360 component map.....	40
Fig. 9.	External battery connector	41
Fig. 10.	GPS and GSM antenna connectors	43
Fig. 11.	Ethernet port of the Orbit 360 data logger	44
Fig. 12.	Orbit 360 removable terminals.....	46
Fig. 13.	Orbit 360 terminal map drawing.....	47
Fig. 14.	Emergency power saving mode.....	76
Fig. 15.	Microswitch to select alkaline (ALK) or Lithium (Li) internal batteries .	78
Fig. 16.	Hanging brackets dimensions (horizontal position)	80
Fig. 17.	Hanging brackets dimensions (vertical position)	81
Fig. 18.	How to ground the logger	84
Fig. 19.	GSM antenna.....	84
Fig. 20.	GPS antenna	84

Fig. 21.	Antenna connectors in Orbit 360	85
Fig. 22.	Orbit 360 keypad	87
Fig. 23.	Orbit 360 display.....	88
Fig. 24.	Memory being accessed icon	90
Fig. 25.	Logger site ID number	90
Fig. 26.	Logger data and time	91
Fig. 27.	GPS status.....	91
Fig. 28.	RS485 communication status indicator	92
Fig. 29.	Modbus status indicator	92
Fig. 30.	Edit mode (sensor model)	93
Fig. 31.	Orbit 360 main menu view (1)	94
Fig. 32.	Orbit 360 main menu view (2)	94
Fig. 33.	Orbit 360 main menu view (3)	94
Fig. 34.	QUICK VIEW screen.....	95
Fig. 35.	FREQUENCY 1-10 screen	95
Fig. 36.	ANALOG 1-8 screen.....	96
Fig. 37.	STATUS screen: Logger Status.....	97
Fig. 38.	STATUS screen: modem.....	100
Fig. 39.	STATUS screen: Serial Channels	101
Fig. 40.	STATUS screen: Modbus	101
Fig. 41.	STATUS screen: Site Coordinates	102
Fig. 42.	STATUS screen: Power supply	103

Fig. 43.	STATUS screen: System info	104
Fig. 44.	Configuration menu	106
Fig. 45.	Configuration: Modem types	107
Fig. 46.	Configuration: Modbus RTU.....	108
Fig. 47.	Configuration: Area number	109
Fig. 48.	Configuration: Location number	109
Fig. 49.	Configuration: Tower number	110
Fig. 50.	Configuration: Num 1 2	110
Fig. 51.	Configuration: Num 3 4	111
Fig. 52.	Configuration: Language.....	112
Fig. 53.	Sensor model.....	112
Fig. 54.	Time & Date configuration screen	117
Fig. 55.	Uploading settings to a SD memory card connected to your PC	119
Fig. 56.	How to take out the SD card	121
Fig. 57.	Display: checking memory card.....	122
Fig. 58.	Display: storage cycle instructions	122
Fig. 59.	Display: new storage cycle screen	122
Fig. 60.	Display: old storage cycle continues	123
Fig. 61.	Downloading data from the SD card	123
Fig. 62.	Logger Name Server (LNS)	126
Fig. 63.	Kintech global SIM card.....	128
Fig. 64.	Iridium modem.....	134

Fig. 65. Satellite: Iridium	135
Fig. 66. Iridium antenna for satellite connection.....	136
Fig. 67. Iridium satellite connection diagram (logger side).....	136
Fig. 68. Iridium satellite connection diagram (office side).....	137
Fig. 69. BGAN satellite modem (logger side).....	138
Fig. 70. Satellite: BGAN.....	139
Fig. 71. Direct COM terminals: 44 and 43.....	139
Fig. 72. Iridium satellite connection diagram (logger side).....	140
Fig. 73. Direct COM terminals: 44 and 43.....	140
Fig. 74. Logger display: logger showing “GSM”	142
Fig. 75. Logger display: status > modem > e04 (logger online)	142
Fig. 76. Selection of Modbus variables to be transmitted	149
Fig. 77. Example of Modbus variables addresses	150
Fig. 78. Several loggers using a shared communication line	151
Fig. 79. ModScan configuration (Office test for Modbus RTU)	156
Fig. 80. Example configuration for Modbus TCP	159
Fig. 81. Atlas Charting Tool: Overview.....	161
Fig. 82. Atlas Charting Tool: Time Series.....	162
Fig. 83. Atlas Charting Tool: Time Series – Wind Vane Options.....	162
Fig. 84. Atlas Charting Tool: Time Series – Battery voltage.....	163
Fig. 85. Atlas Charting Tool: Wind Roses	163
Fig. 86. Atlas Charting Tool: Correlations.....	164

Fig. 87.	Atlas Charting Tool: Polar Charts.....	165
Fig. 88.	Atlas Charting Tool: Distribution	165
Fig. 89.	Atlas Charting Tool: Directional Analysis	166
Fig. 90.	Atlas Charting Tool: Turbulence Intensity.....	167
Fig. 91.	Atlas Charting Tool: Wind shear.....	168
Fig. 92.	Atlas Charting Tool: Energy Output.....	168

List of tables

Table 1. Orbit 360 capabilities	23
Table 2. Orbit 360 order codes.....	25
Table 3. Orbit 360 terminals grouping.....	47
Table 4. Orbit 360 terminals description	53
Table 5. Electrical specifications: inputs	59
Table 6. Operating temperature range.....	59
Table 7. Electrical specifications: outputs	62
Table 8. Frequency channels: characteristics	65
Table 9. Analog channels: characteristics	67
Table 10. Communication capabilities of the Orbit 360 data logger	69
Table 11. Data collection characteristics	70
Table 12. Emergency power saving mode.....	76
Table 13. Internal Lithium backup batteries: characteristics.....	77
Table 14. Internal alkaline backup batteries: characteristics	77
Table 15. Physical characteristics.....	79
Table 16. Keypad key functions	87
Table 17. Display: battery status	89
Table 18. Display: communication status	91
Table 19. Logger status: error code number	99
Table 20. Code number for logger model.....	105
Table 21. Configuration: modem types	107

Table 22. Configuration: Modbus RTU..... 108

Table 23. Configuration: language 112

Table 24. Sensor model: frequency channels 114

Table 25. Sensor model: analog channels..... 117

Table 26. State machine: communications (GSM/GPRS) 143

Table 27. State machine: communications (GSM/GPRS) II 144

Table 28. Modbus RTU types and baudrates..... 151

Table 29. Typical Modbus configuration 154

List of acronyms

APN: Access Point Name

BGAN: Broadband Global Area Network

CPU: Central Processing Unit

CSD: Circuit Switch Data

ESD: Electrostatic Discharge

FW: Firmware

FSM: Finite State Machine

HW: Hardware

GPRS: General Packet Radio Service

GSM: Global System Mobile

IP: Internet Protocol

IRDM: Iridium

LED: Light-Emitting Diode

LNS: Logger Name Server

PSTN: Public Switched Telephone Network

SMS: Short Message System

USB: Universal Serial Bus

UTC: Coordinated Universal Time

V: Volts

WGS 84: World Geodetic System 1984

WRA: Wind Resource Assessment

1 General user information

Thank you for purchasing the Orbit 360. Our toughest and smartest data logger as of today. Designed for industry professionals in wind & solar resource assessment.

Kintech Instruments products are in continuous development. Specifications may be subject to change and design improvements. We invite you to sign up to our newsletter and get the latest news and important updates about the Orbit 360 data loggers and other Kintech products.

1.1 Contact information

If you have any questions about the use of the Orbit 360 data logger, please have a look at this user manual. If you cannot find answer to your question in this user manual, feel free to contact either our main office or your contact person in Kintech Instruments for assistance.

To find the contact information for your contact person in Kintech Instruments you can go to: <https://www.kintech-engineering.com/about/>

You may also contact us for technical support through our online chat from our website www.kintech-engineering.com

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1.2 Warranty and liability

All Kintech data loggers pass through a strict quality control to ensure their correct functioning. Every input and output are tested with an automatic quality control system that emulates the same signals generated by real sensors. The results of the quality control are delivered in paper together with the logger.

Kintech Instruments guarantees that the product delivered has been verified and tested to ensure that it meets the published specifications. In case of any manufacturing defect, the product will be repaired or replaced within the first 24 months after the delivery date.

The warranty will not apply if the equipment has been modified or altered without authorization from Kintech Instruments or if the damage is caused by improper installation, intentional damages or external influences e.g., lightning exposure, heavy icing condition or mechanical stress due to inadequate handling. It also excludes, and Kintech Instruments shall not be liable for, any incidental or consequential damages caused by or related to the use of, inability to use or malfunction of this product.

Kintech Instruments does not reimburse expenses incurred for the repair or the reinstallation of the equipment and does not accept any responsibility for any damage caused by the above-mentioned points.

Remark:

For the transport of device, please use the original packing.

1.3 About this user manual

Copyrights reserved by Kintech Instruments. Making copies of whole or parts of this document without permission from Kintech is prohibited.

This manual was last modified: 05.07.2024.

Should you have any comments on the product or this manual we will be pleased to receive them at: support@kintech-engineering.com.

1.4 Product disposal

In accordance with European directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), these product components must be recycled. This should be done by returning the product to Kintech Instruments or by using an appropriate waste disposal company. This product should not be disposed of in general waste of landfill.

1.5 Getting help

If you have any questions about your Orbit 360 data logger or any other Kintech products we encourage you to first have a look at the product documentation available in kintech-engineering.com.

If you cannot find the answer, contact your closest Kintech office from the listed in section 1.1.

When possible, the most effective way to provide technical support is via email.

When asking for technical support, please provide in advance the following information and files:

- Customer name.
- Serial number of the product.
- Detailed description of the problem, including the events that took place leading up to the issue.
- The settings exported file (.sit file).
- When sending us downloaded data you would like us to analyze, please provide the .log file (raw data), the .txt file (metadata about the logger events and the download), together with the .sit file.

Please be aware that any failure to comply with the above list will hamper troubleshooting.

2 Introduction

At Kintech Instruments we develop and manufacture segment leading data acquisition systems and sensors for wind & solar resource assessment. Our systems are used globally by industry professionals to acquire high accuracy data for optimal project development.

The Orbit 360 data logger is an evolution on our already proven logger technology (used since the year 2000). Beside it being easier than ever to configure and install, it brings several new significant features for more flexibility and for even further enhanced reliability. The Orbit 360 data logger is designed for industry professionals who is looking for a “top of the class” data logger specifically intended for wind & solar resource assessment.

The Orbit 360 includes a new Ethernet port and is now fully compatible with RS485 smart sensors. Reliability and usability are key elements for a successful measurement campaign. Which is why Orbit 360 includes expanded redundant memory, fail-safe power plug and a new powerful internal lithium backup battery that, in combination with the new “smart power management”, ensure “emergency” autonomy for up to 100 days* when the external power supply is interrupted.

The technology in use combined with our expertise in advanced technical support, as well as our comprehensive understanding of anemometry makes for a compelling product offering and a segment leading solution for our international customers.

The Orbit 360 data logger is tested by a strict quality control system throughout the production process, including all its modules, inputs and outputs. The SD memory card is delivered by default and is industrial grade, very robust and appropriate for harsh environments. The SD card has been tested and is blank (except otherwise specified by the client) and contains no saved information or any initial set up.

We thank you for trusting Kintech Instruments products.

** The real consumption of the system depends to a large extent on the sensors connected to the logger, which have very different consumptions depending on their specifications. When estimating the autonomy of the batteries, the consumption of the sensors must be*

taken into account. If there are or may be low battery problems, it is highly recommended to use the modem on/off management and, in critical cases, to disable all digital channels.

2.1 About Orbit 360

The Orbit 360 data logger currently include two models: each with different capabilities. The below table summarizes what features every model has.

	Basic Plus	Premium
Frequency channels (pulse counters)	10	10*
Analog channels (voltage)	15	15
RS485 connectivity (for digital instruments)	N/A	😊
Virtual channels (for digital instruments)	N/A	14
Total number of channels	25	39
Alarms and actuators	N/A	😊
Integrated Modbus RTU (RS485)	N/A	😊
Integrated Modbus TCP (Ethernet)	N/A	😊
Atlas Mobile App	😊	😊
Averaging time	1, 5, 10	1, 5, 10
Internal backup memory	😊	😊

High-capacity internal backup batteries	😊	😊
Global Internet SIM card (one year included)	😊	😊
2G/3G built-in modem	😊	😊
Built-in GPS	😊	😊
Compatible with Iridium satellite communication	😊	😊
Compatible with BGAN satellite communication	😊	😊
1-second data storage	N/A	😊

Table 1. Orbit 360 capabilities

*Up to 16 physical anemometers can be connected to the Orbit 360 Premium data logger by means of the [Frequency Channel Expander](#).

2.1.1 Orbit 360 Basic Plus

The Orbit 360 Basic Plus is our “mid-range” data logger model and can be used for some projects where there is no requirement for digital sensors or new features such as the alarms and actuators, connection to SCADA via Modbus RTU or Modbus TCP, Atlas Mobile, which are not available in this model. It

Frequency (FRQ) channels available on the Orbit 360 Basic Plus: FRQ 1 to 10.

Analog (ANL) channels available on the Orbit 360 Basic Plus: ANL 1 to 15.

2.1.2 Orbit 360 Premium

This is our Premium data logger with all the latest features from valuable feedback from our customers including RS485 connectivity, virtual channels to connect up to 14

digital instruments, alarms and actuators, connection to SCADA via Modbus RTU or Modbus TCP, Atlas Mobile etc. are only available on this Orbit 360 Premium model.

Frequency (FRQ) channels available on the Orbit 360 Premium: Channels 1 to 10, expandable up to 16 with the [Frequency Channel Expander](#).

Analog (ANL) channels available on the Orbit 360 Premium: Channels 1 to 15.

Extra channels for digital instruments: FRQ 11 to 16 and ANL 16 to 23.

2.2 Order options and accessories

The following section describe the order options currently available for the Orbit 360 data logger.

- The Orbit 360 Basic Plus can on request be upgraded to Premium.

To upgrade a data logger please contact our sales team.

Included in the box with every Orbit 360 data logger:

- Orbit 360 data logger (either Basic Plus or Premium).
- GSM antenna (2.6-meter cable).
- GPS antenna (1.5-meter cable).
- SD memory card (can be pre-configured on request).
- One screwdriver.
- A complete set of removable terminal plugs (13 in total).
- Internal backup battery (can be removed on request).
- 4 removable support brackets (already installed on logger).

Optional items:

- Global Internet SIM card.
- Extra backup batteries.



Fig. 1. Included items along with the Orbit 360 data logger

2.2.1 Data loggers

Item description	Order code
Orbit 360 Basic Plus (25 channels). See section 2.1.1.	LOORBITSTD
Orbit 360 Premium (39 channels). See section 2.1.2.	LOORBIT
Upgrade from Orbit 360 Basic Plus to Premium	LOUPSP

Table 2. Orbit 360 order codes

2.2.2 Kintech SIM cards

Having trouble getting local SIM cards that offer internet connection to your data loggers? Do you have unpredictable budgets for communication costs? Problems getting contracts with local GSM operators? Projects in several different countries?

Because of the extensive number of our customers with wind & solar measurement campaigns in several different countries, we know the difficulties to acquire local SIM cards with the optimal settings and local GPRS / 3G coverage.

The need for a more effective way to handle this has motivated our engineers to come up with a solution for a single SIM card that offers internet connection to your data loggers and works in practically all countries worldwide. A single SIM card that checks for all the available local GPRS / 3G signals and automatically connects to the operator with the best coverage. This has in many cases demonstrated to improve and simplify communications compared to conventional SIM cards that just work with a single operator.

Benefits with our new Global Internet SIM card:

- Internet connection to all your data loggers.
- One solution for all your sites.
- Automatically checks for best local GSM operator.
- No more talking to your local GSM provider.
- Cost effective. No monthly data plans. Fixed yearly costs.

Note: When placing your PO (purchase order) with us please mention that you would like have this SIM card included with your order. Sales conditions may vary.



Fig. 2. Global Internet SIM Card

The Kintech Instruments Global Internet SIM card is only and **exclusively for use with data loggers manufactured by Kintech Instruments** including EOL Zenith and Orbit 360.

CONFIGURATION

When configuring your Orbit 360 data logger in Atlas, use the following parameters for this SIM card:

APN name: m2mkt.movistar.es

APN Username: kintech

APN Password: kintech

If you are using our discontinued SIM card - purchased before Dec. 2016, please contact us directly on: m2m@kintech-engineering.com.

3 Quick start

The following section describe the essential steps in order to configure an Orbit data logger.

3.1 How to get an Atlas license / Atlas software

Please contact us on web@kintech-engineering.com to get the Atlas software and valid license.

3.2 System requirements

Operating System: Atlas is supported on Windows 7, Windows 8 and Windows XP with .NET Framework version 4.6.2 or later version installed.

MMC card reader: You need an MMC card reader for accessing the data on the MMC card from your PC and for configuring your data loggers with their settings.

Telephone connection or Internet access: If you are planning to connect to the data logger via a telephone MODEM or Internet*.

* We recommend connecting to the data logger via an internet connection. However, you can connect via a modem as well.

3.3 How to setup your Orbit data logger

All the settings for Orbit data logger are stored in a file with sit extension. This configuration file is created by using Atlas. When the configuration is done, upload the configuration file to the data logger.

3.3.1 Main dashboard

Go to the left side Menu > New site. This opens up a window. Select the data logger model and type its serial number. Then the Site window will be open. Configure all the settings for the first Orbit data logger.

There is an option to import an already prepared configuration file (.sit). Go to the left side Menu > Import sites and select the file to import.

3.3.2 General settings

Set the identification name and number for this site in order to make it easier to organize all the future wind measurement sites.

Choose the language to display in the data logger, fulfill the general and tower info, type notes, etc.

3.3.3 Channels settings

Setup all the sensors that are going to be connected to Orbit data logger as well as the data (Max., Min., Std. dev.) to be collected from each sensor. For now, choose the standard slope and offset, and later, adjust these values to the real values given on the individual calibration certificates.

3.3.4 Communication settings

Select the connection type and password of the data logger.

1. Internet: Fulfill the fields in case of using a different SIM M2M from Kintech. Otherwise leave the default configuration.
2. Select the passwords for accessing the data logger.

3.3.5 Scheduled download settings

Atlas can download data automatically. Select “Atlas should automatically connect to the logger and download data” and set the date and time for the next download. In the timetable below the upcoming events for auto download are shown.

3.4 Upload settings

The configuration of the first Orbit data logger now has been done. A .sit file has been created on Atlas and this file must be stored in the SD memory card (this SD card is later inserted in the data logger).

There are two ways to upload the configuration file to the SD memory card:

3.4.1 SD memory card inserted into the PC

1. Insert the SD memory card in the computer's MMC card reader. Go to Site window > Connections > Upload Settings or in the Atlas dashboard, right click on the data logger and select "Upload Settings".
2. Choose the option "SD Card" and click the "Start" button. A new window comes up and choose the MMC card unit.

Remarks:

1. MMC SD operations will work only if Atlas is launched with administrative privileges.
2. The logger must be **OFF** at the moment the SD cards is inserted, otherwise, the logger will ignore the new configuration and it will actually overwrite the MMC configuration with the one the logger is currently working with.
3. Configuring the SD card in this way overwrites existing data on the memory SD card.

3.4.2 SD card inserted into the data logger

If the data logger is turned ON and already communicating, please upload settings remotely via internet.

1. Go to Site window > Connections > Upload Settings or in the Atlas dashboard, right click on a logger and select "Upload Settings". Make sure the SD card is correctly inserted into the data logger.
2. Choose the option Internet and click the "Start" button.
3. Atlas will now upload the .sit file to the data logger volatile memory.

4. Orbit will store these settings on the next 1/5/10 minute recording. If the data logger is powered off before the next recording the uploaded settings will be lost.

3.5 How to operate Orbit data logger in field

Before installing the Orbit data logger in field, make sure that all settings are correct and that the e.g., internet connection has been thoroughly tested.

1. Install the data logger inside a weatherproof cabinet. Connect all the sensor cables to the data logger terminals. Keep a maximum clearance between the GSM antenna cable and sensor cables. Do not connect the battery to the 12V terminal yet.

2. Make sure that all the grounding shields from the sensors are thoroughly connected to ground.

3. Make sure the SD memory card is correctly inserted. The card is inserted gently with the metal connectors facing towards the right. Press the bezel down until you hear a “click”. The memory only has one possible position when inserted. Forcing the card may damage the internal connector of the logger or the card itself.

4. Check that all sensors are connected correctly.

5. Power on the data logger by connecting the orange battery plug into the data logger.

6. The data logger will now load the settings in the SD memory card and immediately start logging data. The display turns off automatically after a short while.

3.6 How to download data from an Orbit data logger

If Atlas is configured to automatically download data from the data logger, go directly to Site window > Others > Data management and check the data.

If it is not possible to wait for the automatically programmed download, there is an option to download data directly at any time “Download Now”.

1. Go to Site window > Connections > Download now or in the Atlas dashboard, right click on a logger and select “Download now”.

2. Assuming the data logger status is “ONLINE”, mark the “Internet”.

3. Click the “Start Button.”

4. The PC now connects to the data logger and downloads data directly.

How to do a Real Time connection to an Orbit data logger

If it is need to check the well-functioning of the Orbit data logger installed in field, there is an option to do a real time connection, “Real time”.

1. Go to Site window > Connections > Real time or in the Atlas dashboard, right click on a logger and select “Real time”.

2. Assuming the data logger status is “ONLINE”, mark the “Internet”.

3. Click the “Start Button.”

4. The PC now connects to the data logger and a new window will be opened.

5. Do not forget to Stop the connection when finish checking real time data.

4 System overview

The following section describe the essential of the Orbit 360 data logger.

The Orbit 360 data logger has the capacity to connect up to 10 frequency/pulses sensors, 15 voltage/potentiometer sensors and 24 RS485 sensors. The sampling rate is 1 Hz, complying with IEC 61400-12. Using the one-second data samples, the logger calculates the mean, standard deviation, maximum and minimum values of the averaging interval (user-configurable to 1, 5 and 10 minutes). Once calculated, the data is stored in its non-volatile memory (SD card).



Fig. 3. **Where to find Orbit 360 serial number**

4.1 General aspects

This section describes general aspects of the Orbit 360 data logger.

4.1.1 Sampling rate

The Orbit 360 data logger has the capacity to connect up to 10 anemometers or pulse-type sensors and 15 general-purpose analog channels. Every channel is sampled at a rate of 1Hz, complying with IEC 61400-12. Using these records, the logger calculates the mean value, the standard deviation, as well as the minimum and maximum of the period.

4.1.2 Averaging period and timestamp

Averaging period can be configured to 1, 5 or 10 minutes, the recordings are timestamped **at the end** of the period.

For instance, provided that the logger is configured to 10-min averaging intervals, it will calculate the average and all the other statistical data every minute 00, 10, 20, 30, 40 and 50 of every hour. Let's say the time is 00:20:00, at that moment the logger will calculate the average of the 600 readings between 00:10:00 and 00:20:00.

4.1.3 Basics about data management for Kintech loggers

Before configuring the first Kintech data logger it is need to know how the overall data management works:

1. The .sit file (configuration file) needs to be uploaded to the data logger through Atlas and not by copying the file to the SD card.
2. Atlas downloads the encrypted .log file from the data logger. The .log file contains all the raw data (volts and hertz stored from all the sensors connected to the data logger).
3. Atlas then automatically converts the .log file into .wnd file and .txt file using the active logger configuration file (also stored in Atlas).

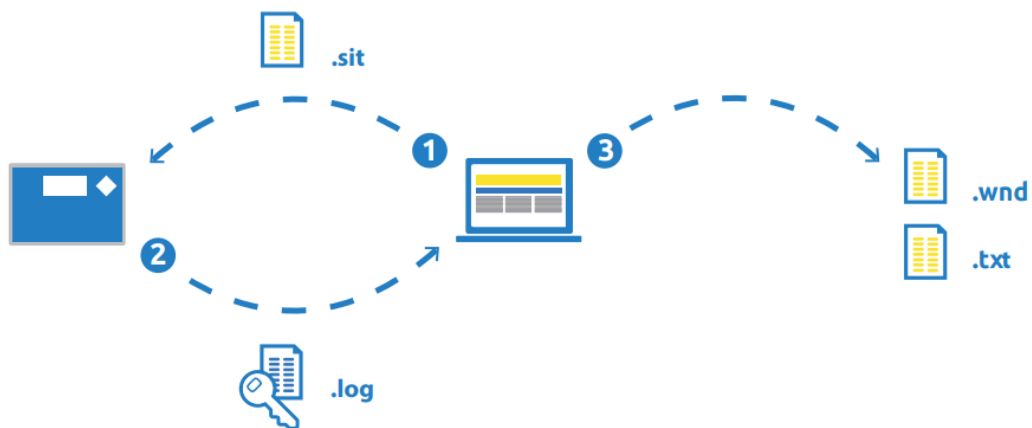


Fig. 4. Understanding the data management system

How does Atlas convert the .log file? When a data logger is set up in Atlas, the slope and offset are typed for the sensors that were going to be connected to that data logger. Atlas uses those slopes and offsets to convert the .log file. It's that simple.

Atlas also keeps a history of all the modifications in logger configurations. Why is that important? Well, say for example an anemometer has been replaced on one of the met masts two weeks ago. It is possible then to modify the configuration file in Atlas and manually convert/decode the last two weeks' raw data (the .log file) into new .wnd files.

4.1.4 Configuration changes becoming effective

Just when the logger receives the configuration from Atlas, it's stored in RAM (temporal volatile memory) and applied immediately.

However, the configuration will not be stored in the SD card (permanent, non-volatile memory) until the next 10 minutes period. If the logger is switched off before that 10-minute period, the configuration will be lost and will have to be uploaded again from Atlas or via keypad.

4.1.5 Logger reset

The Orbit 360 data logger has no reset button. To reset, just disconnect the battery power (the system keeps configuration and data in the internal memory).

If the data logger has internal emergency battery, this should also be disconnected or the keys combination pressed as shown in the data logger display when the battery power gets disconnected.

Just after the logger is turned on, the time and date of the recordings will be the one maintained by the internal RTC. Eventually that time and date will be updated as soon as the Orbit's GPS syncs once again.

4.1.6 Internal tilt sensor

The .txt report shows the tilt of the data logger, allowing for detecting met mast collapses. Provided the usual logger installation inside the cabinet, a 90° value means that the met mast is still standing.

4.1.7 Thirty-second turbulence Intensity calculation (TI30)

The Orbit 360 data logger, in addition to the classic 10-minute standard deviation, calculates the Turbulence Intensity every 30 seconds, (TI30), and saves every 10 minutes, the average of the twenty TI30 records inside a 10-minute 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 Charting 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 10-minute 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

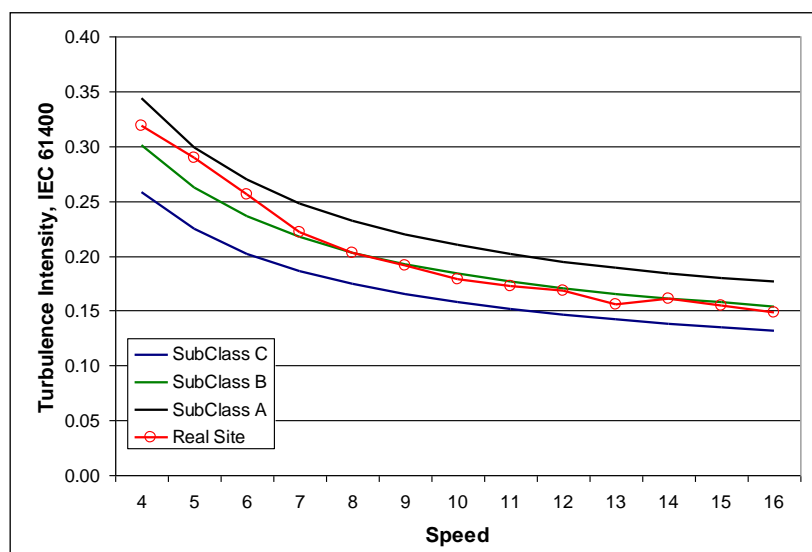


Fig. 5. Turbulence Intensity by the classic Standard 61400-12.

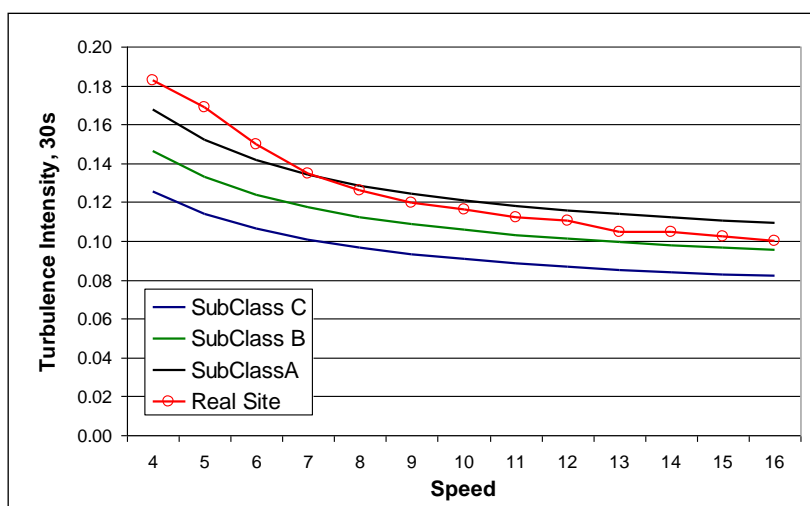


Fig. 6. Turbulence Standard by the new model

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.

4.1.8 Working with digital serial instruments

Some instruments provide the readings from the transducers through a serial communication port rather than through voltage or frequency coded signals: ultrasonic anemometers, Geovanes or a wide range of pyranometer are some of the most common digital instruments that can be connected to the Orbit 360 data logger.

This type of sensors usually provides more than one physical magnitude. For instance, an ultrasonic anemometer is able to provide horizontal wind speed, vertical wind speed, horizontal wind direction and temperature. Each time the ultrasonic instrument is polled, it sends 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.

The Orbit 360 has a dedicated firmware, code and memory space, (i.e. a “virtual” channel) per each physical input reading from these instruments. It will poll once per second through its serial port every digital sensor previously set up in the logger configuration.

The Orbit 360 processes every message from the serial input, according to the format specified by the type of sensor that matches that instrument. Then it associates every physical magnitude in the message to a virtual (not physical) input channel for frequency (FRQx) OR analog (ANLx). As a consequence, for those channels to which a serial instrument has been configured in Atlas, **the signal from the physical terminal will be ignored.**

In the example below, physical signals from ANL1, ANL2, ANL3, ANL9, ANL10... terminals are ignored as the virtual inputs are associated with one Geovane and five Thies First Class Advance X sensors connected to the RS-485 buses of the logger.

Analog channels / Serial instrument variables

ANL1 to ANL15 are used for connecting sensors with analog output or mapping serial instrument variables.
ANL16 to ANL23 are exclusively for mapping serial instrument variables.

	+ Channel	Sensor type	Sensor model		Height	
⌵	ANL1	Serial instrument	GV_SERIAL3_A	True North Orient.	110	A1_TN_1
⌵	ANL2	Serial instrument	GV_SERIAL3_A	Tilt X	110	A2_TX_11
⌵	ANL3	Serial instrument	GV_SERIAL3_A	Tilt Y	110	A3_TY_11
⌵	ANL4	Windvane	Output 0-5V: Thies TMR / K360V		110	A4_WD_1
⌵	ANL5	Windvane	Output 0-5V: Thies TMR / K360V		90	A5_WD_9
⌵	ANL6	Windvane	Output 0-5V: Thies TMR / K360V		70	A6_WD_7
⌵	ANL7	Temperature	K308TH		10	A7_TEM_1
⌵	ANL8	Relative Humidity	K308TH		10	A8_RH_10
⌵	ANL9	Serial instrument	TFCAX_SERIAL1_A	Pressure	110	A9_P_110
⌵	ANL10	Serial instrument	TFCAX_SERIAL1_A	TILT	110	A10_Tilt_110
⌵	ANL11	Serial instrument	TFCAX_SERIAL1_B	Pressure	110	A11_P_110
⌵	ANL12	Serial instrument	TFCAX_SERIAL1_B	TILT	110	A12_Tilt_110
⌵	ANL13	Serial instrument	TFCAX_SERIAL1_C	Pressure	100	A13_P_100
⌵	ANL14	Serial instrument	TFCAX_SERIAL1_C	TILT	100	A14_Tilt_100
⌵	ANL15	Serial instrument	TFCAX_SERIAL2_A	Pressure	90	A15_P_90
⌵	ANL16	Serial instrument	TFCAX_SERIAL2_A	TILT	90	A16_Tilt_90
⌵	ANL17	Serial instrument	TFCAX_SERIAL2_B	Pressure	70	A17_P_70
⌵	ANL18	Serial instrument	TFCAX_SERIAL2_B	TILT	70	A18_Tilt_70

Fig. 7. Example of serial instrument mapping

4.2 Component map

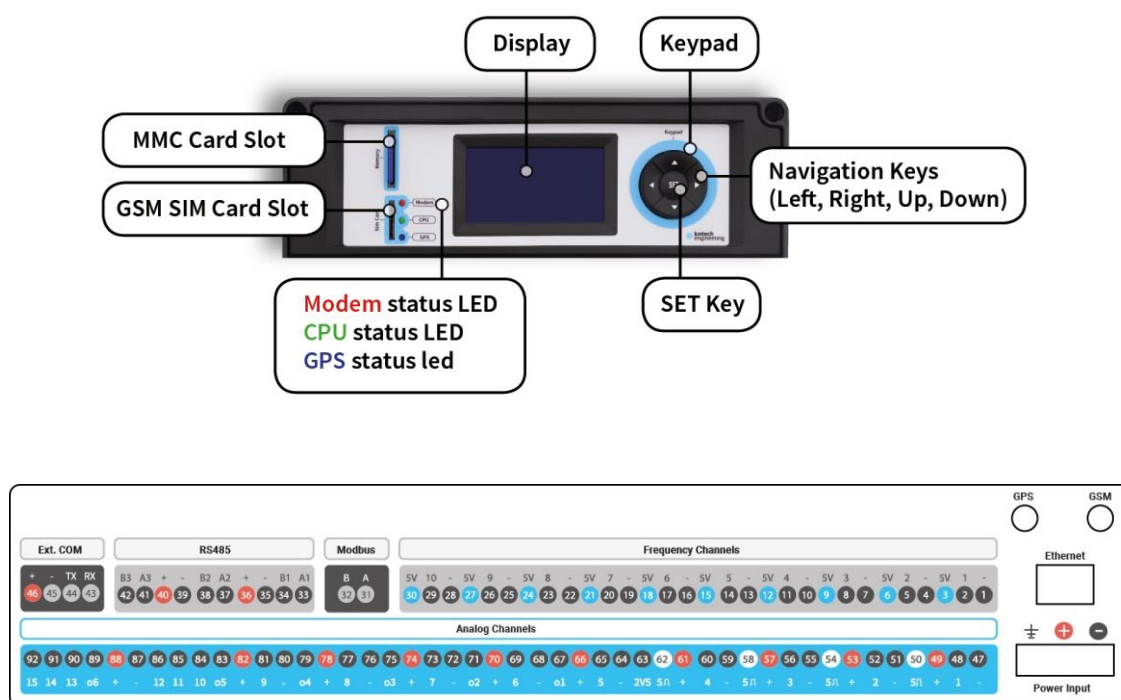


Fig. 8. Orbit 360 component map

4.2.1 Display

Thanks to the 128x44 LCD display of the Orbit 360 data logger, 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 warning messages with important information about an event or process. In order to save energy, the display will automatically switch off after three minutes since the latest access to the keypad. To switch it on again, press any key of the keypad.

4.2.2 Keypad

The keypad 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 their correspondent chapters.

4.2.3 LED indicators

The Orbit 360 features three LED indicators, located at the right of the SIM card slot.

4.2.3.1 Modem (red LED)

- LED indicator is off: the modem has no power.
- LED indicator is steady: the 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: the modem is correctly registered in the network and waiting for communication.

4.2.3.2 CPU (green LED)

- LED blinks once per second to indicate the CPU is running.
- LED indicator is steady when the display is ON.

4.2.3.3 GPS (blue LED)

- LED indicator is blinking: the logger has already obtained GPS fix and updated its, coordinates, date and time accordingly.

4.2.4 External battery

The Orbit 360 data logger works with an **external battery**. We recommend using a flotation (back-up) sealed lead-acid battery (12 VDC). This kind of battery has no maintenance and can be transported in any orientation.



Fig. 9. External battery connector

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... For instance, satellite modem consumption is two times higher than GSM, also, sites with low signal need more transmission power during telemetry sessions. The number of telemetry sessions a week or the number and type of sensors may influence as well. Other factors affecting electrical generation are latitude, solar radiation of the site and panel orientation. We recommend using batteries of at least 24Ah, having that way up to 2 months autonomy without be recharged.

Solar regulator and battery should be inside the same weather proof enclosure that protects the logger. The 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.

4.2.5 Grounding terminal

The GND terminal is designed to be connected to a grounding cable. **You must use a different grounding cable ended in a different grounding rod than the grounding connected to the Franklin spike for lightning protection.** Failure to comply with this will expose the logger to lightening damage.

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.

4.2.6 Modem

The Orbit 360 is provided with a built-in modem with global coverage and 2G, 3G available on all units and 4G on units delivered from 4th quarter of 2020. The GSM antenna must be connected to the antenna connector shown below:



Fig. 10. GPS and GSM antenna connectors

Besides the built-in modem, the Orbit 360 is provided with an external modem port compatible with Iridium, BGAN/direct com or Hays AT command modems.

Therefore, Orbit360 can use either its internal built-in modem or an external modem connected to its Ext. COM terminals. To do so, the Orbit 360 manages both the power supply and the physical lines used for communication.

According to its modem type settings:

- a) It powers on and off the internal or Ext. COM power supply.
- b) It automatically switches between its internal COM port or the Ext. COM terminals.

Modem type 12 connects the internal built-in modem. All other modem types including 6 (Iridium satellite) and 7 (BGAN direct com) connects the Ext. COM port.

Advanced: If for some reason the user wishes to force the connection of either the internal modem or the external COM port, it is possible to do it by the bitwise modification of the 'Mode' parameter on the configuration menu [CONFIGURATION → Mode] according to:

- bit 3 (4th bit, value 8): when set to 0 the modem is automatically selected by the data-logger. When set to 1, the modem used will be according to the bit 4 on Mode settings.
- bit 4: (5th bit, value 16): when bit 3 is set 1, bit 4 is then evaluated: if bit 4 is reset to 0, the internal modem will be used; and if bit 4 is set to 1, the external Ext. COM will be used.

4.2.7 GPS

The Orbit 360 data logger has an internal GPS. The GPS antenna must be connected to the antenna connector shown in Fig. 10.

The logger updates its time and date using standard UTC time provided by the GPS. Every date, time and coordinates update are included in the download reports (.txt files generated at every download).

The GPS is turned off most of the time in order to reduce energy consumption. It will be automatically powered on upon the following situations:

- At startup (logger reset).
- When the user turns on the display by pressing a button of the keypad.
- When the user establishes a real-time connection from Atlas.
- At 00:13h, in order to carry out its automatic daily synchronization.

4.2.8 RTC

The logger features an internal “Real Time Clock/Calendar” that keeps the date and time updated when the data logger is disconnected from power supply.

4.2.9 TCP connector

This port is used to connect the data logger to a Modbus TCP SCADA.

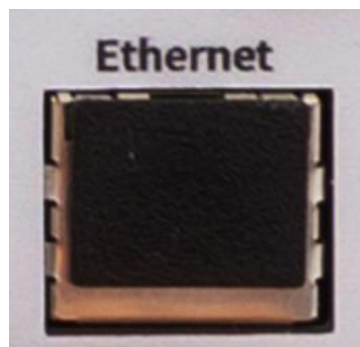


Fig. 11. *Ethernet port of the Orbit 360 data logger*

4.2.10 MMC card slot

The logger works with an external SD/MMC memory. The MMC memory should be inserted in the “Memory” slot. Card should be inserted softly with metal contacts facing the logger display (facing right) and the trimmed corner first (facing downwards) till a “click” sound is produced (then the card moves slightly backwards). There is just one way to insert the MMC card; do not force it or damage 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 4 GB memory capacity, we strongly recommend using the supplied memory. HC memories are not supported. Take into account that 1GB of capacity can store more than 20 years of wind data.

4.2.11 SIM card slot

The SIM card should be inserted in the “Sim Card” slot. The card should be inserted softly with metal contacts facing right (opposite to “Sim Card” text) and the trimmed corner first (facing downwards) until a “click” sound is produced (then the card moves slightly backwards). There is just one way to insert the SIM card; do not force it or damages can be produced.

4.3 Logger terminals

The Orbit 360 data logger features 92 removable terminals for convenient interfacing with the rest of elements present on the met mast. In addition, the logger includes a fail-safe 3-terminal orange plug to connect the external power supply.

Every single terminal block is labeled in the bottom part with a letter ranging from A to L, in alphabetical order, to further facilitate the work on the field.

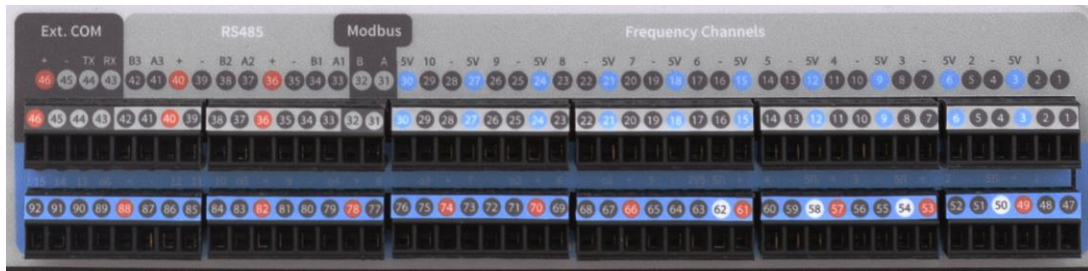


Fig. 12. Orbit 360 removable terminals

Fig. 12 shows the 92 logger terminals:

- External COM Port (RS232) used for:
 - CDMA or satellite modem.
 - Radio-modem.
 - Direct PC to logger connection.
- 3 RS485 buses (logger is Master).
- RS485 Modbus (logger is Slave).
- 10 Frequency channels.
- 15 Analog channels.
- 6 Output channels used for:
 - “External battery” V discontinuous power.
 - Alarm outputs.
- 1 terminal with 2.5V discontinuous supply.
- 4 terminals with 5V discontinuous power (white circles).
- 13 terminals with “External battery” voltage continuous power, labeled with ‘+’ symbol (red circles).
- 23 terminals for reference connection, labeled with ‘-’ symbol

- 10 terminals with 5V continuous power, labeled with '5V' symbol (blue circles).

The terminals are grouped according to Table 3.

Terminal group	Terminal range	Description
Frequency Channels	1 to 30	Frequency sensor connection area
Modbus	31 to 32	Modbus RTU over RS485
RS485	33 to 42	RS485 sensor connection area
Ext. Com	43 to 46	External modem connection area
Analog Channels	47 to 92	Analog sensor connection area

Table 3. Orbit 360 terminals grouping



Fig. 13. Orbit 360 terminal map drawing

The complete terminal description can be consulted on Table 4.

Terminal #	Label	Function	Details
1	-	Sensor GND	Sensor supply(-) / signal reference
2	1	Sensor signal	Input channel 1 (freq. / pulses)
3	5V	5V DC supply	Continuous power supply limited to 40mA for Thies FC, K611P, K620A...
4	-	Sensor GND	Sensor supply(-) / signal reference
5	2	Sensor signal	Input channel 2 (freq. / pulses)

6	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
7	-	Sensor GND	Sensor supply(-) / signal reference
8	3	Sensor signal	Input channel 3 (freq. / pulses)
9	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
10	-	Sensor GND	Sensor supply(-) / signal reference
11	4	Sensor signal	Input channel 4 (freq. / pulses)
12	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
13	-	Sensor GND	Sensor supply(-) / signal reference
14	5	Sensor signal	Input channel 5 (freq. / pulses)
15	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
16	-	Sensor GND	Sensor supply(-) / signal reference
17	6	Sensor signal	Input channel 6 (freq. / pulses)
18	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
19	-	Sensor GND	Sensor supply(-) / signal reference
20	7	Sensor signal	Input channel 7 (freq. / pulses)
21	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
22	-	Sensor GND	Sensor supply(-) / signal reference
23	8	Sensor signal	Input channel 8 (freq. / pulses)
24	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...

25	-	Sensor GND	Sensor supply(-) / signal reference
26	9	Sensor signal	Input channel 9 (freq. / pulses)
27	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
28	-	Sensor GND	Sensor supply(-) / signal reference
29	10	Sensor signal	Input channel 10 (freq. / pulses)
30	5V	5V DC supply	Continuous power supply for Thies FC, K611P, K620A...
31	A	Modbus RTU	RS485 data +
32	B	Modbus RTU	RS485 data -
33	A1	RS485 Bus 1	Data +
34	B1	RS485 Bus 1	Data -
35	-	Supply(-)	Power supply GND
36	+	Supply(+)	Battery(+) with current limitation (200 mA)
37	A2	RS485 Bus 2	Data +
38	B2	RS485 Bus 2	Data -
39	-	Supply(-)	Power supply GND
40	+	Supply(+)	Battery(+) with current limitation (200 mA)
41	A3	RS485 Bus 3	Data +
42	B3	RS485 Bus 3	Data -
43	RX	Received serial data	RS-232 to interface with external modem
44	TX	Transmitted serial data	RS-232 to interface with external modem

45	-	Supply(-)	Power supply GND
46	+	Supply(+)	Battery(+)
47	-	Sensor GND	Sensor supply(-) / signal reference
48	1	Sensor signal	Input channel 1 (voltage)
49	+	Supply(+)	Battery(+) with current limitation (12 mA)
50	5 μ	5V discontinuous supply	Discontinuous power supply for potentiometric wind vanes, K307T...
51	-	Sensor GND	Sensor supply(-) / signal reference
52	2	Sensor signal	Input channel 2 (voltage)
53	+	Supply(+)	Battery(+) with current limitation (12mA)
54	5 μ	5V discontinuous supply	Discontinuous power supply for potentiometric wind vanes, K307T...
55	-	Sensor GND	Sensor supply(-) / signal reference
56	3	Sensor signal	Input channel 3 (voltage)
57	+	Supply(+)	Battery(+) with current limitation (12mA)
58	5 μ	5V discontinuous supply	Discontinuous power supply for potentiometric wind vanes, K307T...
59	-	Sensor GND	Sensor supply(-) / signal reference
60	4	Sensor signal	Input channel 4 (voltage)
61	+	Supply(+)	Battery(+) with current limitation (12mA)
62	5 μ	5V discontinuous supply	Discontinuous power supply for potentiometric wind vanes, K307T...

63	2V5	2.5V discontinuous supply	Discontinuous power supply for Davis pyranometer, propeller anemometer...
64	-	Sensor GND	Sensor supply(-) / signal reference
65	5	Sensor signal	Input channel 5 (voltage)
66	+	Supply(+)	Battery(+) with current limitation (12mA)
67	o1	Alarm output #1	Battery(+)
		Discontinuous	Discontinuous battery(+) <i>(remark below)</i>
		Manually selected as supply(+)	“Always ON” or “Always OFF” barometer
68	-	Sensor GND	Sensor supply(-) / signal reference
69	6	Sensor signal	Input channel 6 (voltage)
70	+	Supply(+)	Battery(+) with current limitation (12mA)
71	o2	Alarm output #2	Battery(+)
		Discontinuous	Discontinuous battery(+) <i>(remark below)</i>
		Manually selected as supply(+)	“Always ON” or “Always OFF” barometer
72	-	Sensor GND	Sensor supply(-) / signal reference
73	7	Sensor signal	Input channel 7 (voltage)
74	+	Supply(+)	Battery(+) with current limitation (12mA)
75	o3	Alarm output #3	Battery(+)
		Discontinuous	Discontinuous battery(+) <i>(remark below)</i>
		Manually selected as supply(+)	“Always ON” or “Always OFF” barometer

76	-	Sensor GND	Sensor supply(-) / signal reference
77	8	Sensor signal	Input channel 8 (voltage)
78	+	Supply(+)	Battery(+) with current limitation (12mA)
79	o4	Alarm output #4	Battery(+)
		Discontinuous	Discontinuous battery(+) <i>(remark below)</i>
		Manually selected as supply(+)	“Always ON” or “Always OFF” barometer
80	-	Sensor GND	Sensor supply(-) / signal reference
81	9	Sensor signal	Input channel 9 (voltage)
82	+	Supply(+)	Battery(+) with current limitation (12mA)
83	o5	Alarm output #5	Battery(+)
		Discontinuous	Discontinuous battery(+) <i>(remark below)</i>
		Manually selected as supply(+)	“Always ON” or “Always OFF” barometer
84	10	Sensor signal	Input channel 10 (voltage)
85	11	Sensor signal	Input channel 11 (voltage)
86	12	Sensor signal	Input channel 12 (voltage)
87	-	Sensor GND	Sensor supply(-) / signal reference
88	+	Supply(+)	Battery(+) with current limitation (12mA)
89	o6	Alarm output #6	Battery(+)
		Discontinuous	Discontinuous battery(+) <i>(remark below)</i>
		Manually selected as supply(+)	“Always ON” or “Always OFF” barometer

90	13	Sensor signal	Input channel 13 (voltage)
91	14	Sensor signal	Input channel 14 (voltage)
92	15	Sensor signal	Input channel 15 (voltage)

Table 4. Orbit 360 terminals description

Remark:

Only some sensors, such as barometer Setra 276, have a fast enough settling time to be powered from o1, o2, o3, o4, o5 or o6 terminals. Contact our technical support for more info about compatibility: support@kintech-engineering.com.

4.4 Alarms and actuators

The Orbit 360 data logger features $18 \times 8 = 144$ user-configurable alarms: $16 \times 8 = 128$ alarms based on single channel measurements of the data logger and $2 \times 8 = 16$ alarms based upon the difference between the measurements of two channels. These alarms can actuate any of the six outputs of the logger or automatically make the logger send an email or make an alarm call. The outputs of the Orbit 360 can be utilized to, for instance, deactivate the ventilation unit of a pyranometer upon high wind, activate the heating of an anemometer upon a specific temperature range, etc.

Average values on frequency channels 1 to 8 and analog channels 1 to 8 can be configured to trigger any of the 8 possible alarm actuations. For each channel, there are **two levels** that the user must define: a **lower limit** and an **upper limit**. Once the Orbit 360 has calculated the average value (refer to section 4.1.2), it will compare the calculated average value with the configured limits for each channel to perform the programmed action. The following comparison options are currently available:

- “Minimum” → if the measured value of the logger channel goes below the lower limit level, the alarm/actuator is activated.
- “Maximum” → if the measured value of the logger channel exceeds the upper limit, the alarm/actuator is activated.
- “Minimum with hysteresis” → if the measured value of the logger goes below the lower limit, the alarm/actuator is activated. The alarm/actuator will not be deactivated until the measured value exceeds the upper limit.

- “Maximum with hysteresis” → if the measured value of the logger channel exceeds the upper limit, the alarm/actuator is activated. The alarm/actuator will not be deactivated until the measured value goes below the lower limit.
- “Out of range” → if the measured value of the logger channel is out of the range defined by the levels, the alarm is alarm/actuator.
- “Within the range” → if the measured value of the logger channel is within the range defined by the levels, the alarm/actuator is activated.

In addition to the above described any of the six outputs can be activated at certain hours, individually selectable by the user in Atlas.

Furthermore, any of the 6 outputs can be configured manually so that they are permanently activated or deactivated. The output is updated to the manual-configured value immediately after the keypad, SMS or Atlas software action. When these outputs are configured in manual mode, the alarms configuration, both by sensor measurements and by time programming, are not taken into account.

The configuration of the outputs can be done in 3 different ways:

- With Atlas software
- Through the keypad/display. On the main menu “alarms/outputs” you can modify the configuration of the outputs individually as well as check the current status of said output. It can show one of the following terms:
 - Automatic. If no alarm has been configured, the output will work in discontinuous mode (the display will show the output value as “pulsed”). If any alarm has been configured (by sensor measurements or by time programming), the displayed value of the output will indicate whether the activation of said alarm has occurred (“ON”) or not (“OFF”).
 - Manual ON.
 - Manual OFF.

- By SMS. The SMS that must be sent to the logger to configure the outputs are ("x" varies from 1 to 6, depending on the output to be configured)
 - ORBOUTxON configures the output as Manual ON.
 - ORBOUTxOFF configures the output as Manual OFF.
 - ORBOUTxAUTO sets the output as Automatic.

4.5 Atlas desktop software

Atlas is our latest desktop software to manage and connect with the data loggers from Kintech Instruments. The updated workspace in Atlas lets track the entire fleet of data loggers and automate all the “daunting” tasks so it can be focused on key factors that directly influence the overall data quality of the measurement campaign.

4.5.1 Atlas Free

Atlas Free has the same functionalities that EOL Manager has plus the availability of managing Orbit 360 data loggers too and some new features such as the optimized connectivity for sites with unreliable GSM connection (smart connection), enhanced sensor status flags with built-in logic, improved real-time connection windows and a new calendar showing daily data availability.

4.5.2 Atlas Professional

Atlas Professional includes more advanced new features such as a new 3rd level password for 3rd party decoding, a complete timeline of the site history displaying all the instrument changes, site events and changes to the logger configuration, as well as a world map that shows all the sites are also among the new features in Atlas.

For further information, please contact our technical support: support@kintech-engineering.com.

4.5.3 Atlas Enterprise

The new Atlas framework and the true “game-changer” is that it can be now worked as a team (Enterprise version). Authorized role-based users can now simultaneously access you central Atlas server to supervise individual data loggers with ease and in a coordinated manner. Changes carried out on the Atlas server are instantaneously reflected on all Atlas clients (all your team members).

For further information, please contact our technical support: support@kintech-engineering.com.

5 Technical specifications

5.1 Operation conditions

Description	Value	Units	Comments
Operating voltage	12	V (DC)	Recommended
	6	V (DC)	Minimum
Average current consumption	20	mA	At 12V DC. Display off, RS-485 and Ethernet disabled. Modem ON.

5.2 Absolute maximum ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Terminal(s)	Parameter		Value	Units
Power Input	V_i max.	Maximum input voltage	36	V
	V_i min.	Minimum input voltage	-40	V
Frequency 1-10	V_i max.	Maximum input voltage	5	V

Analog 1-15	V _i min.	Minimum input voltage	-0.3	V
	V _i max.	Maximum input voltage	5	V
RS485	V _i min.	Minimum input voltage	-0.3	V
	V _i max.	Maximum input voltage	10.5	V
Ext. Com	V _i min.	Minimum input voltage	-10.5	V
	V _i max.	Maximum input voltage	13.2	V
	V _i min.	Minimum input voltage	-13.2	V

Table 5. Electrical specifications: inputs

Parameter	Value	Units
Max. operating temperature	70	°C
Min. operating temperature	-40	°C

Table 6. Operating temperature range

5.3 Technical specifications: outputs

Terminal(s)	Parameter		Value	Units
5V	Desc.	5V DC power supply for Thies FC, K611P...	-	-
	V _o	Nominal output voltage	5	V
	I _{lim}	Output current limiting	40	mA
	I _o	Maximum operative output current	10	mA
5VЛ	Desc.	5V discontinuous power supply for potentiometer wind vanes, K307TH...	-	-
	V _o	Nominal output voltage	5	V
	I _{lim}	Output current limiting	40	mA
	I _o	Maximum operative output current	10	mA
	f	Pulse frequency	1	Hz
	t _{on}	Typical ON time	60	ms
2V5	Desc.	2.5V discontinuous power supply for Gill Propeller anemometer, pyranometers...	-	-
	V _o	Nominal output voltage	2.5	V
	I _{lim}	Output current limiting	27	mA

	I_o	Maximum operative output current		10	mA
	f	Pulse frequency		1	Hz
	t_{on}	Typical ON time		60	ms
+(Analog)	Desc.	Bat+ voltage DC for Galltec, Thies TMR...		-	-
	V_o	Nominal output voltage		*	V
	I_{lim}	Output current limiting		12.5	mA
	I_o	Maximum operative output current		10	mA
o1 to o6	Desc.	Actuators (alarm-based/hourly configurable)		-	-
	V_o	Nominal output voltage		*	V
	I_{lim}	Output current limiting	hardware version <3	-	mA
			hardware version >=3	350	
	I_o	Maximum operative output current	hardware version <3	2000	mA
			hardware version >=3	300	
+(RS485)	Desc.	Bat+ voltage DC for Geovanes, Thies 3D...		-	-
	V_o	Nominal output voltage		*	V
	I_{lim}	Output current limiting		200	mA

	I_o	Maximum operative output current	120	mA
+(Ext. COM)	Desc.	Bat+ voltage DC for Iridium or BGAN modems	-	-
	V_o	Nominal output voltage	*	V
	I_{lim}	Output current limiting	-	-
	I_o	Maximum operative output current	2.5	A

Table 7. Electrical specifications: outputs

*The output voltage will be equal to the voltage on the power supply terminals.

5.4 Technical specifications: input channels

5.4.1 Frequency / Counters channels

The Orbit 360 data logger frequency inputs channels capture and count every single pulse present on its terminals. As the capture is attended through an interrupt service routine, all pulses are captured and processed at any moment, regardless the task the data logger is performing when the pulse arrives.

The number of physical channels available on each logger depends on the commercial model chosen.

Every time the voltage on the frequency input channel, passes from below to above a specific voltage level the data logger will capture the event as a pulse. Therefore, the compatible signals can be a voltage square wave, sinusoidal or any other waveform that has a high and low level above and below the threshold voltage. The threshold voltage level for each channel is preprogrammed in the data logger according to the type of sensor configured for that frequency channel on the data logger settings.

The frequency input channels are provided with varistor and diode overvoltage protection, for short duration electrostatic discharges typically arriving from lightning strikes. The effectiveness of the protection is extremely sensitive to the grounding conditions (refer to sections 4.2.5 and 6.3). Following the protections, there is a second-order low-pass filter with 3KHz cut-off frequency. The filters should attenuate noise interference like those coming from electrical lines, RF antennas or other instruments. It is critical to use shielded cables with the shield properly connected at one end.

Once per second, the Orbit 360 data logger performs the following tasks:

1. Update the storage interval counter by adding the last second pulse count.
2. Associate the number of pulses that arrived during the last second to that '*one second sample*'.
3. Calculate the '*One second reading*' by applying standard slope and offset for display, real time and Modbus.
4. Calculate the sliding average over the last seconds interval set up in the '*gust interval*' parameter, typically 3 seconds for wind assessment. Compare it with the currently highest and lowest over the present recording interval. Refresh the highest and lowest if it goes beyond them.

At the end of the storage interval, the standard deviation is calculated from the *one second samples*. Depending on the type of sensor configured for the frequency input channel on logger settings, a pre-scaling factor of 16 is applied to the total number of pulses that arrived along the recording interval stored on data logger's memory. The 16-pre-scaling factor applied increases the range of pulse count along the recording interval. Considering that the pulse count is stored in a 16-bit register, the average frequency in a ten minutes interval ranges from 0 to 1747.6Hz ($16 \cdot (65535/600)$). In general, frequency sensor types above 20 have this prescaling factor applied. The prescaling only affects to the total counter but not to maximum, minimum or standard deviation. The pre-scaled count, maximum, minimum and standard deviation are stored in the SD card memory.

Remark:

Instrument specific calibration, typically used for anemometers after a wind tunnel test, is not used for stored raw data. The software will apply slope and offset from software site settings at decoding time to obtain the output data files.

When the software is decoding the raw data stored from the logger, depending on the type of instrument set up in the software site settings, it will convert from the total number of pulses to hertz by dividing it by the storage interval duration. For types of instruments like precipitation sensors or water counters, the software will use the total number of pulses rather than frequency.

When the sensor type configured on the logger settings is an associated digital serial input data, the origin of the data is not the pulse count from its associated input channel terminal but the corresponding field from its associated digital serial input instrument telegram.

The number of physical channels available on each logger depends on the commercial model chosen. The following table is a summary of the frequency channel characteristics.

Property / Description	Value	Comments
Number of physical channels	10	Basic Plus
	10**	Premium
Number of virtual channels (RS485 sensors)	0	Basic Plus
	6	Premium
Resolution	16	Bits

	<0.01 m/s	wind speed (avg.)
	0.05 m/s	Gust
	0.01 m/s	Std. deviation
Voltage Threshold	1.5V	Default (Hertz's)
	*auto	80mV to 2.5V
Input Resistance	220	kΩ
Frequency range	0 to 2	kHz

Table 8. Frequency channels: characteristics

*The voltage threshold is automatically set according to the signal characteristics of the configured sensor.

**Up to 16 by means of the [Frequency Channel Expander](#).

5.4.2 Analog channels

The Orbit 360 data logger reads the analog input channels through its 12-bit analog to digital converters. In turn, this provides a 0.025% resolution throughout its 0 to 5V range. The analog input channels are equipped with varistor and diode overvoltage protection for short duration electrostatic discharges typically arriving from lightning strikes. The effectiveness of the protection is extremely sensitive to the grounding conditions (refer to sections 4.2.5 and 6.3).

Following the protections, a low pass filter attenuates noise interference like those typically coming from electrical lines, RF antennas or other instruments. It is critical to use shielded cables with the shield properly connected at one end.

In order to reduce the data logger power consumption, the power supply of internal electronics and power supply terminals is switched off immediately after the readings (unless CONFIGURATION → Mode is set to 02). Consequently, the input impedance on the analog input terminals is low while the electronics are powered off. User should employ available standard sensors with wiring guidelines to assure appropriate impedance coupling, wiring and power supply of data logger and sensor. Power supply is applied around 30ms before starting the readings of analog input channels.

Remark:

Due to the data logger discontinuous power supply of the internal electronics and supply terminals, external voltmeter readings could show wrong readings. Set mode 2 [CONFIGURATION → Mode → 02] temporarily to activate continuous supply and be able to check voltage on logger terminal with a voltmeter.

The number of physical channels available on each logger depends on the commercial model chosen. The following table is a summary of the analog channel characteristics:

Property / Description	Specification	Comments
Number of physical channels	15	Basic Plus
	15	Premium
Number of virtual channels (RS485 sensors)	0	Basic Plus
	8	Premium

Internal resolution	12*	Bits
	1.2	mV
Wind vane resolution	10	Bits
	0.35	°
Input resistance	>1	GΩ
Voltage range	0 to 5V	DC signals

Table 9. Analog channels: characteristics

*16-bit version available upon request.

5.5 Communication / Protocols

The Orbit 360 data logger is provided with an internal internet modem with global connectivity, i.e., compatible with GSM operators worldwide.

In addition to the internal modem, the Orbit 360 is provided with an external communication port, compatible with Iridium, Inmarsat and direct communications.

If the site where you plan to perform wind or solar resource assessment is without a GSM signal, satellite communication is most likely the best option. Kintech Instruments offers two alternative satellite solutions, Iridium and BGAN. For both the Iridium and the BGAN Satellite Module we include all the hardware, firmware and software components to communicate to the loggers.

Depending on the logger modem type settings, the data logger will switch the power supply and communication to internal modem or external port.

The following table is a summary of Orbit 360 capabilities regarding communications:

Property / Description	Specification	Comments
Number of RS485 buses (logger master)	0	Basic Plus
	3	Premium
Ethernet for BGAN / Modbus TCP (logger slave)	N/A	Basic Plus
	1	Premium
Modbus RTU over RS485 (logger slave)	N/A	Basic Plus
	1	Premium
Data retrieval	Remote (24h access)	GSM/GPRS, BGAN satellite (Internet), IRDM satellite, CSD call
	local	Removable SD card, RS-232
	email	Daily email from logger

Real time (24h access)	Internet / Satellite / CSD call	Atlas Desktop
	Atlas APP (Internet)	Atlas Mobile

Table 10. Communication capabilities of the Orbit 360 data logger

5.6 Data collection and storage

Property / Description	Specification	Comments
Sampling Rate	1	Hz
Recording interval	1, 5, 10	Minutes
Timestamp	GPS (UTC)	Synchronization and geolocation
Statistical values	Average, Std. Dev., Min., Max.	All channels
	30 sec. turbulence intensity	FRQ1 and FRQ2
Gust	1, 2, 3, 4... 15	Seconds
Main data storage	Removable SD card	>20 years of data
Backup data storage	Internal memory	Approx. 100 days of data
Security	Data encryption and digital signature with GPS coordinates	Always

	Password protection	User-configurable
	Access control	Remote connections, keypad access, etc.

Table 11. Data collection characteristics

5.7 One-second data and FTP

Some Orbit 360 versions allow you to record the values of each input channel of the datalogger once per second. We call this type of recording 1-second data storage. This kind of recording means that the datalogger will store 86,400 recordings per day, equivalent to more than one and a half years of statistical recordings.

All the 1-second data that is configured to be sent through Modbus TCP is also recorded in an additional microSD card.

The 1-second data usually has two main applications: recovery of instant data when data loss occurs due to communication errors (e.g., network congestion, SCADA without power ...) and very advanced meteorological studies.

5.7.1 Requirements

1. Your Orbit360 data logger must support Modbus TCP and 1-second data storage functionalities. Contact our technical support team to check if your Orbit 360 supports these functionalities, usually included in the Premium version.
2. microSD card. Only the Kintech approved microSD card, which is available as an option, is guaranteed to operate correctly. Said microSD card meets all the necessary features: industrial grade, robust, reliable, high read/write speeds, capacity, and correct format (exFAT). The 64GB microSD card can store around 9 years of 1-second data.
3. The logger must have Modbus TCP/1-second-data-storage activated.

4. The values that you wish to record must be selected on the software's section Modbus/1-second-data-storage.
5. The firmware version of the ethernet board must be ≥ 1.0 .

To check the state of the microSD card (card inserted, recording without errors, percentage of the card used), the firmware version of the logger must be ≥ 2.48 .

5.7.2 FTP

The Orbit 360 datalogger has a built-in FTP server that can be accessed through its ethernet port. This server allows you to access the 1-second data files stored in the microSD card.

The TCP / IP parameters of this server are the same as those configured for modbus TCP. The FTP port is the standard one: 21.

Multiple simultaneous connections and FTP passive mode are not supported. Most of the standard FTP commands are supported. The literal FTP STAT command returns the ID of the logger.

The login credentials are:

- User: kintech
- Password: The one that you have defined in Atlas as your real-time password. If you have not defined a real-time password, the default password would be "orbit" (without quotation marks).

5.7.3 Data access

The 1-second data files can be accessed in 2 different ways:

- Extracting the microSD card and plugging it in into any device (e.g., PC).
- Via FTP connection, through the ethernet port of the datalogger.

5.7.4 Python script

In the case of using the FTP connection, this script can be executed from the SCADA itself since it will already have (due to the use of Modbus TCP) a direct connection with the datalogger.

Said script admits as parameters:

- Initial date of the data.
- End date of the data.
- IP address (the one configured in the logger in the Modbus TCP section).

The script downloads this data in a folder named “1_second_data”, located in the same folder from which the script is launched.

When using the script, the name of the downloaded files is prefixed with the ID of the logger (the last 4 digits of the sit number) from which the data was downloaded.

5.7.5 Download speed

The speed of downloading data via FTP connection is about 100 kB/s, so the download time of large amounts of data might be significant.

For this reason, it is recommended to automate downloads in short intervals of time (for example, every 1-2 days).

5.7.6 Display/Atlas Realtime

You can check the status of the 1-second data storage in the logger’s menu (from logger firmware version ≥ 2.28) “Status -> 1-sec data storage” or through real-time from Atlas. The following fields are displayed:

- “Inserted”.
 - “YES”: the microSD card is inserted.
 - “NO”: the microSD card is not inserted, or it is not detected.
- “Status”.
 - “Ok”: the microSD card works correctly.
 - “Error”: a failure has been detected when recording on the microSD card.
- “% used”: indicates the used capacity of the microSD.

The fields may also show “N/A” (Not Available). This value may be due to:

- There is a communication failure with the Ethernet Board.
- The firmware version of the Ethernet Board is < 1.00 , so it does not have the 1-second data storage function implemented.

5.7.7 Reports

The reports show you the following information related to the 1-second data and FTP:

- Firmware version of the Ethernet Board.
- Accesses via FTP.
- Errors due to microSD not inserted or data recording failures.

5.7.8 Storage structure

The data is recorded on the microSD in a directory called "1_second_data". Within this directory, the data is stored in a directory structure that follows a Year/Month/Day pattern.

Within the directory that contains the data of one day, there will be 24 files, one for each hour of the day. As well, each of these files will contain 3600 lines, one for each second of an hour, except for when the datalogger changes its time. Each line will contain all the data of said second. The name of the files follows the pattern YYMMDD.txt

For example, the file named "20070100.txt" will contain the 1-second data for hour 00 of July 1, 2020.

5.7.9 Data format

The data recorded in each hourly file has a csv format, with fields separated by commas, without leading lines. Each line of the file represents the data of one second:

```
2020/06/01 00:00;25.3;-117.0;-117.0;-117.0;-117.0;-204.8;-204.8;-204.8;-204.8;-202.3;-202.3;-202.3;
2020/06/01 00:00;25.4;-117.0;-117.0;-117.0;-117.0;-204.8;-204.8;-204.8;-204.8;-202.3;-202.3;-202.3;
2020/06/01 00:00;25.4;-117.0;-117.0;-117.0;-117.0;-204.8;-204.8;-204.8;-204.8;-202.3;-202.3;-202.3;
2020/06/01 00:00;25.4;-117.0;-117.0;-117.0;-117.0;-204.8;-204.8;-204.8;-204.8;-202.3;-202.3;-202.3;
2020/06/01 00:00;25.3;-117.0;-117.0;-117.0;-117.0;-204.8;-204.8;-204.8;-204.8;-202.3;-202.3;-202.3;
```

The first field is the date/time and the second one the battery. The rest of the fields correspond to the Modbus address map.

5.7.10 Ethernet board firmware update

If the firmware version of the Ethernet Board is ≥ 1.01 , its firmware can be updated using the microSD. To do this you have to save 2 files (provided by Kintech) in the root directory of the microSD.

The files can be saved on the microSD card the following ways:

- Extracting the microSD and recording the files through any device (e.g., PC)
- Via FTP connection, using the Ethernet port of the logger.

Once the files are on the microSD, the firmware update process can be started in 2 ways:

- Using the logger's display/keyboard (logger firmware version ≥ 2.28), setting mode 32 through the menu "Configuration -> mode". In this case, the logger shows the result of the process on the display (bottom line):
 - "Programming aux board": The firmware is updating correctly.
 - "Unavailable (Code 1)": The firmware cannot be updated because the logger is in low power mode.
 - "Unavailable (Code 3)": The firmware cannot be updated because a communication error has occurred with the Ethernet Board.
 - "Unavailable (Code 4)": The firmware cannot be updated because the Ethernet Board does not support the firmware update (its version is lower than 1.01).
 - "Unavailable (Code 5)": The firmware cannot be updated because the logger does not detect the microSD.
 - "Unavailable (Code 6)": The firmware cannot be updated because the microSD does not contain the necessary files.
- Via FTP connection, using the logger's Ethernet port to send the literal REPRO command.

The firmware update process takes less than 1 minute. Once the firmware has been updated, the Ethernet Board boots normally. If the firmware update process is interrupted (e.g., due to a power outage or removing the microSD), the previous firmware version will be unusable. In this case you need to repeat the firmware update process.

If the logger does not detect an inserted microSD during the firmware update process or does not find the necessary files on the microSD, the Ethernet Board starts normally with the firmware version it had previously.

When the firmware of the Ethernet Board is updated, the configuration that it had previously is kept: the speed of the sonic ports (BPS) and the TPC/IP configuration.

The green and orange LEDs of the Ethernet connector stop doing their normal function when the Ethernet Board firmware is being updated. The orange led is permanently off, while the green led indicates the status of the process as follows:

- Permanently ON: the internal microcontroller is not working properly. The Ethernet Board needs to be replaced.
- 2 rapid flashes repeating every second: The logger does not detect a microSD card and there is no valid previous firmware, so the Ethernet Board cannot be started. To get out of this situation, the user should insert a microSD card with the 2 necessary files recorded on it.
- The led blinks once per second: The logger detects a microSD card, but it cannot find the necessary files and there is no valid previous firmware, so the Ethernet Board cannot be started. To get out of this situation, the user should insert a microSD card with the 2 necessary files recorded on it.
- The led blinks 5 times per second: the firmware is being updated.

5.8 Emergency power saving mode

The Orbit 360 data logger features an emergency power saving mode that allows it to extend the time it is capable of logging data in the scenario of encountering power supply issues. **When enabled** by the user (enabled by default), the logger will enter into this mode whenever the supply voltage drops below 6V. In this mode many features of the logger such as the modem, Ethernet, GPS, etc., are switched off. As soon as the power is reestablished and the supply voltage exceed 7V, the logger returns to its normal operation mode.

Besides this, for Orbits 360 equipped with internal backup batteries, the logger will switch automatically between external power supply and internal battery, provided that the emergency power saving mode is enabled.

The following table summarizes how the emergency power saving mode works:

External supply voltage range [V]	Emergency power saving mode			
	Enabled		Disabled	
	Operation	Backup batteries	Operation	Backup batteries
6 to 30	normal	disconnected	normal	disconnected
5.6 to 6	power saving	disconnected	normal	disconnected
3.3 to 5.6	power saving	connected	normal	disconnected

Table 12. Emergency power saving mode

Fig. 14 displays the information shown in Table 12 according to whether the external battery goes low or high and can help to fully understand how the power modes work.

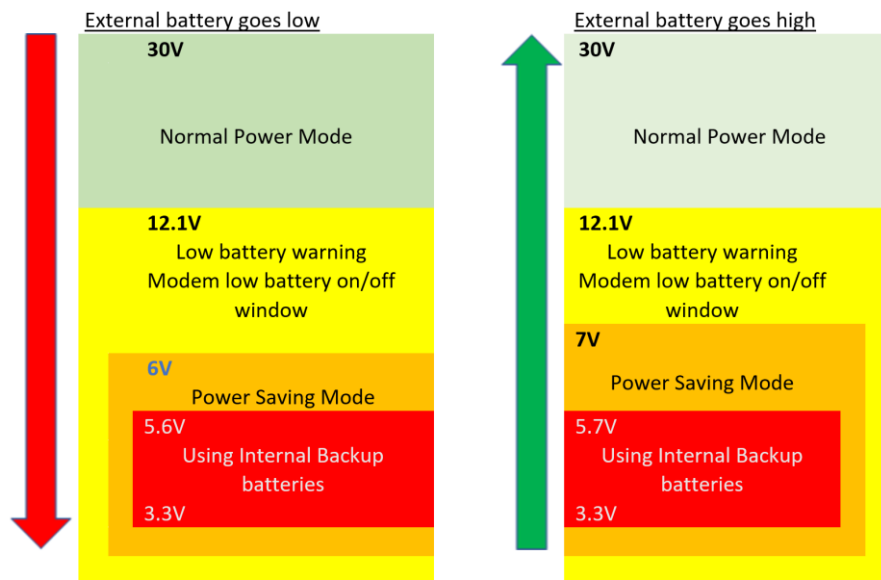


Fig. 14. Emergency power saving mode

5.9 Internal backup batteries

The Orbit 360 data logger can be ordered along with four internal lithium or alkaline batteries, whose technical characteristics are described in the two tables below.

Property / Description	Specification
System	Lithium Thionyl Chloride
Size	C
Number of batteries	4
Nominal voltage (global)	7.2V (2x 3.6V, with a Schottky diode in series)
Capacity (global)	17000 mAh (2 x 8500 mAh)

Table 13. Internal Lithium backup batteries: characteristics

Property / Description	Specification
System	Alkaline Zinc Manganese Dioxide
Size	C
Number of batteries	4
Nominal voltage (global)	6V (4 x 1.5 V), with a Schottky diode in series
Capacity (global)	6800 mAh

Table 14. Internal alkaline backup batteries: characteristics

The internal batteries are **only intended for backup** and emergency mode operation in case the external power supply stops working or it is stolen. An external power supply is always required for normal operation.

An internal microswitch accessible next to the battery holder **must be** set according to the actual used technology. Refer to Fig. 15 for more detail (Lithium option selected).

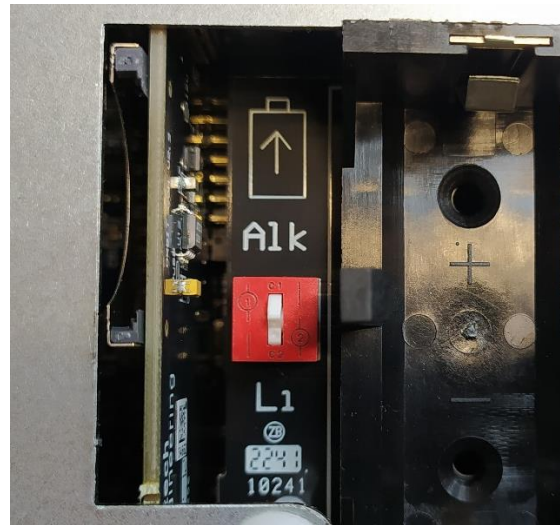


Fig. 15. **Microswitch to select alkaline (ALK) or Lithium (Li) internal batteries**

The decision to use one technology over another is often conditioned by the transportation: alkaline batteries are less restricted than lithium batteries when traveling in the cargo hold of an airplane, which often simplifies air shipping.

The only way to turn on the logger once it has been powered off is by means of an external power supply. It **cannot** be switched on through the internal backup batteries.

To **turn off** Orbit 360 data loggers featuring internal batteries the user must:

1st) Unplug the 3-terminal orange power plug to disconnect the external power supply.

2nd) Follow the instructions on the display and **press UP + SET + DOWN** to also disconnect the internal power supply.

5.10 Physical characteristics

Property / Description	Specification	Comments
Dimensions	263x180x88	mm
Weight	1.8	kg
Display	128x64 pixel resolution	LCD
Keypad	5	buttons
LEDs	3	Modem, GPS, CPU
Capacity	8500	mAh

Table 15. Physical characteristics

6 Installation

The Orbit 360 data logger should be installed inside an electric enclosure or shelter box rated for outdoor use (IP66). Customers can buy the shelter box from any provider or directly to Kintech Instruments. The enclosure will protect against weather and intrusion the data logger, solar charger, battery as well as any other item inside of it.

The Orbit 360 data logger has four metallic hanging brackets in the back for simple attachment to the metallic plate of the enclosure. Their orientation with respect to the logger case can be adjusted by means of a screwdriver.

The hanging brackets can be placed horizontally, as described in Fig. 16 or vertically, as shown in Fig. 17).

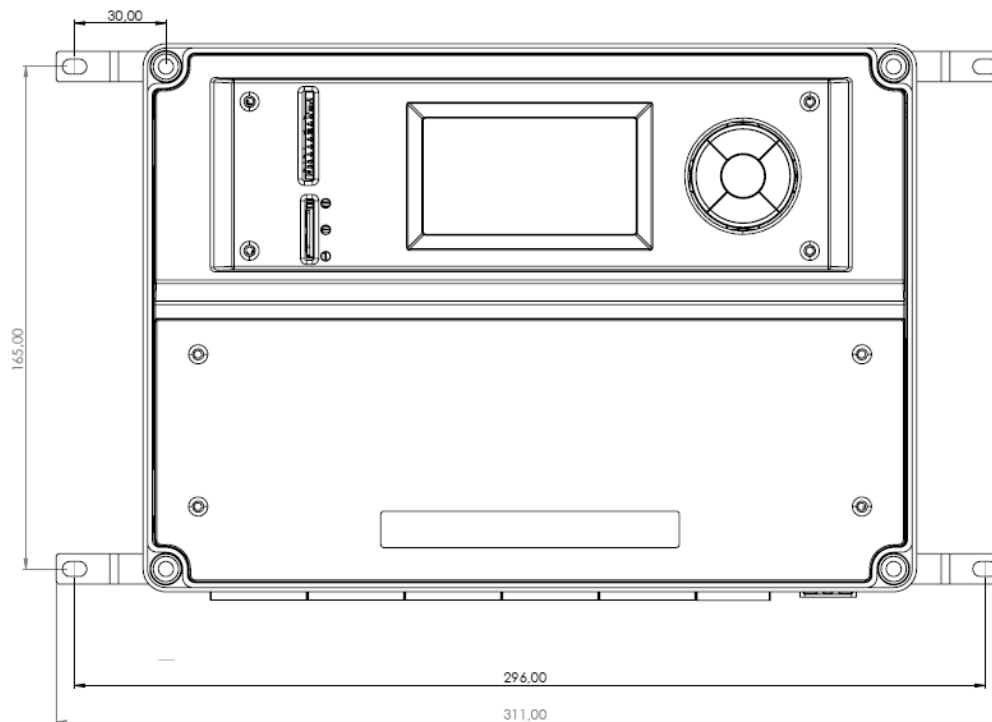


Fig. 16. *Hanging brackets dimensions (horizontal position)*

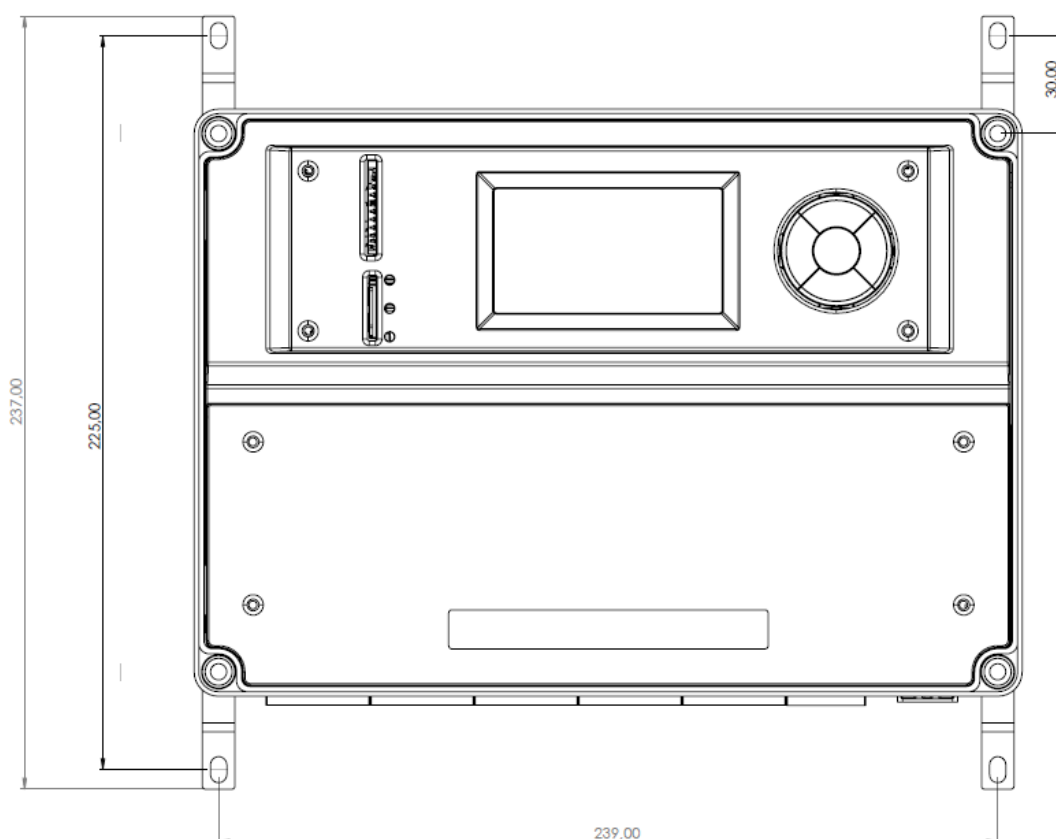


Fig. 17. *Hanging brackets dimensions (vertical position)*

6.1 Preparation

All Orbit 3 data-loggers units manufactured by Kintech Instruments 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 recommend carrying an unlocked mobile phone to the site so you can test SIM card settings and signal on site.

6.2 Configuration

Before going to the site to install the data logger, it is necessary to configure it according to the sensors, calculation and communication parameters, as described in section 3.4. Failing to do this can lead to problems in the settings as certain settings cannot be modified via keypad.

The Orbit 360 settings are stored in the data logger's external SD card, together with the input channel data. The Orbit 360 data logger reads the settings from the SD card when it is powered on. **Changing the SD card while the data logger is powered on, will not make the data logger read the settings from the new SD card but copy the data logger's settings to the SD card.**

6.3 Grounding

Metallic tower structures are lightning spikes by its own so it is essential to provide the best ESD and grounding protection to minimize damages. To attract and handle 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 to 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 WRA as the cost of adding salt soils, measuring resistivity, etc., would significantly increase the cost for a temporary installation. The purpose of this chapter is to explain the basics of grounding and lightning protection, without going into the subject in depth.

The first element of a met mast grounding system is the lightning rod: a copper-clad lightning spike (sometimes a metal spike covered with wolfram to resist the heat of the strike). The spike is to be installed on top of the structure, above sensors installed

there. The lightning rod gives effective protection to all elements located inside a 45° degrees cone underneath it.

To join the lightning rod to the grounding rod we recommend using at least a 35mm² copper ground wire. Grounding rods are usually 1,5m long.

To ground the Orbit 360 data logger, connect one end of the copper ground wire (usually yellow-green color) to the data logger GND terminal (orange plug) and the other end to an independent grounding spike. If the enclosure is metallic, you must also connect the enclosure to the ground wire of the data logger, to do so, all metallic enclosures have a connection screw terminal with the ground symbol on it.

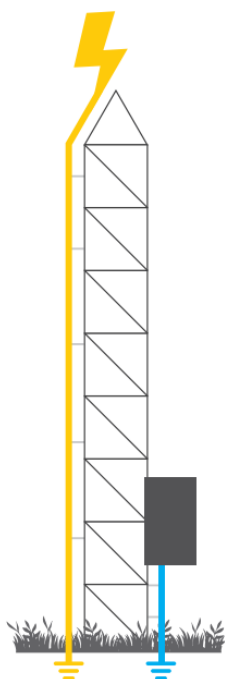
Shielded wires must be used for all sensors, the shield helps to minimize electromagnetic interference and provides additional mechanical resistance. If you are installing a considerable number of sensors it is recommended to connect all shields in an external patch panel and then use a single wire to connect the patch panel to the logger GND terminal.

Remark:

The data **logger GND** terminal (to which all the sensor shields must have been previously connected) should always be connected to a **separate ground** rod and NOT to the lightning rods (Fig. 18).

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

RIGHT



WRONG

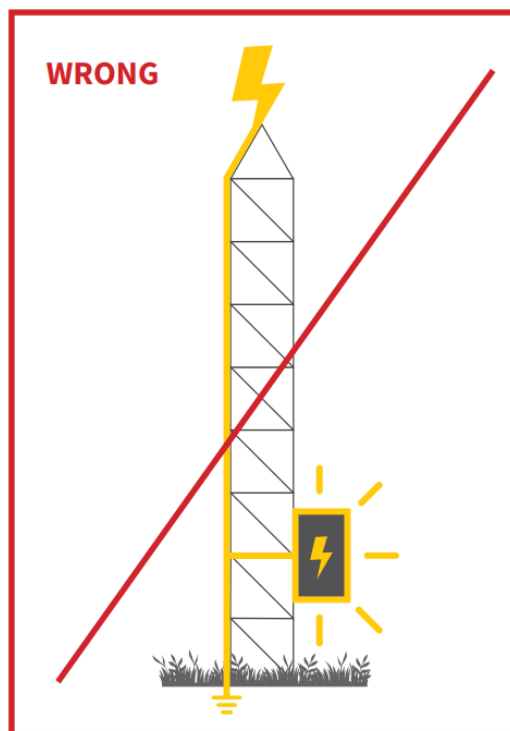


Fig. 18. *How to ground the logger*

6.4 Antennas

There are two antennas that come with the Orbit 360 data logger: a GSM antenna (see Fig. 19) and a GPS antenna (Fig. 20). Both of them are strongly magnetized at their base for ease of installation.



Fig. 19. *GSM antenna*



Fig. 20. *GPS antenna*

The antennas must be connected to their corresponding logger connectors, located in the upper right corner of the terminals side of the case (Fig. 21).



Fig. 21. Antenna connectors in Orbit 360

Both antennas must be installed out of the shelter box, in vertical position and as far as possible from the tower structure to minimize signal attenuation.

6.5 Sensor connection

The Orbit 360 features 92 removable terminals, arranged in such way that cluttered cable connection is avoided.

Different sensors produce different types of signal outputs. For your data logger to interpret the sensor signal, the signal output from the sensor must be compatible with the data logger input terminal to which it is connected. Depending on the Orbit 360 model, a different number of sensors can be connected its frequency, analog or RS485 channels.

All the most common sensors (anemometers, wind vanes, etc.) used in wind & solar resource assessment are compatible with the Orbit 360. Please refer to the [online sensor compatibility list](#) for an updated compatibility list.

6.6 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 'Orbit 360' 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 gets the date and time from the internal RTC. If the RTC doesn't work properly, the logger seeks the last input data recording and then it loads the date and time from there. 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 last line, it shows the status that the logger had before being powered off.

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 cannot 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 the memory card reader with Atlas software. If you do not 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.

7 On-site operations

7.1 Using the keypad

The Orbit 360 data logger features a keypad with five function keys: SET, UP, DOWN, LEFT/BACK and RIGHT/ENTER.



Fig. 22. Orbit 360 keypad

Key	Function
SET	Select and modify a parameter (EDIT/SAVE key)
UP	Scroll up through the menu options
DOWN	Scroll down through the menu options
LEFT	Page backward to the access the previous menu (BACK key)
RIGHT	Page forward to access the next menu (ENTER key)

Table 16. Keypad key functions

The Orbit 360 keypad has also the next two special functions:

- Reset memory: press UP + SET to make the logger reset the SD memory pointer and therefore initiate a new recording cycle (new data overwrites old data).
- Firmware update via SD card: this is an emergency on-site firmware upgrade from SD card memory. The procedure is as follows: 1) power off the logger by removing the 3-terminal orange power plug, 2) while simultaneously pressing UP and DOWN keys, turn on the logger. The green LED will start blinking several two times per second. 3) Press now LEFT+RIGHT to initiate the firmware upgrade and make sure power is **not** removed during the process.

7.2 Turning off the logger

The Orbit 360 data logger has neither “reset” nor “switch on/off” button. To turn it off, just disconnect the battery power by removing the 3-terminal orange plug. In case the data logger has internal emergency battery, this should also be disconnected or the keys combination pressed as shown in the data logger display when the battery power gets disconnected.

7.3 Using the display

An LCD display with 128x64p resolution is built into the Orbit 360 data logger to allow for on-site operation.



Fig. 23. Orbit 360 display

The display is divided into three different areas:

- Upper information bar: shows the battery status, memory accesses, logger site ID and communication status.
- Navigation area: scroll through the logger menus, access real-time values, set parameters, etc.
- Lower information bar: shows time, date and GPS, RS485 and MODBUS status.

7.3.1 Upper information bar

The upper information bar displays the following data and icons:

- Battery icon: shows the current power supply status. When the system is powered by a 12V battery, five level bars means that the battery is fully charged, whereas one single level bar indicates low battery. When voltage is above 12.9V a flashing arrow appears meaning that the system is being powered from an external source (e.g. solar panel).







Battery icon	Meaning
	Battery is being charged (bars flashing)
	Fully charged battery
	Medium level charge
	Low battery voltage
	Very low battery voltage
	Discharged battery

Table 17. Display: battery status

Remark:

For two bars or less, check the complete power system. Most lead-acid batteries are deteriorated when the voltage level drops below 8.5V and must be replaced.

- Memory icon: appears in the screen whenever the logger is reading or writing in the memory.






Fig. 24. Memory being accessed icon

- Logger site ID number: six-figure number that, together with the logger's name, identifies the site. It is configured in Atlas during the logger settings setup or it can be also done via keypad.



Fig. 25. Logger site ID number

- Communication status: the right side of the upper information bar displays the logger communication status.

Comm. status icon	Meaning
	GSM connection OK. There is correct communication between logger and modem and the SIM card is registered in the GSM network
	GPRS connection OK and the logger has been given an IP address
	The logger is connected to the Internet





	The logger is ready to receive and transmit data over the Internet by means of Atlas desktop software
	The logger is configured to communicate by means of the Iridium satellite module
	Communication error. Wrong SIM PIN code, modem not detected, etc.
	E-mail transmission in progress (envelope after the ONLINE word)

Table 18. Display: communication status

7.3.2 Lower information bar

The lower information bar displays the following data and icons:

- Time and date: in the absence of pop-up warnings, the data and time of the logger are shown in the left side of the lower information bar. Both date and time are synchronized with UTC* via GPS. Orbit holds the date and time even if the unit is switched off.



Fig. 26. Logger data and time

*The data can be decoded applying any time offset to account for the local time, if wanted.

- GPS status: shows the signal of the GPS receiver. In case of GPS failure, an X is shown instead of the coverage bars.

Fig. 27. GPS status

- RS485 communication status: a flashing dot indicates RS485 communication between the logger and the sensors connected to the digital buses.



Fig. 28. *RS485 communication status indicator*

- Modbus status:



Fig. 29. *Modbus status indicator*

7.4 Parameter edit mode

To edit a value in Orbit 360 via keypad, simply access the value by pushing the SET button. Once the value has been selected, press SET again to save the changes.

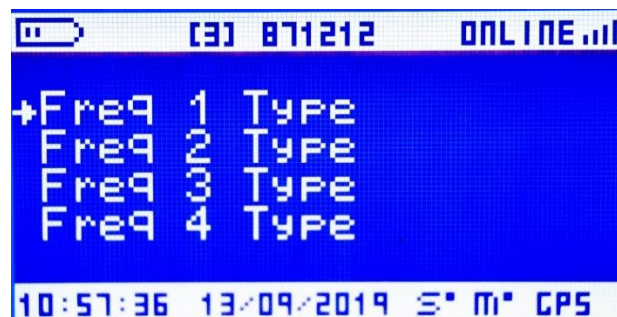




Fig. 30. Edit mode (sensor model)

7.5 Navigation menus on logger display

The liquid crystal display is built into the logger to facilitate site visits and is activated by pressing any key on the logger keypad. The user can view real-time wind conditions as well as data logger settings. As a power saving function, the display will always shut off after two minutes without any key inputs. The logger continues to collect data while the display is off.

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

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

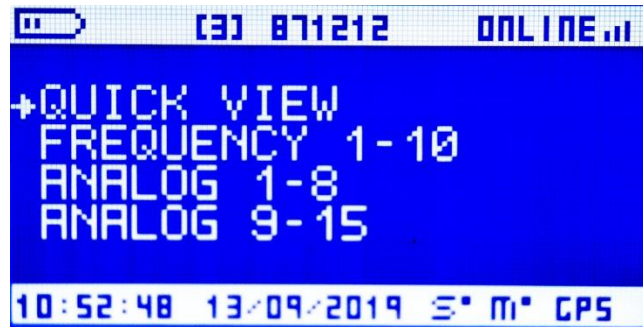


Fig. 31. Orbit 360 main menu view (1)



Fig. 32. Orbit 360 main menu view (2)

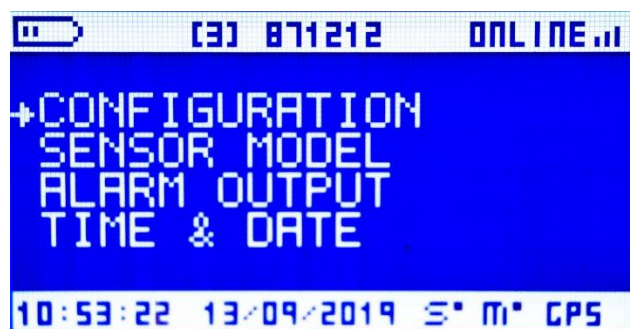


Fig. 33. Orbit 360 main menu view (3)

7.5.1 QUICK VIEW

In this window the real time values from all the active sensors are displayed. The values are refreshed every second and they are expressed in the default units for that particular magnitude.

The initial view shows FR1 to FR6 and ANL1 to ANL6 channels. **Scroll DOWN/UP to access to the rest of channels.**

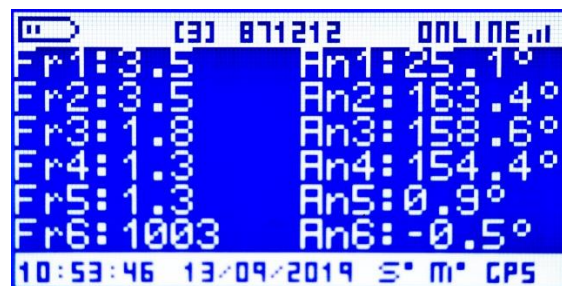


Fig. 34. QUICK VIEW screen

7.5.2 FREQUENCY 1-16

In this window you can access both real time and the last averaged value of every frequency channel, together with the sensor model name configured in that particular channel. Again, the values will be expressed in the default units for that particular magnitude: m/s for wind speed, mbar for pressure, degrees for the True North offset, etc.



Fig. 35. FREQUENCY 1-10 screen

1st line → channel ID, e.g., “Frequency 1”.

2nd line → Sensor model ID, e.g., “07 K620A / Ornytion 107”.

3rd line → Instantaneous value, e.g., “Inst: 3.1 m/s”.

4th line → Average value, e.g. ”Avg: 2.6 m/s”. Note that, just after turning on the logger, there will be no average value available until a 10-min interval has been exceeded.

7.5.3 ANALOG 1-8

In this window you can access both real time and the last averaged value of every analog channel ranging from 1 to 8. The values will be expressed in the default units for that particular magnitude.



Fig. 36. ANALOG 1-8 screen

1st line → channel ID, e.g., “Analog 4”.

2nd line → Sensor model ID, e.g., “1A GEOVANE TILT X”.

3rd line → Instantaneous value, e.g., “Inst: 0.9°”.

4th line → Average value, e.g. ”Avg: 0.4°”. Note that, just after turning on the logger, there will be no average value available until a 10-min interval has been exceeded.

7.5.4 ANALOG 9-23

In this window you can access both real time and the last averaged value of every analog channel ranging from 1 to 8. The values will be expressed in the default units for that particular magnitude.

1st line → channel ID, e.g., “Analog 12”.

2nd line → Sensor model ID, e.g., “61 GEOVANE TILT X”.

3rd line → Instantaneous value, e.g., “Inst: -1.4°”.

4th line → Average value, e.g., “Avg: 1.4°”. Note that, just after turning on the logger, there will be no average value available until a 10-min interval has been exceeded.

7.5.5 STATUS

This screen provides information regarding the status of the data logger, as well as other system parameters such as firmware and hardware version, the serial number, or the of the GSM/GPRS coverage and current communication status.

7.5.5.1 Logger status

Go to [STATUS → Logger Status] for general information about the status of the logger.



Fig. 37. STATUS screen: Logger Status

The following information is displayed on this screen:

- Error code number: shows errors produced in the last 10 minutes recording period. The code consists of two bytes and it is given in hexadecimal format. Each of the 16 bits corresponds to one error and the complete error code number can exhibit more than one error. The logger offers a brief error summary in addition to the code.

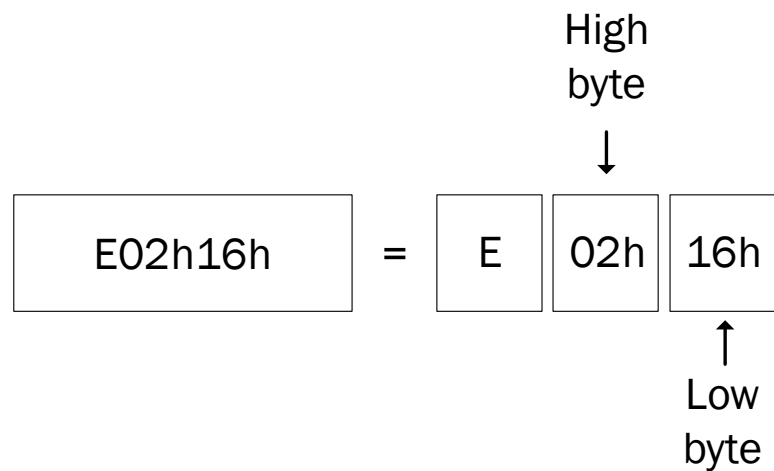
High byte (HB)	Meaning
HB.0	<i>Not used</i>
HB.1	Internal memory contains data
HB.2	GPS error
HB.3	Micro SD card (1-second data) not inserted
HB.4	Micro SD card (1-second data) error
HB.5	Reboot
HB.6	Aux board error (Modbus TCP, RS485, GPS)
HB.7	Operating with emergency battery
Low byte (LB)	Meaning
LB.0	The logger has been turned off (Power reset)
LB.1	Low battery warning
LB.2	SD card error
LB.3	Corrupt data in SD card (SD card format error)
LB.4	SD card not inserted

LB.5	Internal memory error
LB.6	A/D converter error
LB.7	<i>Not used</i>

Table 19. Logger status: error code number

In the following example the error code number is equal to E02h16h, indicating the following errors:

- HB.1: Internal memory contains data.
- LB.1: Low battery warning.
- LB.2: SD card error.
- LB.4: SD card not inserted.



- Microprocessor performance: shows the % of free CPU. The lower the %, the busiest the system is.
- Error messages: in case there are errors, the bottom lines of the logger status screen will describe the meaning of the errors contained in the Error Code described above.

7.5.5.2 Modem

Go to [STATUS → Modem] for specific information about the status of the modem.



Fig. 38. STATUS screen: modem

The following information is displayed on this screen:

- Second line:
 - Signal strength (**Cov**): a two-digit number shows the numeric value of the signal, in dBm (0 to 31 for GSM connection). Iridium satellite signal strength is displayed in a 0 to 5 scale.
 - Telemetry finite state machine status (**e**): a two-digit number that provides its current state ID of the modem FSM (refer to section 9.4 for more info).
 - RX buffer (**b**): a two-digit number that shows the latest number of bytes received by the modem.
 - Time-out timer (**t**): for technical support and troubleshooting.
- Third line:
 - IP address: the dynamic or static Internet Protocol address when the Orbit 360 is connected to the internet, followed by the port number listening to incoming connections.

- Fourth line:
 - Access Point Name (APN): the APN settings that the user has configured in the Orbit 360 for accessing to the General Packet Radio Service (GPRS). It is provided by the mobile network operator.

7.5.5.3 Serial channels

Go to [STATUS → Serial channels] for information about the the number of times that one instrument of the specified bus didn't send a correct answer. The counter is reset to 0 after every automatic download. The maximum number of errors per bus ranges up to 200. Above that, the system displays >200. To provide information on whether errors are currently occurring with a counter of >200, 199 and > 200 are alternately displayed.



Fig. 39. STATUS screen: Serial Channels

7.5.5.4 Modbus

Go to [STATUS → Modbus] for a summary about the Modbus communication status. Refer to section 9.7 for detailed info about Modbus and SCADA connectivity.



Fig. 40. STATUS screen: Modbus

The following information is displayed on this screen:

- First line:
 - Modbus finite state machine status (**e**): a two-digit number that provides its current state ID of the Modbus FSM (for technical support and troubleshooting).
 - Modbus RX buffer (**b**): a two-digit number that shows number of bytes received through the bus.
- Second line:
 - Register count (**Reg Count**): number of registers a Modbus request should ask the Orbit for.
- Third line:
 - Slave number (**Slave #**): slave ID of the Orbit 360.

7.5.5.5 GPS location

Go to [STATUS → GPS location] for information about the geographical location of the met mast. The site coordinates are displayed in WGS 84 format.



Fig. 41. STATUS screen: Site Coordinates

The following information is displayed on this screen:

- First line:
 - Latitude (e.g., **41°38.937'N**).
 - GPS finite state machine status (**e**): a two-digit number that provides its current state ID of the GPS FSM (for technical support and troubleshooting).
- Second line:
 - Longitude (e.g., **000°53.593'W**).
 - GPS RX buffer (**b**): a two-digit number that shows the latest number of bytes received by the GPS.
- Third line:
 - Altitude above sea level (e.g. **227m**).
 - Number of satellites: a two-digit number that reflects how many satellites are accessible to the GPS (the more satellites, the better accuracy, with a maximum of 12).
 - Internal parameters of the GPS FSM, for technical support and troubleshooting (e.g., **c02t60**).

7.5.5.6 Power supply

Go to [STATUS → Power supply] for detailed information regarding the battery status.

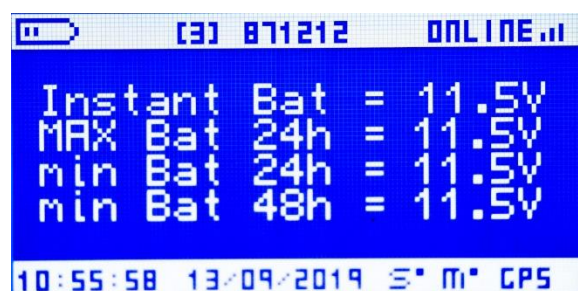


Fig. 42. STATUS screen: Power supply

The following information is displayed on this screen:

- First line:
 - Instantaneous value: current voltage value, in volts. (e.g. **Instant Bat = 12.4V**).
- Second line:
 - Maximum of the last 24h: the maximum voltage of the previous day (UTC time), in volts. (e.g. **Max Bat 24h = 13.2V**).
- Third line:
 - Minimum of the last 24h: the minimum voltage of the previous day (UTC time), in volts. (e.g. **Min Bat 24h = 11.9V**).
- Fourth line:
 - Minimum of the 24h previous to the last 24h: the minimum voltage of the day before the previous UTC day. (e.g. **Min Bat 48h: 12.1V**).

The [STATUS → Power supply] screen allows for checking the proper functioning of the solar charging system by comparing the day and night values and by evaluating the evolution of the minimum values of the last two days.

7.5.5.7 System info

Go to [STATUS → System] info for general information regarding the Orbit 360 unit.



Fig. 43. STATUS screen: System info

The following information is displayed on this screen:

- First line:
 - Number of days of stored data (e.g., **Stored = 27 Days**).
- Second line:
 - Firmware version (e.g., **FW: 02.09**).
 - Hardware version (e.g., **HW: 01**).
 - Logger model (e.g. **Md: 03**). See table below.

Logger Model	Code number
Basic Plus	02
Premium	03

Table 20. Code number for logger model

- Third line:
 - The three least significant bytes of the last SD card memory location with data, for technical support and troubleshooting. (e.g., **MEM:03BD28**).
 - Last four digits of the serial number of the Orbit 360 unit (e.g., **s/n: 12014**).

7.5.6 CONFIGURATION

This screen allows the installer to configure some basic logger parameters on site, such as the modem type (external, internal...), the SIM pin code, language...

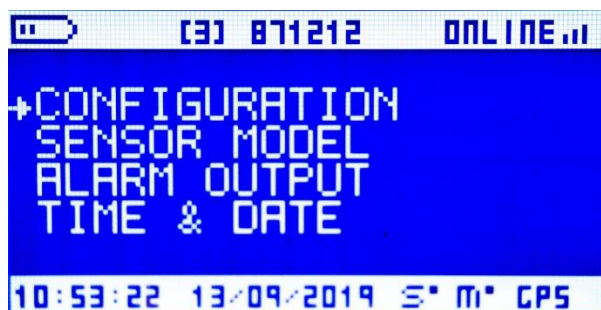


Fig. 44. Configuration menu

Remark:

All configuration changes become effective at the end of the recording period.
Do not turn off the logger before this happens to avoid losing the changes.

7.5.6.1 Modem type

Go to [CONFIGURATION → Modem type] to modify the modem settings. Different options are available, specified in the following table:

Number	Description
01	Anl/CDMA Maxon (by Maxon, for CDMA wireless networks)
02	Kintech GSM
03	GSM SIEMENS (GSM modem by Siemens)

05	CDMA MULTITECH (by Multichech, for CDMA wireless networks)
06	Iridium Sat. (external satellite modem by Iridium)
07	BGAN/direct com
12	Kintech GPRS

Table 21. Configuration: modem types



Fig. 45. Configuration: Modem types

7.5.6.2 Modbus RTU

Go to [CONFIGURATION → Modbus RTU] to select among different Modbus options, specified in the following table:

Number	Description
22	MODBUS 9600 bps
23	MODBUS 19200 bps
24	MODBUS 38400 bps

25	MODBUS 57600 bps
26	MODBUS 115200 bps
27	MODBUS Suzlon
28	MODBUS Enercon 9600 bps
29	MODBUS Enercon 19200 bps
30	MODBUS Enercon 38400 bps

Table 22. Configuration: Modbus RTU

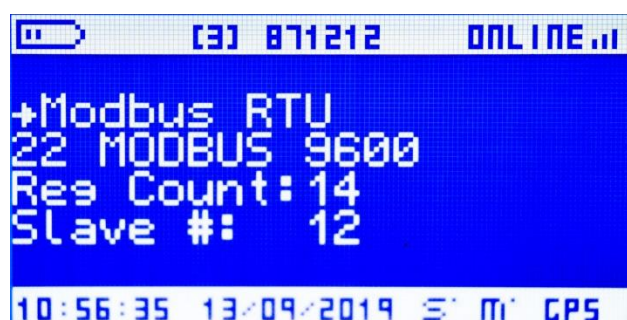


Fig. 46. Configuration: Modbus RTU

7.5.6.3 Area number

Each logger needs a unique ID number to avoid data processing errors or maintenance misunderstandings. This unique ID number is called **site ID**, and it is always visible in the upper central part of the display, no matter the screen (refer to section 7.3.1). The site ID parameter consists of three variables, each being a two-digit number.

Go to [CONFIGURATION → Area Number 0-99] to edit the first two digits of the site ID number.



Fig. 47. Configuration: Area number

7.5.6.4 Location number

Go to [CONFIGURATION → Location Number 0-99] to edit the second two digits of the site ID number.



Fig. 48. Configuration: Location number

7.5.6.5 Tower number

Go to [CONFIGURATION → Tower Number 0-99] to edit the two third digits of the site ID number.



Fig. 49. Configuration: Tower number

7.5.6.6 Num 1 2

Go to [CONFIGURATION → Num 1 2] to edit the two first digits of the SIM PIN code. Due to security reasons, two asterisks ** will be shown instead of the actual number.

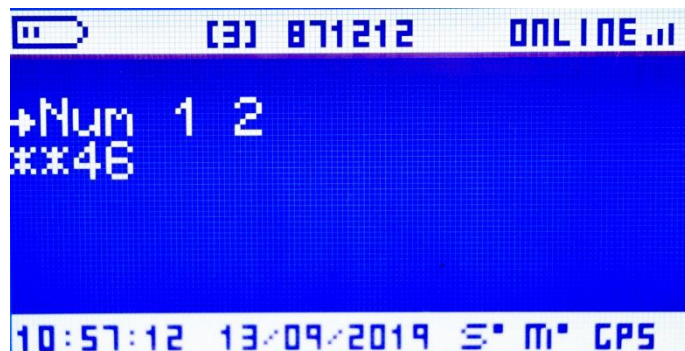


Fig. 50. Configuration: Num 1 2

7.5.6.7 Num 3 4

Go to [CONFIGURATION → Num 3 4] to edit the two second digits of the SIM PIN code.



Fig. 51. Configuration: Num 3 4

Remark:

If the logger introduces an incorrect SIM PIN code three times, the SIM card will be blocked. To unblock the SIM card, insert it into a normal mobile phone and enter the PUK code and then the correct PIN code.

7.5.6.8 Language

Go to [CONFIGURATION → Language] to choose among the following four languages available for the logger menus:

Number	Language
00	English
01	Español

02	Français
03	Português

Table 23. Configuration: language



Fig. 52. Configuration: Language

7.5.6.9 Flags configuration

Reserved operation. Do not edit unless assisted by Kintech Instruments.

7.5.6.10 Mode

Reserved operation. Do not edit unless assisted by Kintech Instruments.

7.5.7 SENSOR MODEL

This screen allows the installer to configure the type of sensor to be connected to a specific channel of the Orbit 360 data logger.



Fig. 53. Sensor model

Each of the available channels can be individually and accordingly configured as shown in the following lists. These lists include most of the sensors known in the wind and solar energy sector. However, if you are planning to connect sensors to the data logger that are not 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.

Frequency Channels

Type	Sensor Model	Units
00	NOT ENABLED	-
01	MAXIMUM 40/40H	m/s
02	Young 3102	m/s
03	Vector A100R_S	m/s
04	RISO P2546	m/s
05	NRG ICEFREE	m/s
06	THIES_4.3515.30	m/s
16	Rain Gauge 0.2mm	mm
17	Rain Gauge 0.1mm	mm
21	Young 05103	m/s
22	THIES First Class	m/s

23	Vector A100LK	m/s
24	Vaisala WAA252	m/s
25	Ornytion 107H Optic	m/s
26	Metone	m/s
27	THIES FC Advanced	m/s
28	Hertz	Hz
29	Pressure K611P-B	mBar
30	Kriwan INT10	m/s
31	Vector A100LM	m/s
32	Geovane True North	°

Table 24. Sensor model: frequency channels

Analog Channels

Type	Sensor Model	Units
00	NOT ENABLED	-
01	Milivolts	mV
02	Temperature EOL 307	°C

03	Temperature Young 41342VC	°C
04	Temperature NRG 110S	°C
05	Temperature GALLTEC KPC 1/5	°C
06	Temperature Vaisala HMP45A	°C
07	Temperature	°C
08	Temperature C.CELL SI-V10	°C
11	Windvane Ornytion 207	°
12	Windvane NRG/THIES 10K	°
13	Windvane Young 03001	°
14	Windvane Vector W200P	°
15	Windvane Young 05103	°
16	Windvane THIES 2K	°
17	Windvane FRIEDRICHS	°
18	Windvane OUTPUT 0-5V	°
19	Windvane GENERIC VCC 2.5V	°
21	Anemometer Young Propeller 270106	m/s

22	Anemometer Young Propeller 270105	m/s
25	Anemometer THIES Ultrasonic Coordinate X	m/s
26	Anemometer THIES Ultrasonic Coordinate Y	m/s
27	Anemometer THIES Ultrasonic Coordinate Z	m/s
31	Pressure SETRA 276 800-1100	mBar
32	Pressure Vaisala PTB100	mBar
33	Pressure NRG BP20	mBar
34	Pressure SETRA 276 600-1100	mBar
37	Humidity GALLTEC KPC 1/5	%
38	Humidity Vaisala HMP45	%
39	Humidity	%
42	Radiation Thermopile	W/m ²
43	Pyranometer Kintech	W/m ²
44	Pyranometer Photodiode	W/m ²
45	Radiation C.CELL SI-V10	W/m ²
48	Sound Level Cesva	dBA

49	Sound Level Bruel KJAER	dBA
51	Analyzer Bieler & Lang	PPM
54	General A1	-
55	General A2	-
60	Geovane True North	°
61	Geovane Tilt X	°
62	Geovane Tilt Y	°

Table 25. Sensor model: analog channels

Remark:

Serial Inputs need to be configured in Atlas software since they cannot be setup via keypad.

7.5.8 TIME & DATE

This menu allows the configuration of hour, minute, day, month and year applied to the timestamp of the data register:

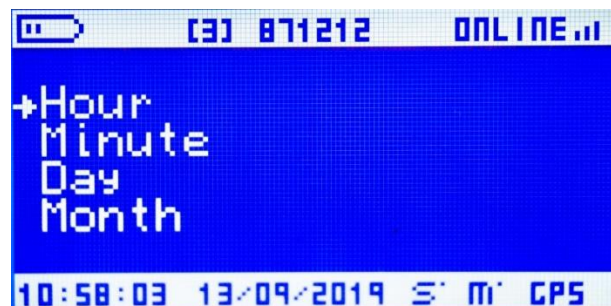


Fig. 54. Time & Date configuration screen

Remark:

If for whatever reason the user want to avoid the automatic set up of date/time via GPS synchronization, the installer has to disable it by removing the GPS antenna.

7.6 On-site logger configuration via SD card

Besides the configuring options available via keypad described in section 7.5.6, general on-site configurations are carried out by means of the logger SD card. Once you are done with the configuration of your logger in Atlas, you need to export those settings to the SD memory card that is going to be later inserted in the logger by carrying out the following procedure:

1. Insert the SD memory card in your computer's MMC card reader.
2. In Atlas, access the Site Window of the logger whose configuration you want to upload to the SD card.
3. On the left menu, go to CONNECTIONS > Upload settings, select to upload "Logger settings from Atlas", select "Connect via SD card" and click Start.



What to upload

☒ Logger settings from Atlas ☐ UTC time ☐ New password

This option will upload the latest settings in Atlas to the logger

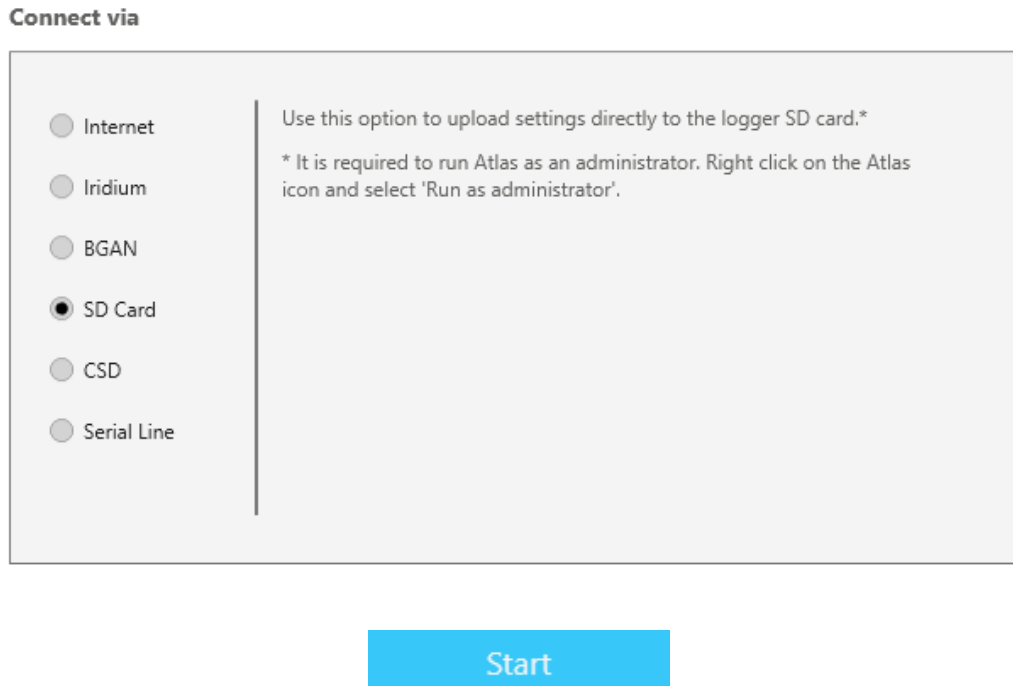


Fig. 55. **Uploading settings to a SD memory card connected to your PC**

7.7 Changing the SIM card (PIN code)

In the event that it is necessary to change the SIM card of the Orbit 360 and the new SIM card has a different PIN code than the current one, the new PIN code can be configured in the data logger. Follow the below steps to carry out such replacement:

1. Turn off the Orbit 360 by removing the orange plug. If the logger features internal backup batteries, press simultaneously UP + SET + DOWN after removing the main power supply to turn it off.
2. Extract the old SIM card by gently pushing it in until it clicks.
3. Turn on the logger (without SIM card).
4. Configure the new SIM PIN code by following the instructions in sections 7.5.6.6 and 7.5.6.7.

5. Wait until the next recording period for the configuration change to become effective (refer to section 4.1.4). If the logger is turned off before the logger makes the SD recording, the changes will be lost.
6. Turn off the logger.
7. Insert the new SIM card.
8. Turn on the logger.

Remark:

APN parameters can only be modified by using the Atlas software and uploading the new settings to the SD card.

7.8 Sensor replacement

If a sensor replacement alters the sensor's model, the logger's channel should be reconfigured. To do it directly from the logger's keypad, the installer needs to follow the below navigation steps:

1. Press SET at the logger's keypad to turn on the screen and then up or down to enter the main menu;
2. Select the Sensor Model menu with the right arrow;
3. Navigate with the keypad's up and down arrows until the channel respective to the sensor replaced is highlighted;
4. Press keypad's right arrow to enter and view the channel's settings;
5. Press SET to edit channel's settings;
6. Select the correct sensor model with the keypad's up and down arrows and press keypad's right arrow to apply the change.

7.9 Downloading from SD card

You can take out the SD card from the logger at any time by gently pushing it in until it clicks, as described in Fig. 56.



Fig. 56. *How to take out the SD card*

Removing the SD card does not stop any of the logger tasks. When the logger detects that the SD card has been released from its memory holder, it will show on display the instructions to begin a new storage cycle.



Fig. 57. Display: checking memory card

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.

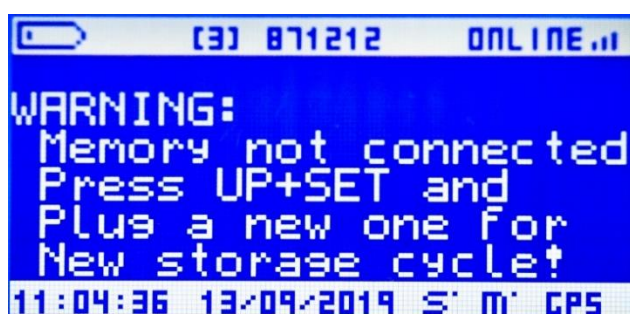


Fig. 58. Display: storage cycle instructions



Fig. 59. Display: new storage cycle screen

If you want the logger to continue storing the data at the memory address where it was left, just do not follow the keypad sequence. The logger will then keep going the previous storage cycle and the old data will be kept in the SD card, available for future downloads.

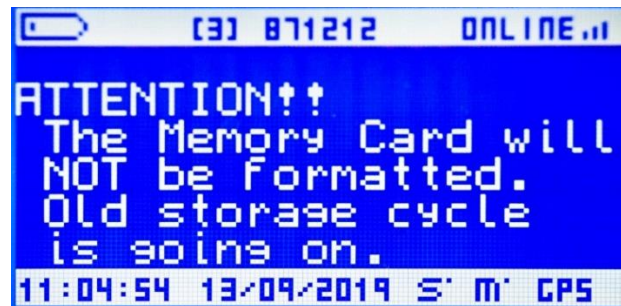


Fig. 60. *Display: old storage cycle continues*

Once the SD card is removed, you can download the data by simply inserting it into a PC. Then **run Atlas as administrator** and perform a **manual download** by selecting the SD Card option.

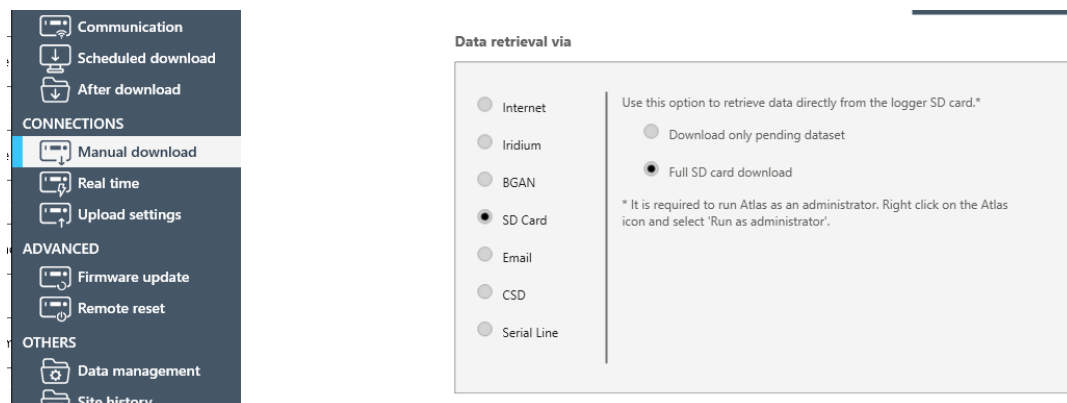


Fig. 61. *Downloading data from the SD card*

Please note that there is no other way to download the data from an SD card from Kintech data loggers, as it is encrypted and cannot be viewed from the Windows file explorer.

8 Data security

There are **three different passwords** when working with Orbit 360 data loggers:

1. **Full access** password: with this password, the user can perform all types of communication with the data logger (real time connection, remote data download, upload new configurations to the logger, etc.).
2. **Real time** data password: on a second level, the real time data password locks this type of connections. It must be noted that the full access password does not restrict real time connections, with the purpose of allowing the installer or maintenance teams verify any on-site operations carried out at the met station. It is necessary to firstly set up the Full access password for the Real time password to function.
3. **Data** password: Atlas allows embedding a password to the raw data (.log files) before sending them to a trusted third party. The third party will need to manually input the password when decoding the received raw data files.

8.1 Orbit passwords

The first two type of passwords, full access and real time, need to be **uploaded to the logger** to take effect, for they are used by the logger to block incoming connections.

8.2 Atlas passwords

The data password does not to be uploaded to the data logger, since it is embedded into the raw data files (.log).

9 Communication options

The Orbit 360 data logger can communicate in a wide variety of systems and protocols. Each of them has advantages and disadvantages in terms of cost, efficiency and geographical availability.

The communication tasks do not stop any others basic data-logging tasks. They are performed in a lower priority scheme in the CPU free time.

9.1 GSM/GPRS

The Orbit 360 data-logger is always equipped with a built-in GSM/GPRS modem. Kintech Instruments recommends the use of the GSM/GPRS communication network because of its effectiveness and cost.

While the GSM/GPRS modem is not accessible to the user, the SIM card holder and the modem status LED are located in prominent positions of the front panel of the logger. The GSM antenna connector, for its part, can be found at the right area of bottom side of the box, together with the GPS antenna connector.

The built-in modem of the Orbit 360 data logger consists of a penta-band GSM/GPRS/3G modems with 2G fallback.

9.1.1 Internet

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 Orbit 360 data logger can connect to the Internet through the APN configured in its settings. When the logger is connected to the internet (ONLINE), it is waiting for incoming connections from an Atlas software. In order to establish the desired communication, the Atlas software needs to know the logger's IP address.

9.1.1.1 Logger Name Server (LNS)

As the logger IP address may be unpredictably changing (this is known as “dynamic IP”), Kintech Instruments has developed the necessary infrastructure to let Atlas get the logger IP address from a server on the internet. We have named it “Logger Server Name”, LNS. This LNS server holds in a table the current IP address of every ONLINE logger.

When the Orbit 360 data-logger connects to the APN and receives an IP address, the logger shows INET in the upper right corner of the display. Then the logger initiates a connection to the LNS to update its IP address in the table. After that, the INET sign turns into ONLINE, indicating that the logger is ready for incoming connections from Atlas. When Atlas wants to connect to a particular logger, it firstly asks to the LNS what the IP of that particular logger is (of that serial number).

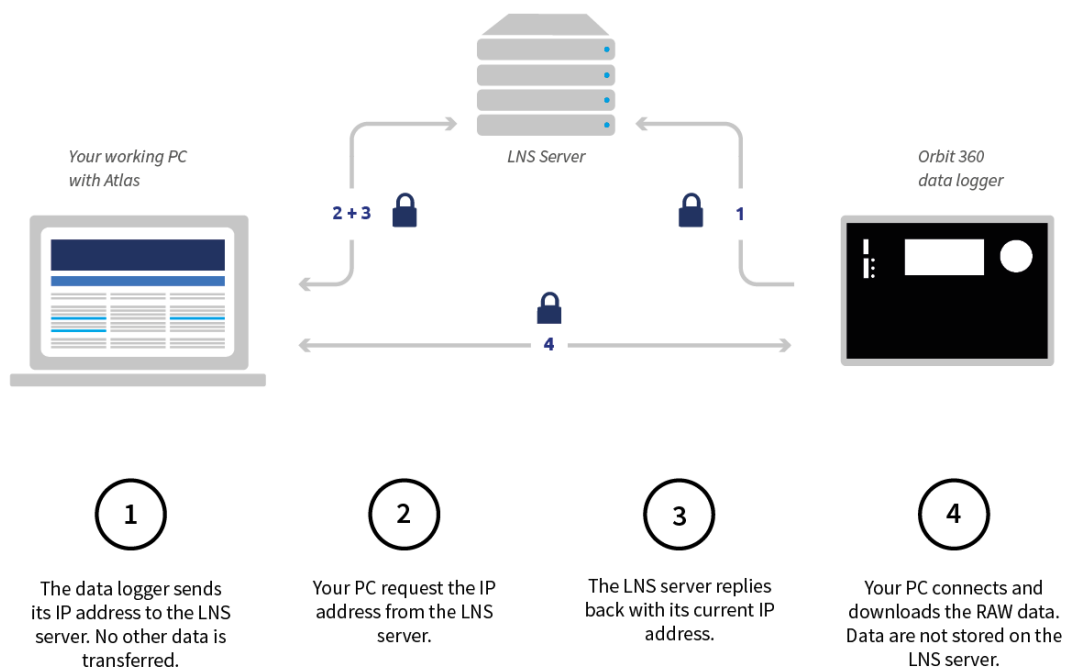


Fig. 62. Logger Name Server (LNS)

Unfortunately, not all GSM lines and GSM operators allow the reception of incoming connections from the internet. In other words, they do not 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”, but a “private” one. There is no response to ping commands or the peer IP that responds to them does not correspond to the logger.

Some GSM operators require ordering specific Internet contracts that consent public IP and internet incoming connections. Sometimes the service that matches the necessities also includes static IP assignment, which is not necessary. Other GSM operators offer IPsec to VPN's.

9.1.1.2 Kintech Global Internet SIM cards

Because of the extensive number of our customers with wind & solar measurement campaigns in several different countries, we know the difficulties to acquire local SIM cards with the optimal settings and local GPRS / 3G coverage.

The need for a more effective way to handle this has motivated our engineers to come up with a solution for a single SIM card that offers internet connection to your data loggers and works in practically all countries worldwide. A single SIM card that checks for all the available local GPRS / 3G signals and automatically connects to the operator with the best coverage. This has in many cases demonstrated to improve and simplify communications compared to conventional SIM cards that just work with a single operator.

Benefits with our new Global Internet SIM card:

- Internet connection to all your data loggers.
- One solution for all your sites.
- Automatically checks for best local GSM operator.
- No more talking to your local GSM provider.
- Cost effective. No monthly data plans. Fixed yearly costs.



Fig. 63. *Kintech global SIM card*

The Kintech Global Internet SIM card is only and exclusively for the Kintech data loggers: EOL Zenith and Orbit 360.

CONFIGURATION

When configuring your data logger in Atlas, use the following parameters for this SIM card:

APN name: m2mkt.movistar.es.

Username: kintech

APN Password: kintech

If you are using our discontinued SIM card - purchased before Dec. 2016, please contact us directly on m2m@kintech-engineering.com

9.1.2 Modem call (CSD)

Some GSM service providers offer data exchange communications through a GSM call made from one GSM modem (located at the office) to the built-in GSM modem of the Orbit 360. This service is usually called CSD (Circuit Switched Data), GSM data reception or 2G data communication.

To perform this type of communication it is necessary to have a modem connected to the PC where the Atlas software 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.

When Atlas is told to connect via CSD to a given data logger, it will dial the telephone number of the SIM card on the logger.

CSD allows speeds up to one kilobyte per second. The cost of communication depends on the time the communication lasts and not on the number of bytes transferred.

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 M2M 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.

CSD technology, which was cutting edge in the past, has now become outdated by internet connectivity. After 2010 many telecommunication carriers dropped support for CSD, and CSD has been superseded by GPRS and EDGE (E-GPRS). As a matter of fact, Kintech Global SIM cards are intended for internet connection only and they do not support modem calls.

9.1.3 SMS

The SMS transmissions have a very low byte transfer capacity, which makes it very effective when there is poor GSM coverage on-site. Although there is no way SMS can be used to retrieve stored data, it can be employed to check the current met mast status, get instantaneous monitoring and modify logger settings.

One of its advantages is that there is no need to use any specific software, modem or internet connection. Any standard cell phone can be used to send an SMS to the telephone number of the SIM card on the logger. The Orbit 360 data logger will answer with other SMS containing information of the last average values of the input channels, along with its internal status.

You can request this message at any time by sending an SMS with the text “ORB” (uppercase) to the telephone number of the SIM card on the logger.

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 without it.

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%

9.1.4 Email

The Orbit 360 data logger can be set up to send data via email. For the logger to be able to send emails, you have to configure the following parameters:

- **Email frequency**

Email frequency can be set to a range from one to seven days.

- **Time**

The time at which emails will be sent can be configured from 0h to 23h (UTC).

- **Sender email address**

The sender email address is typically the SMTP user name as a full email address and is the unique email address assigned to the logger. This email address will appear in the “From” field of the emails the Orbit 360 will send.

- **Recipient email address 1**

First email address to which the logger will send the data files.

- **Recipient email address 2**

Second email address to which the logger will send the data files.

- **SMTP Server**

For the logger to be able to send emails, you have to configure the SMTP Server, which necessarily **needs to be TLS/SSL**.

- **SMTP Port**

Consult your email service provider to confirm the correct port to use. Some typical SMTP ports are 587 or sometimes 25.

- **SMTP Username**

The username associated with the email account.

- **SMTP Password**

The password associated with the email account.

If the logger has been set up to send emails, 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 'ORBCONF0393201\$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.

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 Instruments 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.

An example of how-to setup a yahoo account:

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

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:

1. The auto-download check box must be checked with the option "Read Emails from Logger" of the data logger.
2. The email header has both SiteName and yyyyMMdd.
3. The email has the following displayed: Sit SiteNumber.
4. Have an attachment with the file extension ".elog"
5. The correct and specific pop server for this email account must be used.
6. SN last 5 digits must be included in the email.

9.2 Satellite

Kintech Instruments offers two alternative satellite solutions, Iridium and BGAN. Either solution enables you to connect with data loggers installed in locations without GSM coverage.

Unlike the built-in GSM modem that comes by default with every Kintech logger, the satellite solution consists of external hardware that must be wired to the logger terminals.

Both Iridium and BGAN modems have an accessible SIM card holder. The SIM card is similar to the GSM SIM cards and must have its PIN1 code request disabled.

Please be aware that the parameters of the modem must be set up by Kintech Instruments so they match the Orbit 360 features.

9.2.1 Iridium

An optional Iridium connectivity system can be supplied for Orbit 360. It consists of all the necessary hardware including modem, data cable, antenna and RF antenna cable. To enable Iridium communications on the Orbit 360, all you need is to set up modem type to Iridium on logger settings, which can be done locally via logger keypad or remotely through Atlas software.

The Iridium satellite module enables remote bi-directional communication with your Orbit 360 data logger. This means that you can get your measurement data from anywhere in the world. It actually requires two IRDM modems: one connected to the data and another one installed on the roof of your office, connected to the PC running Atlas (central modem).

The 9522B modem is Iridium's 2nd-generation satellite transceiver and offers a comprehensive and reliable worldwide coverage. It is ideal for sending and receiving voice and data from equipment everywhere on the planet. It functionally supports all of Iridium's voice and data services and easily integrates into a wide variety of applications through a RS232 serial interface and AT command set.

Kintech Instruments offers several satellite minutes bundles, depending on data logger settings, sensor configuration and download frequency. A local Iridium modem at the office, what we call "central modem", (installed on the roof) is required in order to communicate with your met masts through Iridium. Ask Kintech about other options to skip using a central modem.



Fig. 64. *Iridium modem*

9.2.1.1 Characteristics

- Meant for wind resource assessment met masts.

- Consumption is measured in minutes.
- Central modem needed.
- One connection at a time (provided a single central modem to connect to all the loggers).
- 66 non-geostationary satellites → no need for on-site antenna orientation.



Fig. 65. Satellite: Iridium

9.2.1.2 Installation (logger side)

The Iridium antenna must be installed in vertical position, with the cable entry facing the ground. The antenna needs to have the greater open-sky visibility possible, with the only interruption of the tower structure. We recommend the boom for the antenna to be long enough, for instance 1,5m.

The Iridium modem needs to be connected to the Ext. Com RS-232 terminals 44 and 43. The modem can be powered directly from the logger terminals 46 and 45.



Fig. 66. Iridium antenna for satellite connection

The following diagrams illustrate how to connect the IRIDIUM 'S antenna and modem to the Orbit 360 data logger:

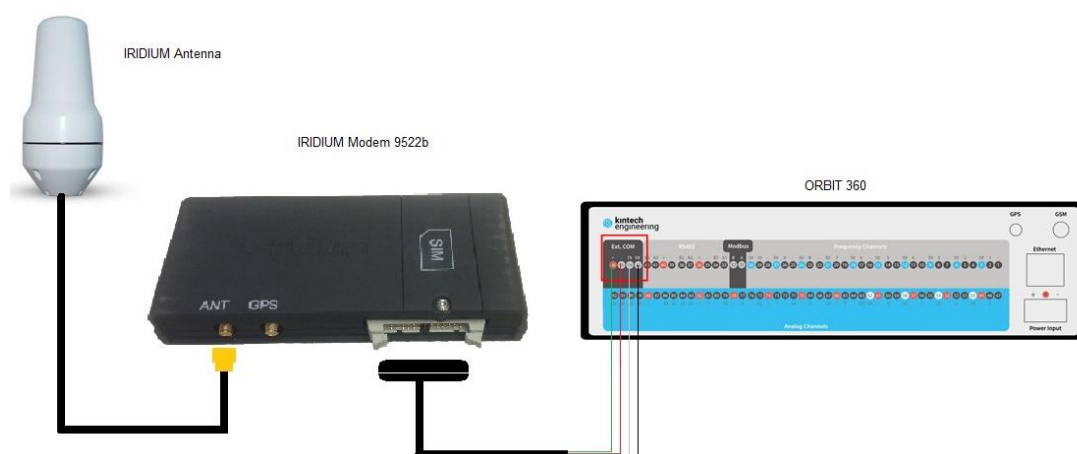


Fig. 67. Iridium satellite connection diagram (logger side)

9.2.1.3 Installation (office side)

The antenna installation in the office side has the same procedure of the logger side. The only difference might be the type of structure that it is commonly installed.

As for the modem, it has a procedure slightly different from the previous one. This time the modem is powered by a 12V power supply and has to be connected to a computer that includes the Atlas software.

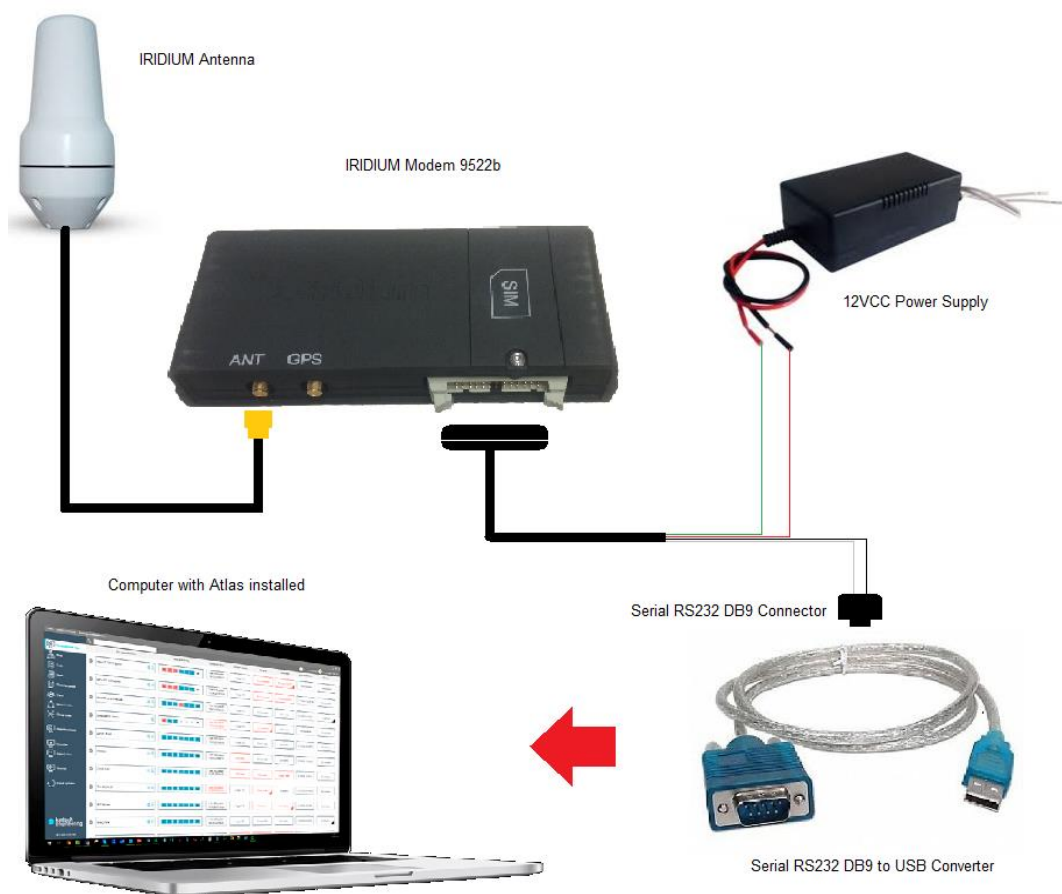


Fig. 68. *Iridium satellite connection diagram (office side)*

9.2.2 BGAN

The BGAN satellite module enables remote bi-directional communication with your Orbit 360 data logger using your **existing office internet connection**. This means that you can get your wind & solar measurement data from anywhere in the world.

Each BGAN satellite module ships with BGAN Modem, BGAN antenna, support boom including angular support bracket and network cable.

Since the BGAN system connects through your standard office internet connection, it allows for several simultaneous satellite connections. This results in a more flexible system when operating a large number of towers.

The BGAN satellite system requires satellite data service. Select one of the data packages that Kintech Instruments offers, depending on data logger settings, sensor configuration and download frequency.



Fig. 69. BGAN satellite modem (logger side)

9.2.2.1 Characteristics:

- Meant for solar stations or wind resource met masts with heavy data traffic.
- Consumption in Mbytes.
- NO central modem needed (Internet connection).
- Multiple connections at a time.
- 3 geostationary satellites → on-site antenna orientation required.

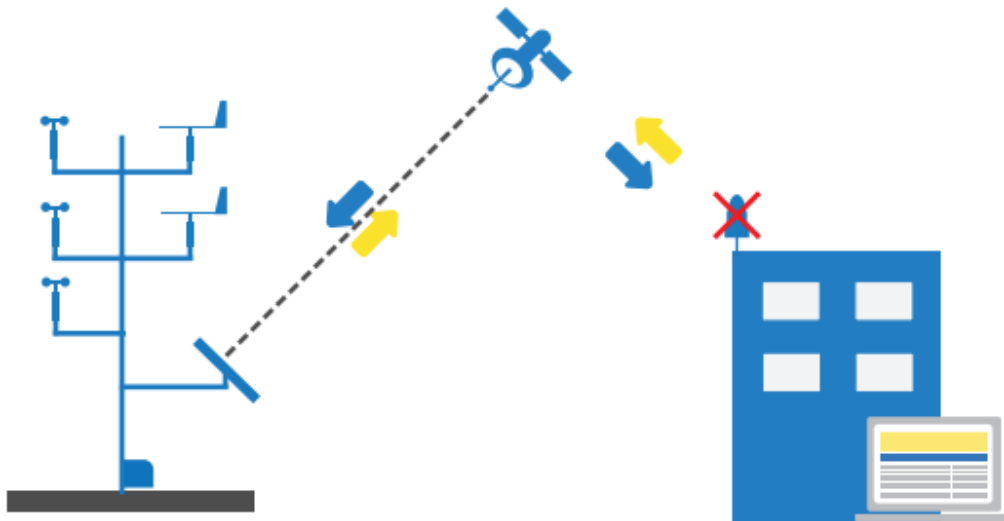


Fig. 70. Satellite: BGAN

9.2.2.2 Installation (logger side)

The BGAN antenna must be oriented to a particular position that depends on the exact location. Detailed instructions are provided together with the purchased equipment.

The BGAN modem needs to be connected to the Ext. Com RS-232 terminals 44 and 43. The modem can be powered directly from the logger terminals 46 and 46.

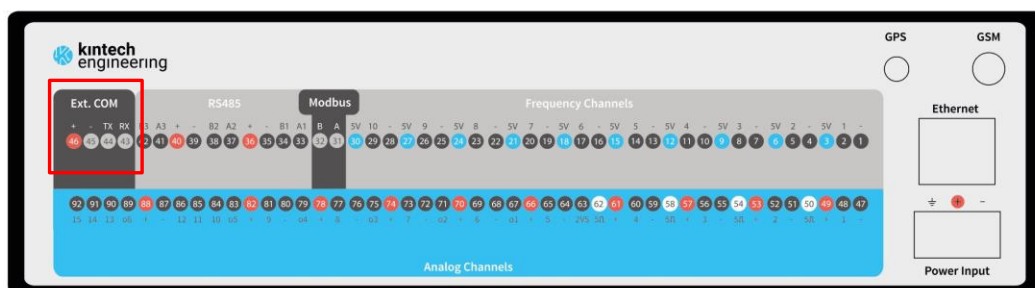


Fig. 71. Direct COM terminals: 44 and 43

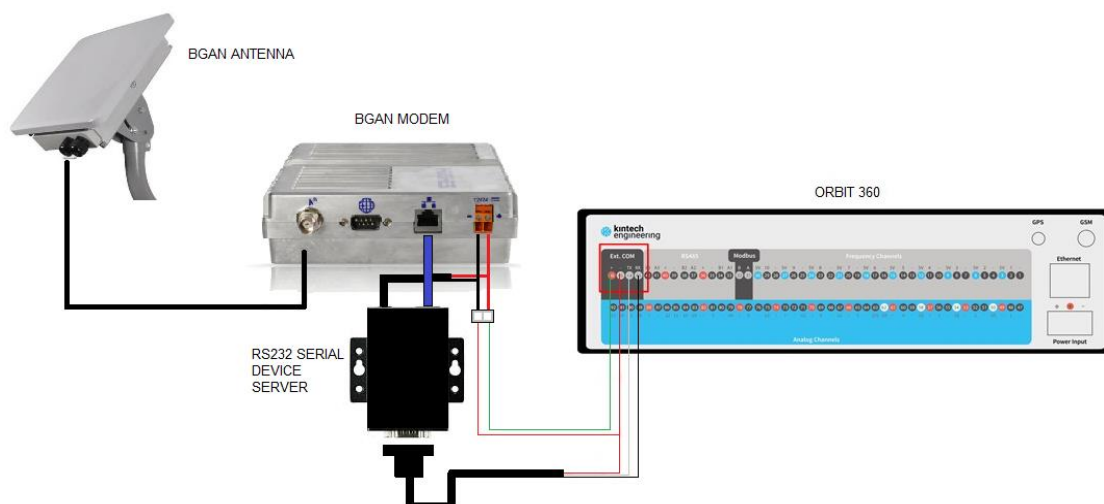


Fig. 72. Iridium satellite connection diagram (logger side)

9.2.2.3 Installation (office side)

Not required.

9.3 Direct COM

Although it is not really necessary for the normal use of the Orbit 360 data logger, a direct COM communication is available over the **RS-232** terminals located at the Ext. COM section (terminals 44 and 43).

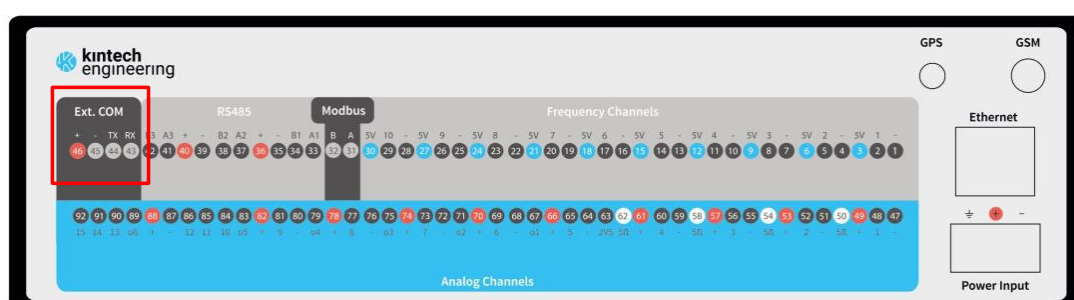


Fig. 73. Direct COM terminals: 44 and 43

All the usual functions such as download, real time connections, uploading of logger settings are also available via Direct COM.

Remark:

In order to use this feature, the installer should have a Serial RS232 to USB cable converter, so it's possible to connect the logger directly with any computer.

9.4 Troubleshooting

Before any tests or procedures are executed, we recommend reading carefully all of the information described in the '[Communication Options](#)' chapter. Also, revise the cable and components connections (such as SIM, Satellite or Global cards, antennas and power supplies), as well as the communications settings.

9.5 Internet troubleshooting

In case the data logger's telemetry is set to INTERNET and it is not working properly, then the next steps should help identify the issues:

1. Power on the logger and check if the display turns on and its red led (modem) is blinking;
2. Go to Quick View to check that all sensors show plausible information;
3. Check the communication status in the display's upper right corner. As soon as the logger turns on, 'GSM' should be shown. After that, GPRS, iNET and ONLINE should appear respectively. A while later, the logger will show on upper right corner the coverage bars according to the signal strength;



Fig. 74. *Logger display: logger showing “GSM”*

4. If only GSM is shown on upper right corner, check the antenna and SIM card connections, as well as the configurations applied;
5. If SIM PIN ERROR is shown on the logger ´s screen, then carefully revise the APN and PIN settings, as well as the SIM card connection and functionality;
6. To check telemetry hardware status, turn the data logger on and navigate to STATUS>MODEM and check how large the two-digit number that is followed by the letter 'e' (or 'q', depending on the modem model) gets.



Fig. 75. *Logger display: status > modem > e04 (logger online)*

The following tables determines the status represented by the two-digit number, both for Telit modem ('e') and for Quectel modem ('q'):

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 socket parameters
GPRS	e67-68	Waiting for connection to GPRS network
GPRS	e69	Setting APN name
GPRS	e72	Setting APN user and password. Connecting to APN
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

Table 26. State machine: communications (GSM/GPRS)

Indication	Code	Status
		Waiting for connection to GSM or satellite network.
X	q33-37	Enter PIN code if necessary
GSM	q64-65	Starting modem internet stack
SAT	q3-4	Satellite modem ready, showing signal strength in display
GPRS	q66	Setting up TCP socket parameters
GPRS	q67-68	Waiting for connection to GPRS network
GPRS	q69	Setting APN name, user and password
GPRS	q72	Connecting to APN (Access Point Name)
INET	q73	Reading IP assigned from the network
INET	q74	Starting listening incoming connections
INET	q75	Connecting to LNS (Logger Name Server)
INET	q80	Sending data to LNS
		IP address has been updated to LNS.
ONLINE	q3-4	Showing signal strength in display

Table 27. State machine: communications (GSM/GPRS) II

9.5.1 Selection of GSM frequency band

The Orbit 360 data logger 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.

9.6 Satellite troubleshooting

To identify some possible causes of the common failures in satellite telemetry (IRIDIUM or BGAN), check the following steps:

1. Power on the logger (reset it in case it is already powered on) and check if the display turns on and its red LED (modem) is blinking;
2. Check the communication status in the display's upper right corner. As soon as the logger detects the Iridium modem, 'SAT' should be shown. As for the BGAN modem, 'BGAN' should be shown. A while later, if the logger acquires signal, it will show on upper right corner the coverage bars according to the signal strength;
3. If SAT or BGAN is not shown on upper right corner, check the power and data cable connection from logger to modem, as well as verify that the modem has been correctly configured;
4. If no coverage bars are shown, then check antenna orientation, antenna cable proper connections with special attention to the status of antenna cable connectors. Also, make sure that the satellite's plan package is active (at least for 24h);

Remarks:


The BGAN antenna has to be precisely and manually oriented, as described in the manufacturer's manual.

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 interference of the tower structure itself.

If all steps above were executed and the communication problem persists, please do not hesitate to contact our local technical support.

9.7 Email troubleshooting

If the e-mail is programmed on the logger, the two-digit number that is followed by the letter 'e' (or 'q', depending on the modem model, refer to Fig. 75) will go through the sequence shown in the following table:

Indication	Code	Status
	e112 / q112	Connecting to SMTP (outgoing e-mail server)
	e113 / q113	Receiving data from SMTP and type of authentication
	e114 / q114	4 Setting if there is authentication. Maximum status if SMTP uses SSL. Don't use SMTP servers that only work through SSL/TLS
	e115 / q115	Setting type of authentication selected
	e116 / q116	Setting SMTP user
	e117 / q117	Setting SMTP password

e118 / q118 Setting e-mail from. On error check typing. Try adding
 " after the e-mail address from and e-mail address to.

e119 / q119 Setting e-mail to

e120 / q120 Starting data session

e121 / q121 Sending e-mail text

e122 / q122 Sending e-mail attachment

e123 / q123 Ending e-mail attachment

e124 / q124 Ending e-mail

e125 / q125 Closing session with SMTP

10 SCADA

Orbit 360 data logger is compatible with all of the most common SCADAs for wind farms using the Modbus protocol. The Orbit 360 data logger has a Windfarm / SCADA module integrated into it which allows for both Modbus RTU (RS485) and Modbus TCP communication. The data logger acts always as a slave. Both options can be used simultaneously.

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.

It allows 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.

10.1 Modbus configuration

Atlas software lets the user set up which calculated variables you want to provide in the Modbus telegrams but not the address used by those variables.

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


































































Modbus channels								
Channel	Sensor type	Sensor model	Instantaneous	Average	Maximum	Minimum	Variance	TI 30s
FRQ1	Serial device	Thies ultrasonic_SERIAL1: Horizontal Speed						
FRQ2	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ3	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ4	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ5	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ6	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ7	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ8	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ9	Anemometer	THIES FIRST CLASS ADVANCED						
FRQ10	Anemometer	THIES FIRST CLASS ADVANCED						
ANL1	Voltage	VOLTS						

Fig. 76. Selection of Modbus variables to be transmitted

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, TI30 (the average of the twenty TI30 records inside a 10-minute interval, see section 4.1.7) and for the same order of channels of the window (from top to bottom).

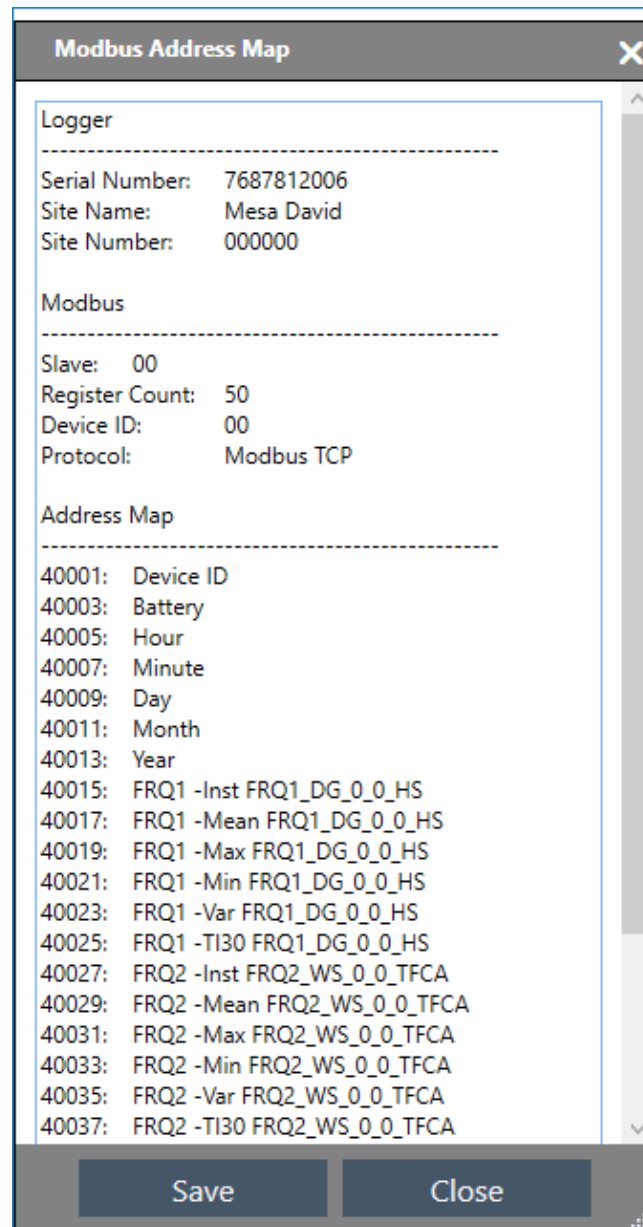


Fig. 77. Example of Modbus variables addresses

The Modbus function code implemented is the “03: holding registers”.

The system is compatible with MODBUS RTU RS485, 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.

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:

Modbus RTU type	Connection	Speed
22	MODBUS RTU	9600bps
23	MODBUS RTU	19200bps
24	MODBUS RTU	38400bps
25	MODBUS RTU	57600bps
26	MODBUS RTU	115200bps

Table 28. Modbus RTU types and baudrates

In Modbus RTU, 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.

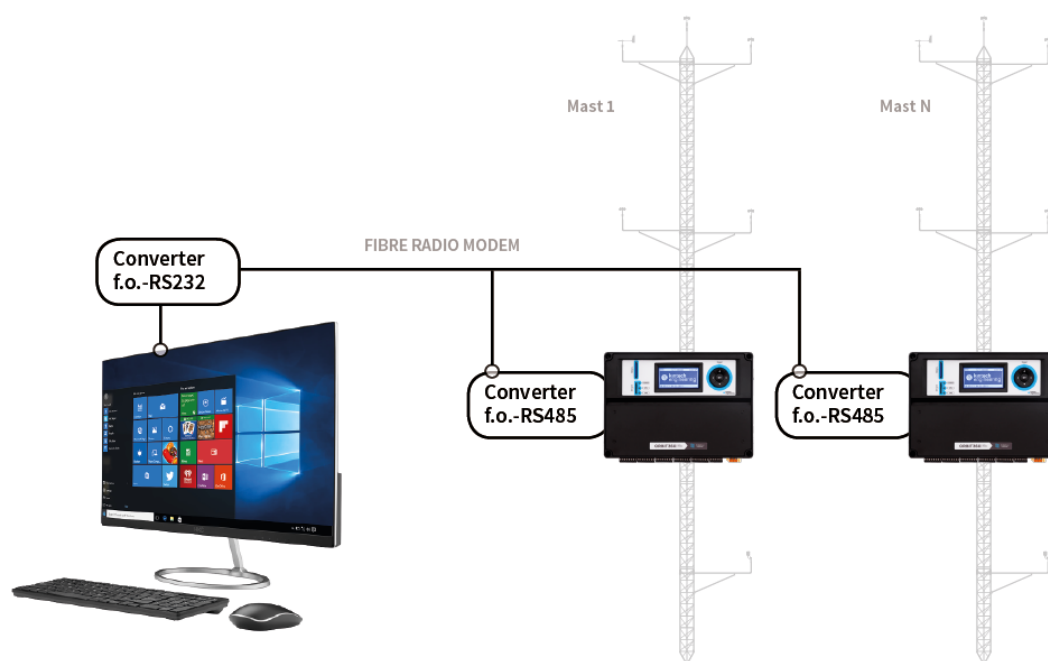


Fig. 78. Several loggers using a shared communication line

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

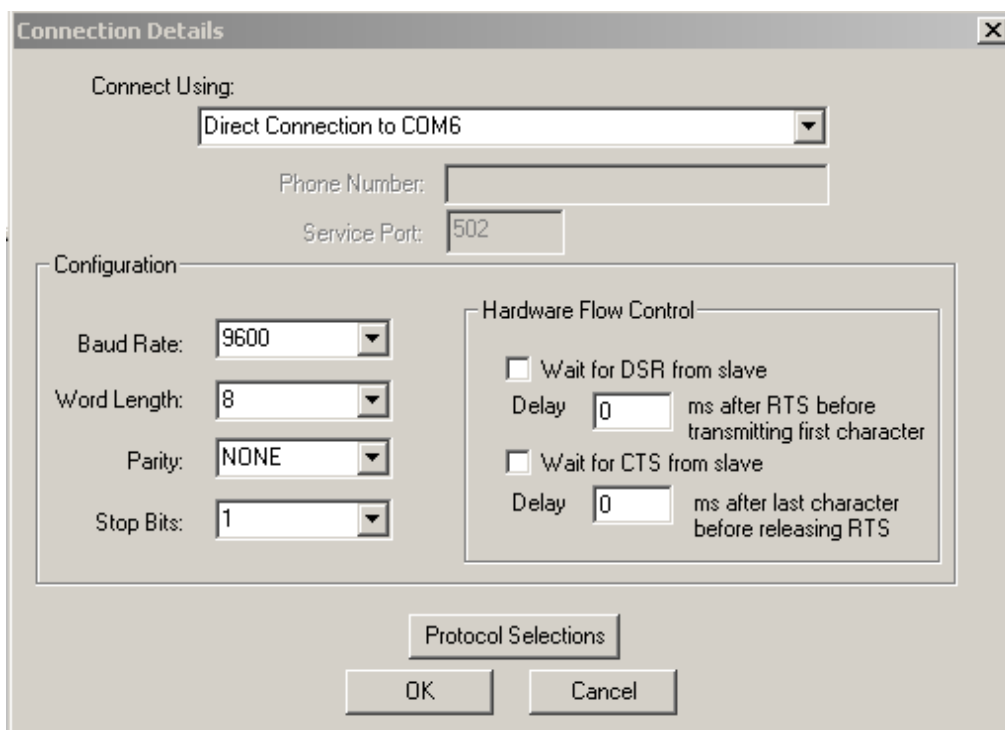
Table 29. Typical Modbus configuration

That corresponds to the following:

01038C800043FA0000414800004180000041B0000041D000004120000040E0000000000
00
00
408000004080000041A8000041A800004250000042500000444E0000444E0000000000
000000D354.

10.2 Modbus RTU troubleshooting

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



Display Definition [X]

Scan Rate: ☒ Milliseconds ☐ Seconds

Modbus Data

Slave Address:

Point Type: [v]

Point Address:

Length:

Modbus Protocol Selections [X]

Transmission Mode

STANDARD		DANIEL/ENRON/OMNI	
<input type="radio"/> ASCII	<input checked="" type="radio"/> RTU	<input type="radio"/> ASCII	<input type="radio"/> RTU

Slave Response Timeout: (msecs)

Delay Between Polls: (msecs)

☐ Force modbus command 15 and 16 for single-point writes.
(To be used in cases where the slave does not support the single-point write functions 05 and 06.)

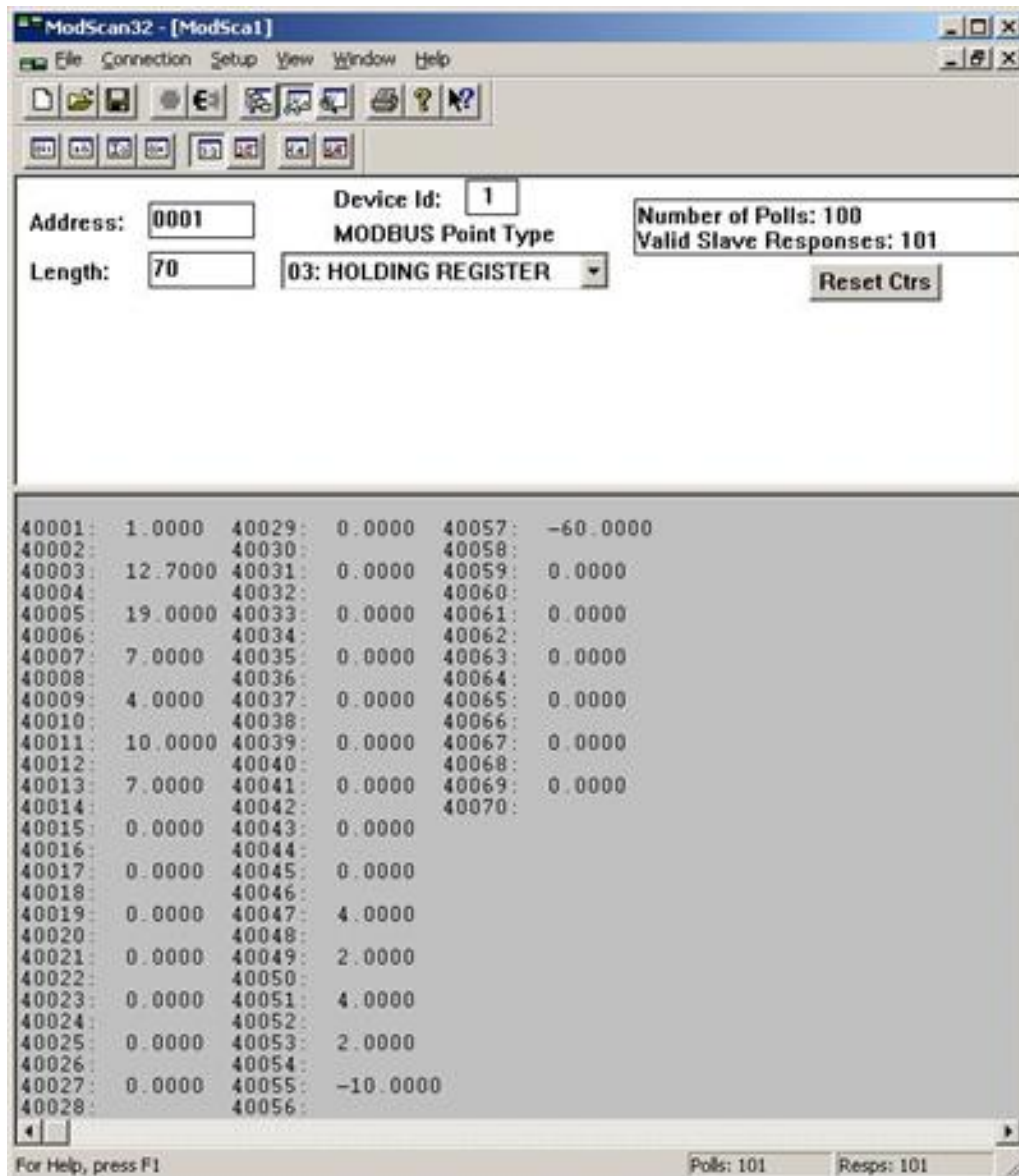


Fig. 79. ModScan configuration (Office test for Modbus RTU)

10.3 Modbus types

- **Acciona:** Adaptation to SCADA WinCC (Siemens), adds compatibility to Acciona SCADA.
- **Suzlon:** Adaptation to SCADA SC-METSTATION (Suzlon Energy - legacy data logger Modbus telegram). It is configured at type 27 (baudrate: 9600). EOL Zenith data logger 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 (Before 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:** Adaptation to SCADA Meteo-32 (legacy data logger proprietary telegram - Woben). It is configured to type 28 (baudrate: 9600), type 29 (baudrate: 19200) and type 30 (baudrate: 38400). EOL Zenith data logger 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/m² - 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/m²

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

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
```

10.4 Modbus TCP

When using Modbus TCP, it's necessary to set up the TCP parameters in Atlas software:

Modbus	
Apply custom slope and offset	<input type="checkbox"/>
Modbus Serial	<input type="checkbox"/>
Modbus TCP	<input checked="" type="checkbox"/>
IP address	192.168.18.158
IP Mask	255.255.255.0
IP Gateway	192.168.18.1

Fig. 80. *Example configuration for Modbus TCP*

The TCP port used by the logger is the standard one: 502.

In the case of Modbus TCP it's possible to query only a portion of the variables (Modbus registers), i.e. not all the set up variables must be read at the same time.

11 Atlas Charting Tool

Atlas 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.

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. Just right-clicking on the graph the context menu will open showing printing or saving options.

A different control allows applying different colors according to the time for not temporary time representations.

11.1 Overview

The “Overview” tab allows you to see all the signals recorded by the data logger in one view. It is divided into three sections. The first section displays the wind speed data, the middle one displays the wind direction data and the bottom one collects any sensors that do not fall into one of the previous two designations.

For ease of reading the third section has two vertical axes, assigning each variable to the range that best fits.

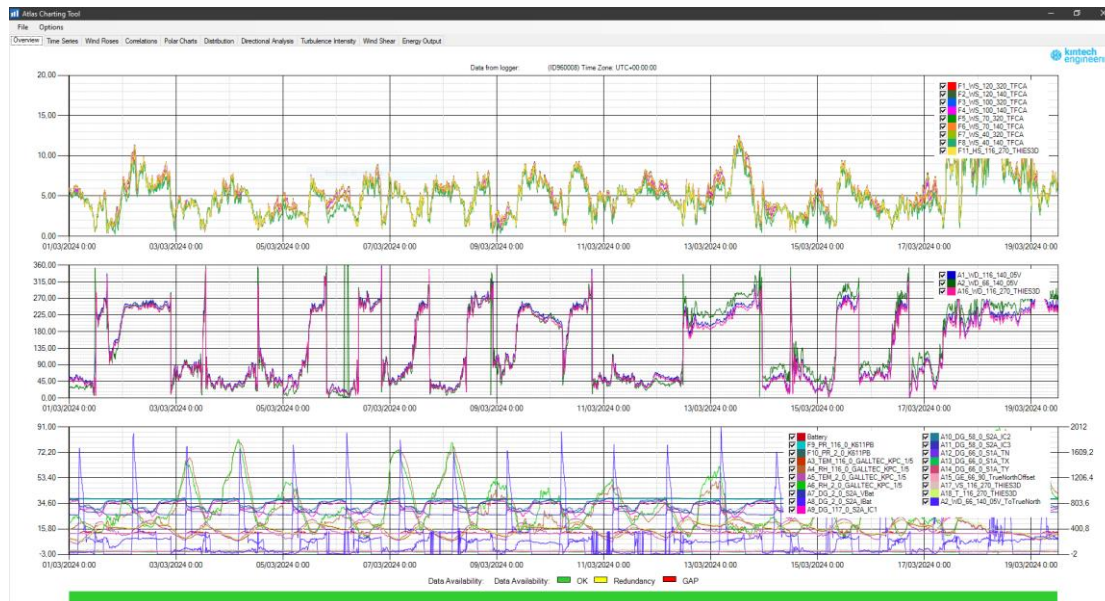


Fig. 81. Atlas Charting Tool: Overview

11.2 Time Series

With “Time Series” user can represent the stored data, studying speed data, direction, temperature, pressure or even battery. A legend with the average value of the data currently displayed in the window is shown at the top right. Data availability is shown in the “availability bar” located in the bottom.

Functions and actions:

- 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.
- Filter the data by dates in the menu in the lower left corner.
- Add data from a second met mast by navigating through File → Open Data Files Tower 2.
- Toggle between ten-minute, hourly or daily averaged data with the radio buttons at the bottom of the screen.
- Modify the time offset with the button at the bottom right.



Fig. 82. Atlas Charting Tool: Time Series

- Use horizontal slider to add offset to the wind direction measurements or click on the “Wind Vane Options” button to open the full options window. Adding offset to a single vane allows comparisons between sensors.

The screenshot shows the 'Wind Vane Option' dialog box. It is divided into two sections for 'Tower 1' and 'Tower 2'. Each section contains a table of wind vane settings:

Wind Vane User Name	Wind Vane Offset	Reverse Wind Vane Data
All Wind Vanes	0	<input type="checkbox"/>
A1_WD_116_140_05V	0	<input type="checkbox"/>
A2_WD_66_140_05V	0	<input type="checkbox"/>
Wind Vane 3		<input type="checkbox"/>
Wind Vane 4		<input type="checkbox"/>
Wind Vane 5		<input type="checkbox"/>
Wind Vane 6		<input type="checkbox"/>
Wind Vane 7		<input type="checkbox"/>
Wind Vane 8		<input type="checkbox"/>
Wind vane 9		<input type="checkbox"/>
Wind vane 10		<input type="checkbox"/>
Wind vane 11		<input type="checkbox"/>

The 'Tower 2' section contains the following settings:

Wind Vane User Name	Wind Vane Offset	Reverse Wind Vane Data
Wind vane 12		<input type="checkbox"/>
Wind vane 13		<input type="checkbox"/>
Wind vane 14		<input type="checkbox"/>
Wind vane 15		<input type="checkbox"/>
A16_WD_116_270_THIES3D	0	<input type="checkbox"/>
Wind vane 17		<input type="checkbox"/>
Wind vane 18		<input type="checkbox"/>
Wind vane 19		<input type="checkbox"/>
Wind vane 20		<input type="checkbox"/>
Wind vane 21		<input type="checkbox"/>
Wind vane 22		<input type="checkbox"/>
Wind vane 23		<input type="checkbox"/>

The dialog box includes a 'Close' button at the bottom right.

Fig. 83. Atlas Charting Tool: Time Series – Wind Vane Options

- Use this tab to check the battery voltage level and its correct daily charge cycle.

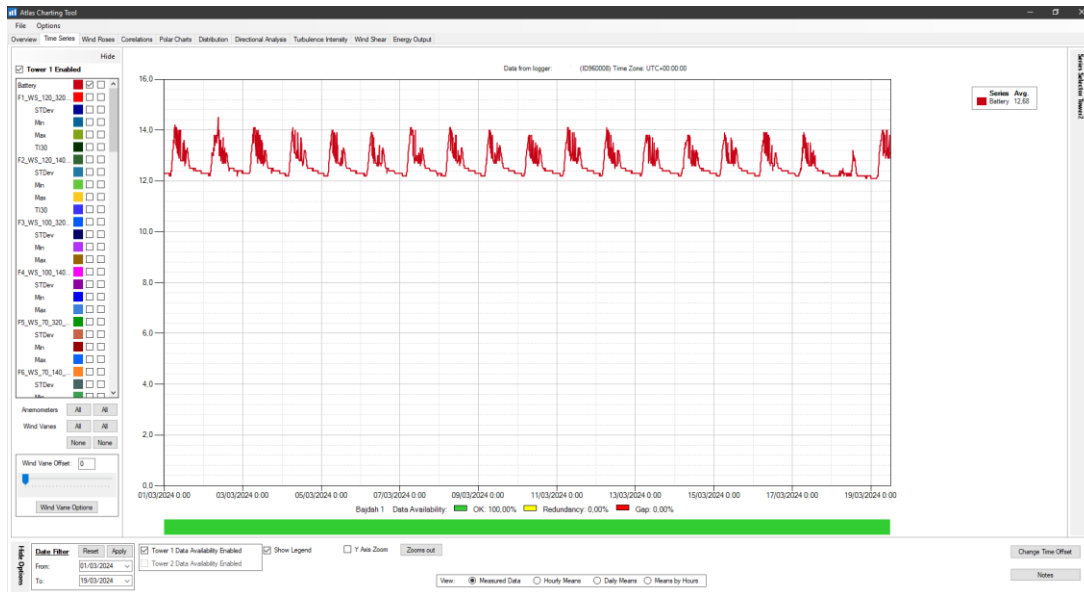


Fig. 84. Atlas Charting Tool: Time Series – Battery voltage

11.3 Wind Roses

“Wind Roses” helps to know the percentage of time when the wind comes from a particular direction and the percentage of energy / average wind speed of that wind.

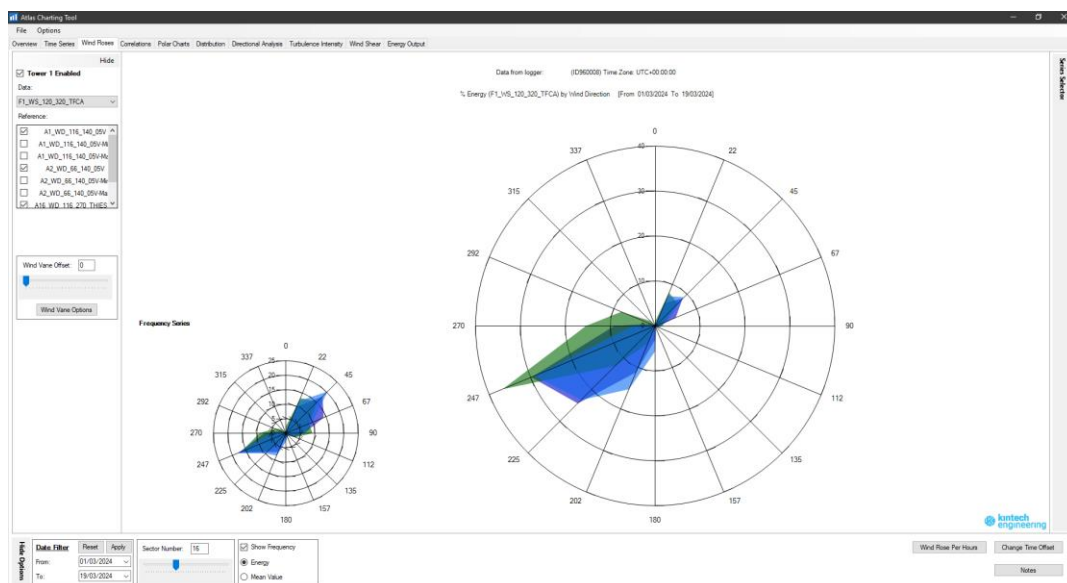


Fig. 85. Atlas Charting Tool: Wind Roses

11.4 Correlations

“Correlations” allows to 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 is 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.

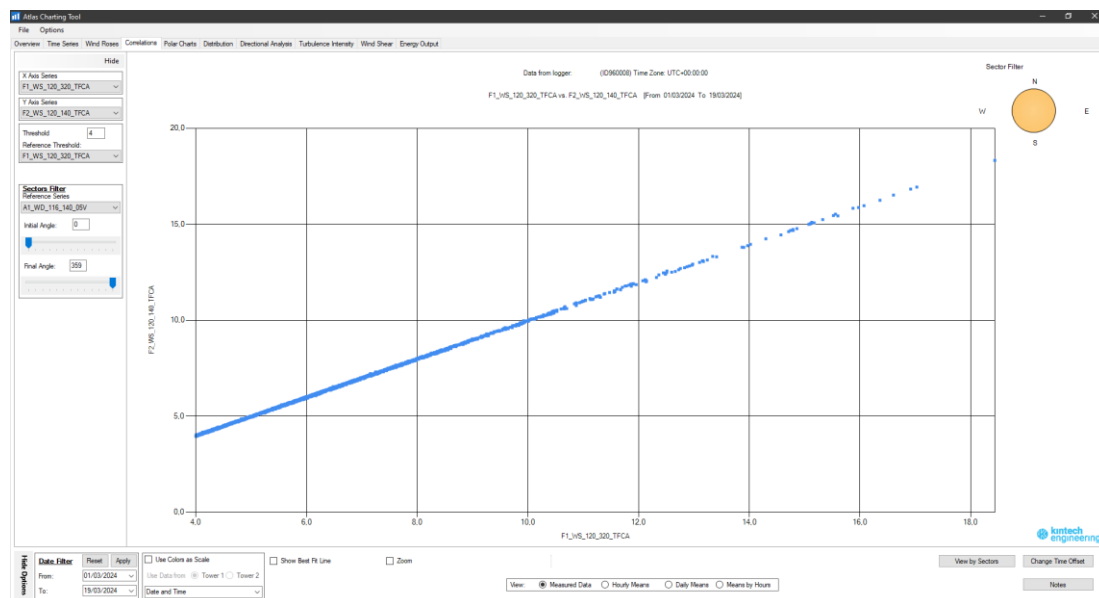


Fig. 86. Atlas Charting Tool: Correlations

11.5 Polar Charts

Data have different colors according the direction (using a color time scale).

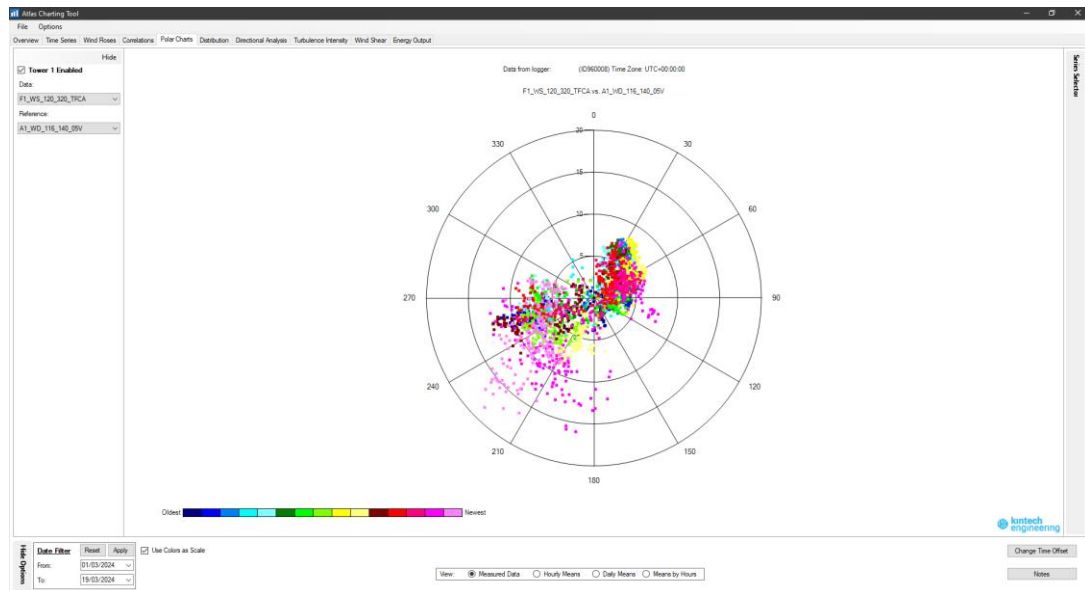


Fig. 87. Atlas Charting Tool: Polar Charts

11.6 Distribution

Get the Weibull distribution by clicking “Distribution”. Bin size is adjustable.

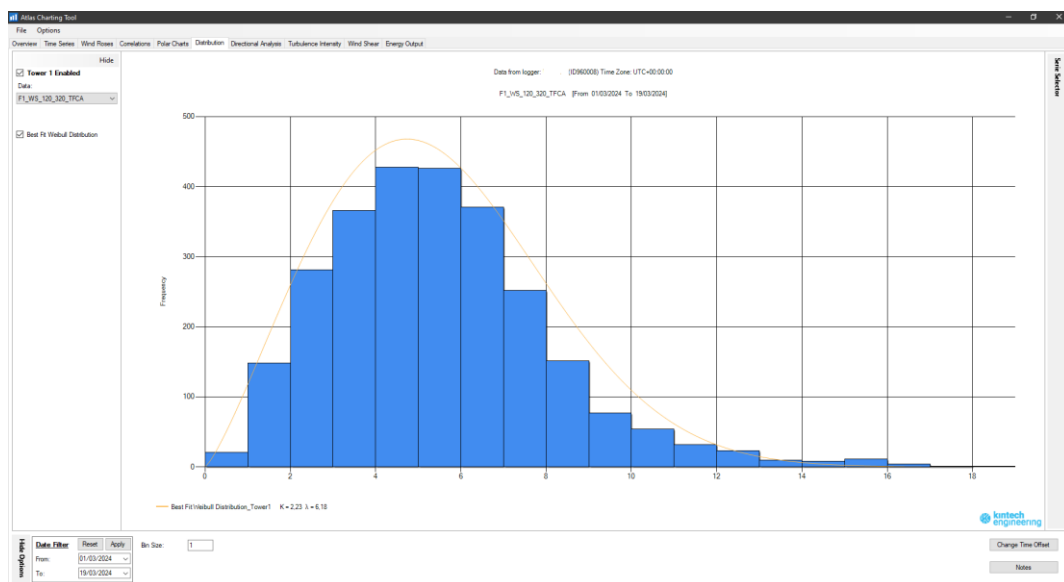


Fig. 88. Atlas Charting Tool: Distribution

11.7 Directional Analysis

“Directional Analysis” allows finding alterations between the relations of different variables according to a wind 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 close to one probably one of the sensors is under the effect of **mast shadow**.

We recommend applying a “Threshold” to avoid interferences created for low wind speeds.

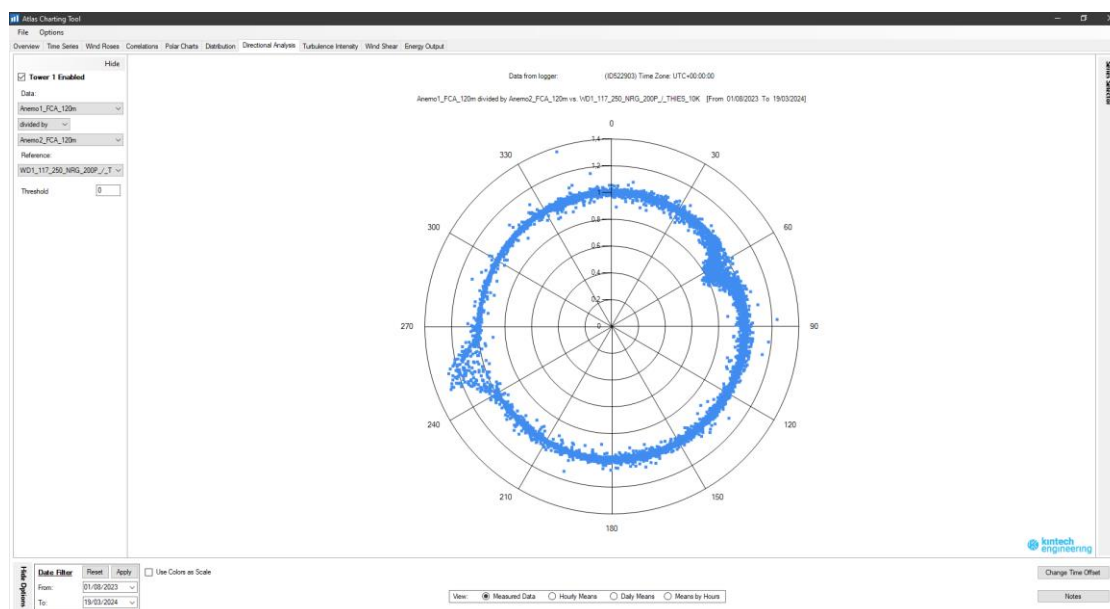


Fig. 89. Atlas Charting Tool: Directional Analysis

11.8 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: support@kintech-engineering.com.

By designating a percentile, one can study the turbulence representative value for every speed bin.



Fig. 90. Atlas Charting Tool: Turbulence Intensity

11.9 Wind shear

This tab enables to easily study the wind profile for every direction sector. 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 frozen anemometers, broken, vertical type...).

Applying a “Threshold” is also possible for further filtering.

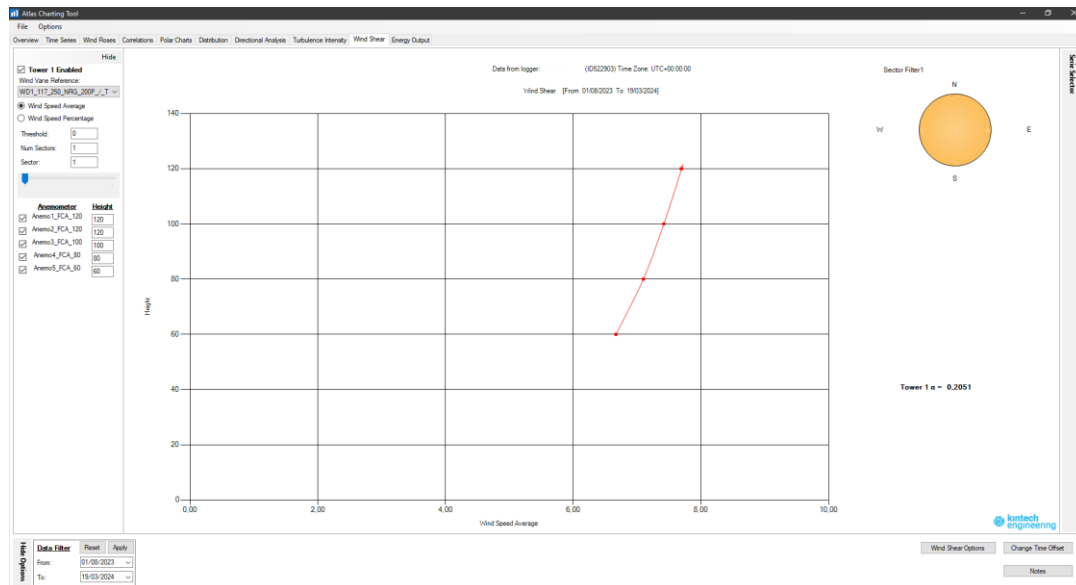


Fig. 91. Atlas Charting Tool: Wind shear

11.10 Energy Output

“Energy Output” shows the equivalent power output according to density, turbine and power curve selected.

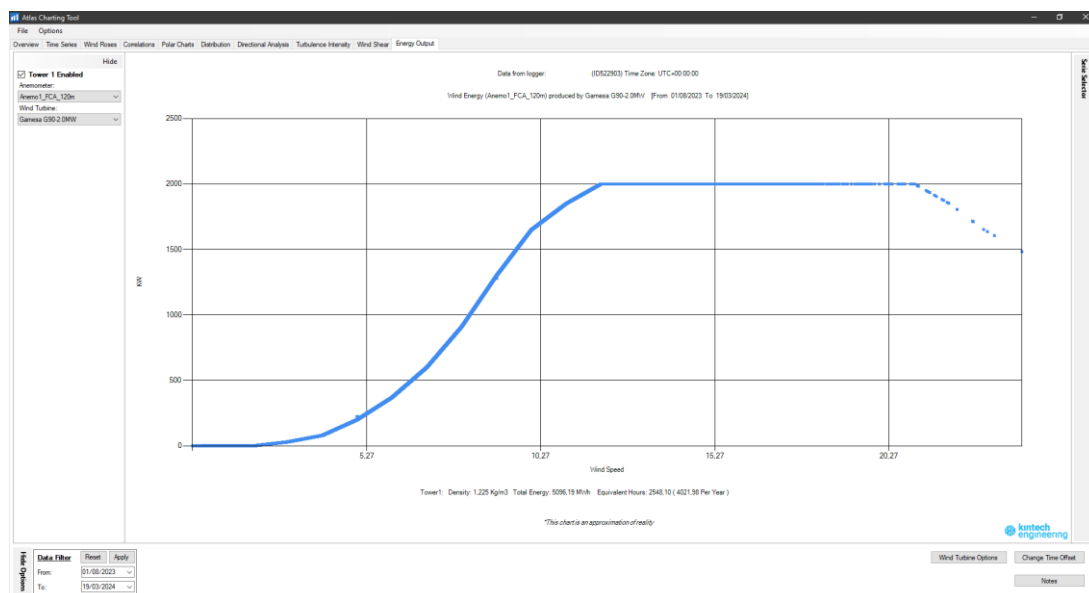


Fig. 92. Atlas Charting Tool: Energy Output

12 Regulatory Compliances

12.1 Applicable European Directives



The Orbit 360 data logger is in conformity with the following EC directives:

- RoHS Directive 2011/65/EU
- EMC Directive 2014/30/EU
- RE Directive 2014/53/EU(*)

*RF spectrum efficiently, Article 3 (2); EMC, Article 3 (1b); Safety, Article 3 (1a).

This product complies with the following test standards:

- EN 61000-4-2:2009
- ETSI EN 301489-1 V2.2.3 (2019-11)
- ETSI EN 301489-52 V1.2.1 (2021-11)
- EN 61000-4-3:2020
- ETSI EN 301489-1 V2.2.3 (2019-11)
- ETSI EN 301489-52 V1.2.1 (2021-11)
- EN 55032:2015
- ETSI EN 301489 EN 55032:2015 -1 V2.2.3 (2019-11)
- EN 301 908-1 V13.1.1
- EN 301 908-13 V13.1.1
- EN 303 413 V1.2.1 (2021-4)

It is mandatory to use the original antenna supplied with the product in order to comply with the applicable directive.

12.2 FCC Compliance

The Orbit 360 data logger complies with:

- 47 CFR part 15, Subpart B- §15.105(a).
- 47 CFR part 15, Subpart B- §15.21.



This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in an industrial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product contains part identified as follows by national authorities:

- FCC ID: XMR201903EG25G.

It is mandatory to use the original antenna supplied with the product in order to comply with the applicable regulations. RF exposure separation distance of at least 20 cm must be met.

Signed for and on behalf of:

Kintech Instruments S.L.U.

11/10/2023

Íñigo Vázquez, Technical Manager