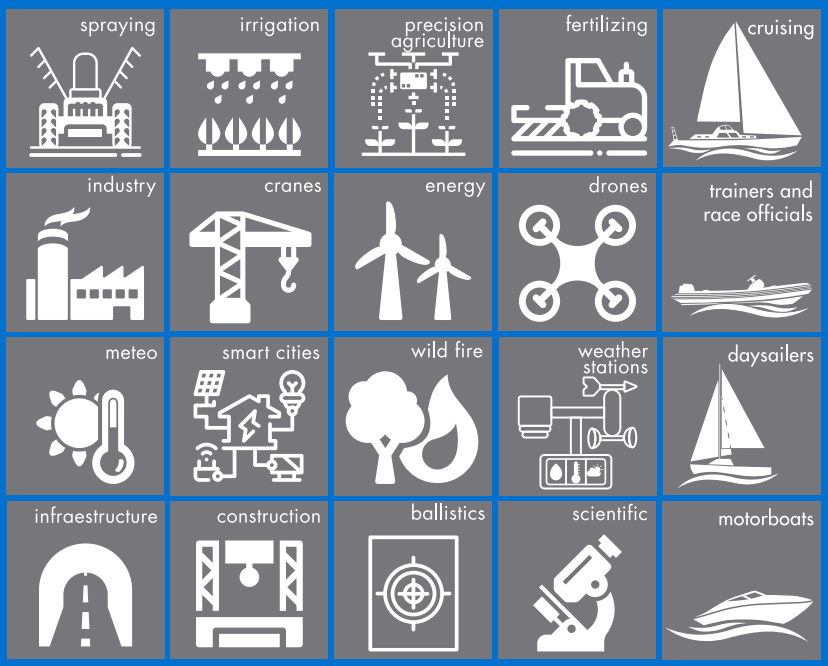
CALYPSO instruments
www.calypsoinstruments.com

CALYPSO INSTRUMENTS
ULTRA-LOW-POWER ULTRASONIC PRO (ULP PRO) WIND METER
User manual

English version 3.0
30.05.2023

CE FC 0809



If you want to know more about our new ULP Pro wind meter, please keep reading or visit our website **www.calypsoinstruments.com**

0. Index

1. Product overview

Thank you for choosing the ULP Pro Ultrasonic Anemometer from Calypso Instruments. This ULP Pro is the second model of our generation II, representing an important technology breakthrough condensing an extensive R+D investment.

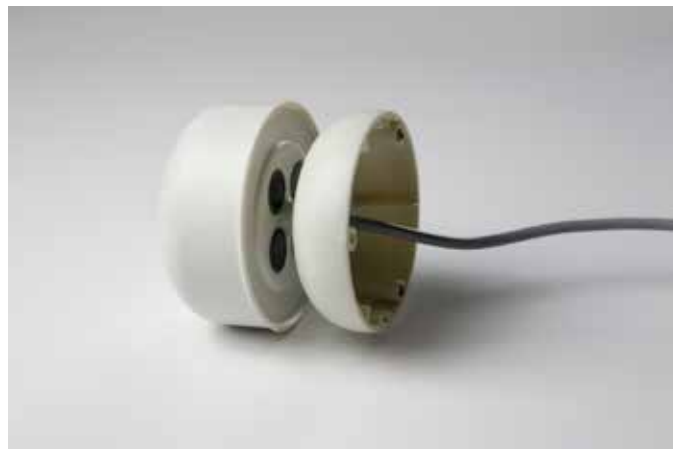
· Both shape and firmware have been enhanced for an improved rain performance. This is key for static applications such as weather stations.

· Mechanical design has been revamped making the unit more robust and dependable.

· We feel very proud to release a unit that requires under 0.4 mA of power at 5V, sampling at 1Hz.

· Different output options available: RS485, UART/TTL and MODBUS.

Applications for the ULP485 are the following:
Weather Stations | Drones
Temporary Scaffolding and construction | Infrastructures and building | Cranes
Spraying | Irrigation | Fertilizing | Precision Agriculture
Smart Cities | Wild fires | Shooting | Scientific



2. Package content

The package contains the following:

· One ULP Pro Wind Instrument plus 2 meters (6.5 ft) of cable for connection

· Serial number reference on the side of the packaging.

· A quick user guide on the back of the packaging and some more useful information for the customer.

· M3 headless screw (x7)

3. Technical specifications

The ULP has the following technical specifications:

3.1. Dimensions

· Diameter: 68 mm (2.68 in.)

· Height: 65 mm (2.56 in.)

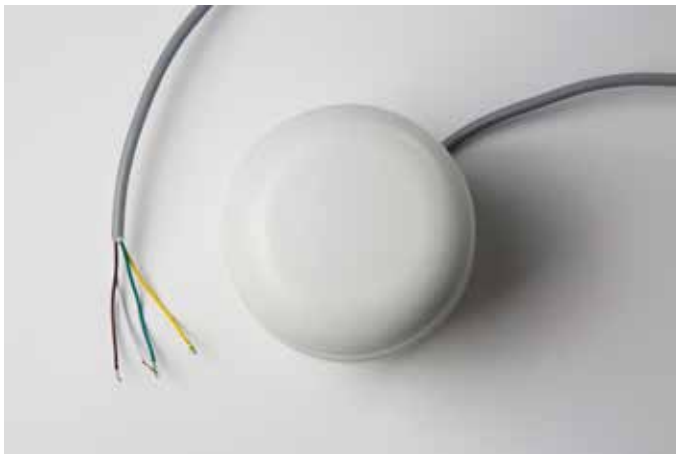
3.2. Weight

200 grams (7 ounces)

3.3 Power

· 3.3-18 DCV

The ULP has to be connected as shown in this section.



RS485 (NMEA 0183) / MODBUS RTU Output:

White GND (Power -)	Yellow DATA (B-)
Brown VCC (Power +)	Green DATA (A+)

UART/ I2C Output:

White GND (Power -)	Yellow DATA RX / SDA
Brown VCC (Power +)	Green DATA TX/ SCL

4-20 mA ANALOG Output:

White V+ (Channel 1)	Yellow V+ (Channel 2)
Brown V- (Channel 1)	Green V- (Channel 2)

Data interface	1Stream 2-POLL 3-MODBUS
Data format	NMEA0183
Baudrate	2400 to 115200 bauds
Voltage range	3.3-18V

Power consumption:

Ultra-Low-Power (RS485 NMEA0183) : 0,25mA @5V, 1Hz / (MODBUS) : 1 mA @5V,1 Hz

Ultra-Low-Power (UART / I2C): 0,15 mA @5V, 1Hz

Ultrasonic NMEA 2000: 20 mA @115.200 bauds, 12V

Ultra-Low-Power (4-20 mA analog) : 4-20 mA, @12-24 V, 1Hz

3.4. Sensors

Ultrasonic transducers (4x)

Sample rate: 0.5 Hz to 10 Hz

The ULP PRO has been designed to avoid any mechanical parts to maximize reliability and minimize maintenance.

The transducers communicate between themselves two by two using ultrasonic range waves. Each pair of transductors calculates the signal delay and get information about both wind direction and wind speed.

3.5 Wind Information

· Wind speed

· Wind direction

Sample rate: 1 Hz

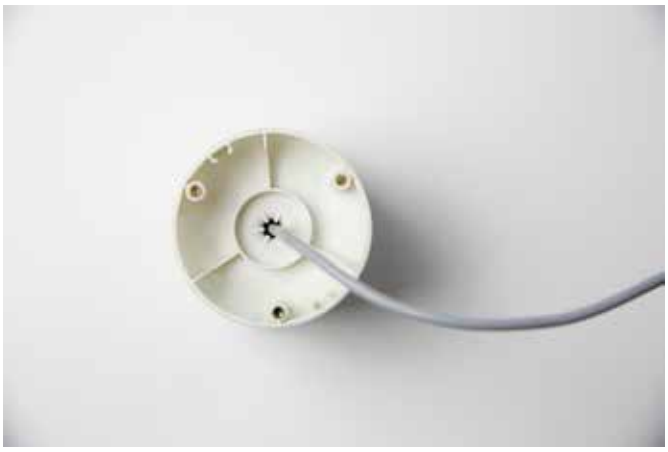
Wind Speed
Range : Range: 0 to 45 m/s (1.12 to 100 mph)
Accuracy: ±0.1 m/s at 10m/s (0.22 at 22.4 mph)
Threshold: 1 m/s (2.24 mph)

Wind direction
Range: 0 - 359º
Accuracy: ±1º

3.6. Easy mount

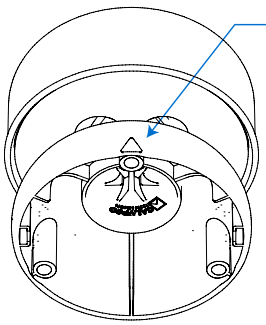
- 2 x M3 lateral female tripod thread
- 3 x M3 base female tripod thread

UNC 1/4" - 20



North mark position

Make sure the north mark is perfectly aligned to the north.



3.7. Mounting accessories

A wide range of accessories can be used with the device. The ULP Pro can be mounted on a flat service and screwed on to different sizes of poles. It can also be used with an adaptor for poles of 39 mm.

* Please, visit our website and check all the accessories available and their possible combinations.

3.8. Firmware Upgradable RS485, MODBUS or UART/TTL, I2C configurator tool available on our website for downloading in the section **Technical Information**.

3.9 Product Material

The ULP Pro is engineered to be a robust device with minimal downtime. This new shape has been designed for optimum water spillage which implies lower probability of ice formation. Frost might affect measurements if it blocks the wave path. The input wires are protected by Transient Voltage Suppression (TVS) diodes. The instrument body is inject molded.

3.10 Quality Control

Every single unit is calibrated with accuracy, following the same calibration standards for each one in a wind tunnel.

A Q/C report for both wind speed and direction is generated and kept in our files. Standard deviation is checked to guarantee that each unit has been calibrated to the highest standards.

4. Firmware

Firmware upgradable. Configurable via cable using the configuratior (https://calypsoinstruments.com/technical-information). A USB converter cable is available as an accessory on **calypsoinstruments.com**.

5. Configuration Options

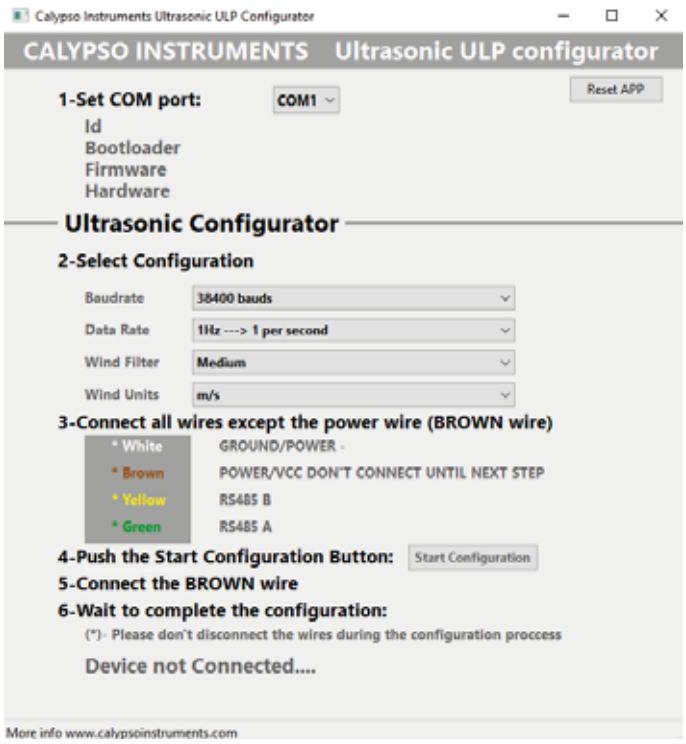
The ULP Pro can be set up by using a special configurator App made by Calypso Instruments.
In order to use the app you should download the configurator from our website at **www.calypsoinstruments.com**.

To configure your device, connect the ULP Pro via either a USB to RS485 converter cable (in case of the ULP Pro RS485 or the ULP Pro Modbus) or via a USB to UART converter cable (in case of the ULP Pro UART). Connect all the ULP Pro cables except for the brown cable to the converter. Insert the USB into the computer, open the configurator app, select the configuration wanted and follow the instructions on the screen to finish the configuration.

For more information, please watch the following video.
https://bit.ly/3DuA7lM

*USB converter cables available on **calypsoinstruments.-com**

baudrate:	2400 to 115200 (8n1) bauds
output rate:	0.5 to 10 Hertz
output units:	m/sec., knots or km/h



6. Communication Protocols

6.1 Modbus Registers

DIR_BASE_LA1 30001
SYSTEM_STATUS DIR_BASE_LA1 + 200
WIND_SPEED DIR_BASE_LA1 + 201
WIND_DIRECTION DIR_BASE_LA1 + 202
TWO_MIN_AVG_WS DIR_BASE_LA1 + 203
TWO_MIN_AVG_WD DIR_BASE_LA1 + 204
TEN_MIN_AVG_WS DIR_BASE_LA1 + 205
TEN_MIN_AVG_WD DIR_BASE_LA1 + 206
WIND_GUST_SPEED DIR_BASE_LA1 + 207
WIND_GUST_DIR DIR_BASE_LA1 + 208
FIVE_MIN_AVG_WS DIR_BASE_LA1 + 210
FIVE_MIN_AVG_WD DIR_BASE_LA1 + 211
FIVE_WIND_GUST_SPEED DIR_BASE_LA1 + 212
FIVE_WIND_GUST_DIR DIR_BASE_LA1 + 213

6.2 RS485 and UART Sentences

MWV Wind Speed and Angle
1 2 3 4 5
| | | | |
$--MWV,x.x,a,x.x,a*hh
1) Wind Angle, 0 to 360 degrees
2) Reference, R = Relative, T = True
3) Wind Speed
4) Wind Speed Units, K/M/N
5) Status, A = Data Valid
6) Checksum

By default, the communication parameters are 38400bps, 8N1.
Some examples of sentences are:

$IIMWV,316,R,06.9,N,A*18
$IIMWV,316,R,06.8,N,A*19

The connection is straightforward with no configuration required in RAW mode configuration.

In case of ON DEMAND configuration mode, the sentence received is almost the same, but there is a need of this sentence for requesting data every time you ask for data:

$ULPI*00\r\n //I=id node by default
$ULPA*08\r\n
$ULPB*0B\r\n
$ULP1*78\r\n

The received sentence has this structure, slightly modified: $IiMWV,x.x,a,x.x,a*hh, being i the node (I,A,B,C,....) configured.

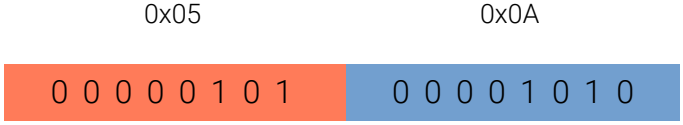
6.3. I2C Sentences

General Options
Address I2C- 0x15 (21 decimal)
Frecuency -100kHz – 400kHz
SDA -TX (Yellow)
SCL - RX (Green)

Write Register
In order to write about the register it is necessary to write 2 bytes, the I2C bus direction and the register you need to check.
I2C Address (1 Byte) + Register Address (1 Byte)
Address -0x15 (21 decimal)
Available Registers:
Wind Raw Stat - 0x10
Wind 2 Min Stat - 0x12
Wind 5 Min Stat - 0x15
Wind 10 Min Stat - 0x1A
Wind Full Stats - 0x1F

Read Register
For the read register we need to take into account how many bytes is the system giving us back and what bytes we need to read in order to obtain the value we need.

Data are under big-endian criteria. The first byte, the more valuable one to be represented.
E.g. If 2 bytes are read, byte 0 and byte 1, we will read the first byte as 0x05 and second byte 0x0A.



The first byte is marked in orange. The more valuable one. The second byte is marked in blue (less significant one LSB).

Write Wind Raw Register Return 7 Bytes
Bytes 0 – 1 - Unused
Bytes 2 – 3 - Wind Speed * 100
Bytes 4 – 5 - Wind Direction * 100
Byte 6 - Checksum

Write Wind 2 Min Stat Register Return 11 Bytes
Bytes 0 – 1 - Unused
Bytes 2 – 3 - Wind Speed * 100
Bytes 4 – 5 - Wind Direction * 100
Bytes 6 – 7 - Wind Speed Gust * 100
Bytes 8 – 9 - Wind Direction Gust * 100
Byte 10 - Checksum

Write Wind 5 Min Stat Register Return 11 Bytes
Bytes 0 – 1 - Unused
Bytes 2 – 3 - Wind Speed * 100
Bytes 4 – 5 - Wind Direction * 100
Bytes 6 – 7 - Wind Speed Gust * 100
Bytes 8 – 9 - Wind Direction Gust * 100
Byte 10 - Checksum

Write Wind 10 Min Stat Register Return 11 Bytes
Bytes 0 – 1 - Unused
Bytes 2 – 3 - Wind Speed * 100
Bytes 4 – 5 - Wind Direction * 100
Bytes 6 – 7 - Wind Speed Gust * 100
Bytes 8 – 9 - Wind Direction Gust * 100
Byte 10 - Checksum

Write Wind Full Stat Register Return 31 Bytes
Bytes 0 – 1 - Unused
Bytes 2 – 3 - Wind Speed Raw * 100
Bytes 4 – 5 - Wind Direction Raw * 100
Bytes 6 – 7 - Wind Speed 2 Min Stat * 100
Bytes 8 – 9 - Wind Direction 2 Min Stat * 100
Bytes 10 – 11 - Wind Speed Gust 2 Min Stat * 100
Bytes 12 – 13 - Wind Direction Gust 2 Min Stat * 100
Bytes 14 – 15 - Wind Speed 5 Min Stat * 100
Bytes 16 – 17 - Wind Direction 5 Min Stat * 100
Bytes 18 – 19 - Wind Speed Gust 5 Min Stat * 100
Bytes 20 – 21 - Wind Direction Gust 5 Min Stat * 100
Bytes 22 – 23 - Wind Speed 10 Min Stat * 100
Bytes 24 – 25 - Wind Direction 10 Min Stat * 100
Bytes 26 – 27 - Wind Speed Gust 10 Min Stat * 100
Bytes 28 – 29 - Wind Direction Gust 10 Min Stat * 100
Byte 30 - Checksum

6.5 Analog 4-20 mA

The Analog 4-20 mA is an analog protocol that has no sentences.

7. General information

7.1. General recommendations

Regarding mounting the unit, align the north mark of the ULP Pro towards the north.

Make sure to install the sensor in a location **free from anything that obstructs the flow of wind to the sensors within a 2 meter radius**, for example, the mast head on a boat.

Other important aspects:

- Do not attempt to access the transducers area with your fingers;
- Do not attempt any modification to the unit;
- Never paint any part of the unit or alter its surface in any way.
- NOT allowed to be submerged fully or partially in water.

If you have any questions or doubts, please contact us directly.

7.2. Maintenance and repair

The ULP Pro does not require great maintenance thanks to the lack of the moving parts in this new design.

Transducers must be kept clean and aligned. Impacts or incorrect impulsive handling may lead to transducers misalignment.

The space around the transducers must be empty and clean. Dust, frost, water, etc... will make the unit stop working.

The ULP Pro can be wiped clean with a damp cloth being careful to not touch the transducers.

7.3. Warranty

This Warranty covers the defects resulting from defective parts, materials and manufacturing, if such defects are revealed during the 24 months after the purchase date.

Warranty is void in case of non-following the instructions of use, repair or maintenance without written authorisation.
Any wrongful use given by the user will not incur in any responsibility of Calypso Instruments. Therefore, any harm caused to the ULP Pro by a mistake will not be covered by the waranty. Using assembly elements different from those delivered with the product will void the guarantee.

7.3. Warranty
(continuation)

Changes on transducers position/alignment will avoid any warranty.

For further information please contact Calypso Technical Support through **aftersales@calypsoinstruments.com** or visit **www.calypsoinstruments.com**.

MODBUS Sensor Data Requests

Measurements all have a resolution of 0.1 but are reported as 10*. 8.2 m/s is returned as a value 82. The user must /10 in order to reinsert the decimal precision. You can use either Input Register (0x03) or Holding Register (0x04). If you want to read register 201, that correspoonds with wind direction in this case 0 m/s , Modbus asks for address 202
Request frame: [001][004] [000][201] [000][001] [255][244]
Response frame: [001][004] [002][000][000] [185][048]

Register	Address	Access Type	Response Range	Data Type	Description
200	201	Read	0 to 15†	16-bit Signed Int	System Status†
201	202	Read	0 to 500*	16-bit Signed Int	Wind speed (m/s) (3 second moving average)
202	203	Read	0 to 3599*	16-bit Signed Int	Wind direction (°) (3 second moving average)
203	204	Read	0 to 500*	16-bit Signed Int	2 min avg wind speed
204	205	Read	0 to 3599*	16-bit Signed Int	2 min avg wind direction
205	206	Read	0 to 500*	16-bit Signed Int	10 min avg wind speed
206	207	Read	0 to 3599*	16-bit Signed Int	10 min avg wind direction
207	208	Read	0 to 500*	16-bit Signed Int	Wind gust speed
208	209	Read	0 to 3599*	16-bit Signed Int	Wind gust direction
210	211	Read	0 to 500*	16-bit Signed Int	5 min avg wind speed
211	212	Read	0 to 3599*	16-bit Signed Int	5 min avg wind direction
212	213	Read	0 to 500*	16-bit Signed Int	5 min Wind gust speed
213	214	Read	0 to 3599*	16-bit Signed Int	5 min Wind gust direction

† If not applicable to ULP-M, the register should report a value of zero (0).
* See Data Format section for numeric conversions.

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