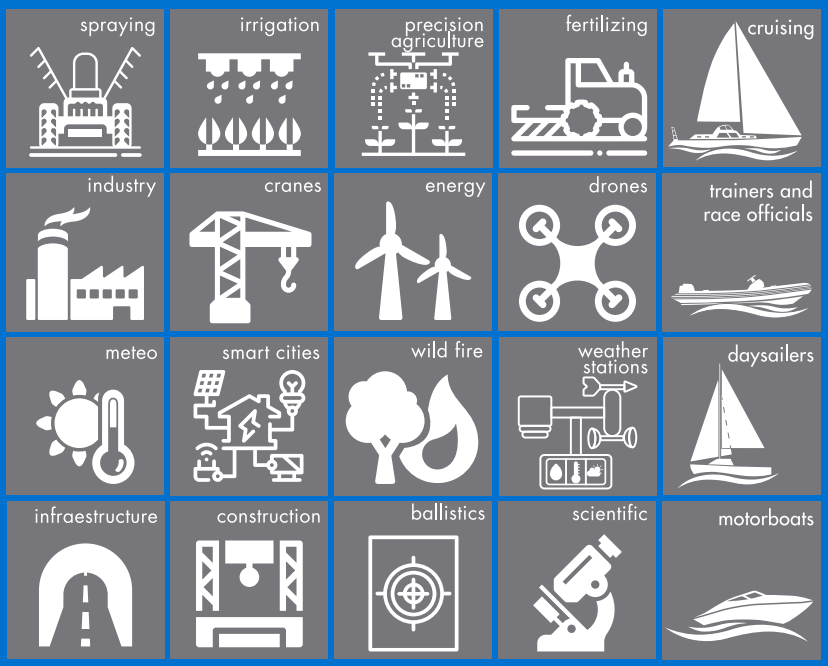
CALYPSO instruments
www.calypsoinstruments.com

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

Index

1 Product Overview

Thank you for choosing the ULP PEO wind meter from Calypso Instruments. This is the first model or 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.

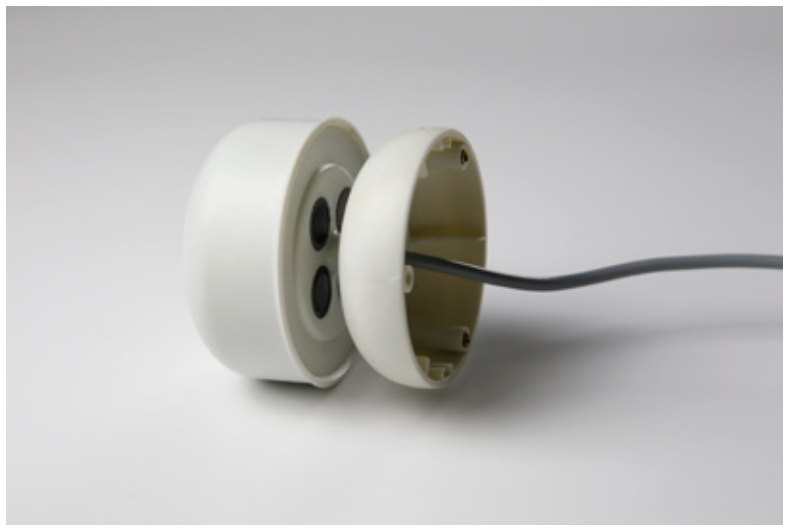
· Mechanical design has been revamped making the unit more robust and dependable.

· 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, I2C, 4-20, SDI 12 and MODBUS.

Applications for the ULP PRO 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.

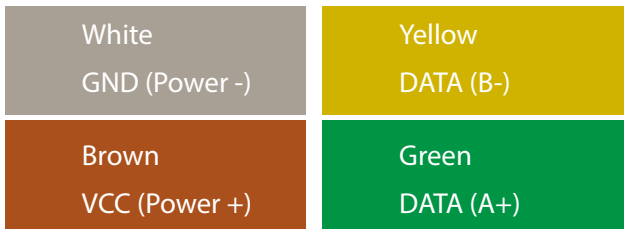
· M3 headless screw (x7)

3 Communication Protocols

3.1 MODBUS RSU

3.1.1 Modbus Wiring

MODBUS RTU Output:



3.1.2 Modbus Configuration

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

The following can be changed with the configurator:

Data Protocol: RS485 to Modbus (or viceversa)
Baudrate: The number of signal units per second that the wind sensor sends. A baud can contain several bits.
Data rate: The number of bits that are transmitted per unit time through a digital transmission system or between two digital devices.
Wind Filter: You can choose between the sensibility of the wind filter.

baudrate:	2400 to 115200 (8n1)
output rate:	0.1 to 10 Hertz (Depends on the filter you select)
output units:	m/sec., knots or km/h

Power consumption:
Ultra-Low-Power (MODBUS) : 1 mA @5V,1 Hz.

Modbus Configuration Setup

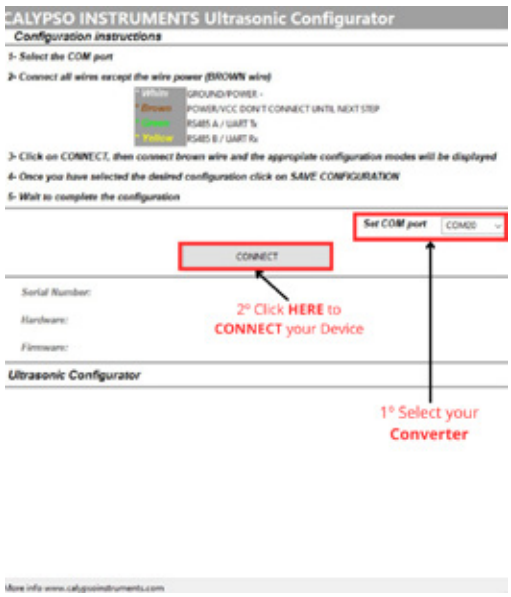
The ULP PRO can be set up by using a special configuration app made by Calypso Instruments. In order to use the app, you should download the configurator from our website at **www.calypsoinstruments.com**.

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

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

This are the STEPS to FOLLOW to Configurate your DEVICE Successfully:

1. Use a USB to RS485 Converter cable to connect your wind sensor to your computer.
2. Connect all the cables to the USB converter cable EXCEPT for the BROWN cable.
3. Open the Configurator app, select your COM port and Click on “Connect button”



4. Connect the brown cable when the configurator tells you to.

5. Wait a few seconds and Configure your Anemometer. In this case, select “Stream” and configure your anemometer. When you’ve finished the configuration click on “Start Configuration” (”SAVE Configuration” in the image)

Modbus Configuration Setup (II)

6. Wait to complete configuration and when the system advises that it is finished, disconnect the USB and cables.

7. Your unit is now configured.

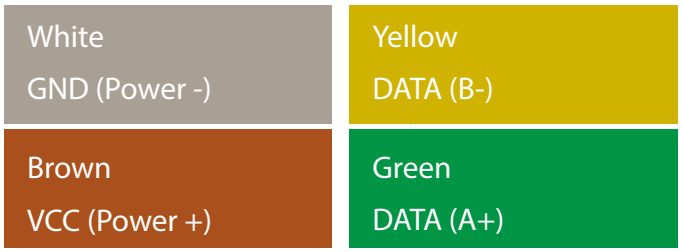
3.1.3 Modbus Registers

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

3.2 RS485

3.2.1. RS485 Wiring

RS485 (NMEA 0183) Output:



3.2.2 RS485 Configuration

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

The following can be changed with the configurator:

Data Protocol: RS485 to Modbus (or viceversa)
Baudrate: The number of signal units per second that the wind sensor sends. A baud can contain several bits.
Data rate: The number of bits that are transmitted per unit time through a digital transmission system or between two digital devices.
Wind Filter: You can choose between the sensibility of the wind filter.

baudrate:	2400 to 115200 (8n1)
output rate:	0.1 to 10 Hertz (Depends on the filter you select)
output units:	m/sec., knots or km/h

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

RS485 Configuration Setup

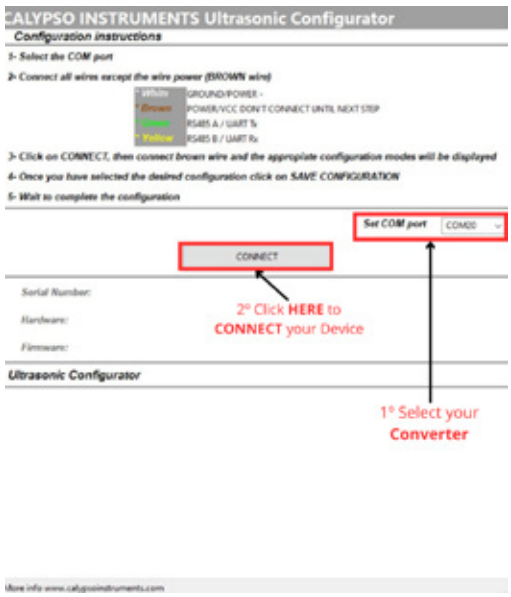
The ULP PRO can be set up by using a special configuration app made by Calypso Instruments. In order to use the app, you should download the configurator from our website at **www.calypsoinstruments.com**.

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

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

This are the STEPS to FOLLOW to Configurate your DEVICE Successfully:

1. Use a USB to RS485 Converter cable to connect your wind sensor to your computer.
2. Connect all the cables to the USB converter cable EXCEPT for the BROWN cable.
3. Open the Configurator app, select your COM port and Click on “Connect button”



4. Connect the brown cable when the configurator tells you to.

5. Wait a few seconds and Configure your Anemometer. In this case, select “Stream” and configure your anemometer. When you’ve finished the configuration click on “Start Configuration” (”SAVE Configuration” in the image)

RS485 Configuration Setup (II)

6. Wait to complete configuration and when the system advises that it is finished, disconnect the USB and cables.

7. Your unit is now configured.

3.2.3 RS485 Registers

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:

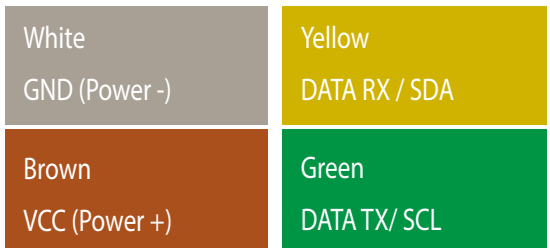
$ULPI*00\r\n //I=id node by default
$ULPA*08\r\n
$ULPB*0B\r\n
 P1*78\r\n

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.

3.3 UART

3.3.1 UART Wiring

UART Output:



3.2.2 UART Configuration

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

The ULP PRO for UART comes in UART Data Protocol standard from factory.

The following can be changed with the configurator:

Data Protocol: UART or I2C
Baudrate: The number of signal units per second that the wind sensor sends. A baud can contain several bits.
Data rate: The number of bits that are transmitted per unit time through a digital transmission system or between two digital devices.
Wind Filter: You can choose between the sensibility of the wind filter.

baudrate:	2400 to 115200 (8n1) bauds
output rate:	0.1 to 10 Hertz (Depends on the filter you select)
output units:	m/sec., knots or km/h

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

UART Configuration Setup

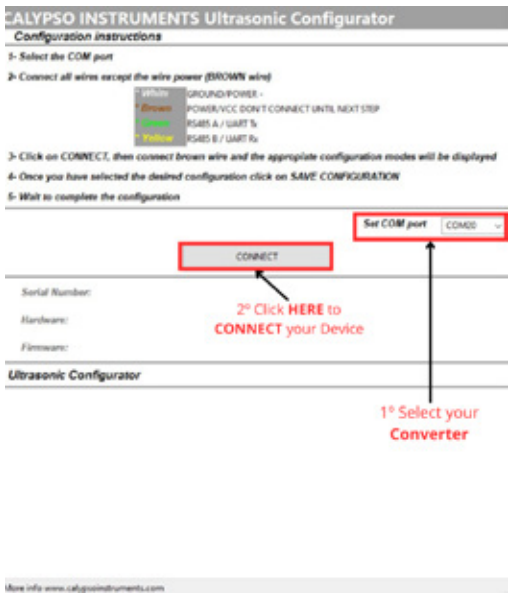
The ULP PRO can be set up by using a special configuration app made by Calypso Instruments. In order to use the app, you should download the configurator from our website at **www.calypsoinstruments.com**.

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

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

This are the STEPS to FOLLOW to Configurate your DEVICE Successfully:

1. Use a USB to UART Converter cable to connect your wind sensor to your computer.
2. Connect all the cables to the USB converter cable EXCEPT for the BROWN cable.
3. Open the Configurator app, select your COM port and Click on “Connect button”



4. Connect the brown cable when the configurator tells you to.

5. Wait a few seconds and Configure your Anemometer. In this case, select “Stream” and configure your anemometer. When you’ve finished the configuration click on “Start Configuration” (”SAVE Configuration” in the image)

UART Configuration Setup (II)

6. Wait to complete configuration and when the system advises that it is finished, disconnect the USB and cables.

7. Your unit is now configured.

3.3.3 UART Registers

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
 P1*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.

3.4 I2C

3.4.1 I2C Wiring

I2C Output:

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

3.4.2 I2C Configuration

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

The ULP PRO for I2C comes in UART Data Protocol standard from factory. This can be changed to I2C data protocol in the configurator app.

The following can be changed with the configurator:

Data Protocol: UART or I2C
Baudrate: The number of signal units per second that the wind sensor sends. A baud can contain several bits.
Data rate: The number of bits that are transmitted per unit time through a digital transmission system or between two digital devices.
Wind Filter: You can choose between the sensibility of the wind filter.

baudrate:	2400 to 115200 (8n1) bauds
output rate:	0.1 to 10 Hertz (Depends on the filter you select)
output units:	m/sec., knots or km/h

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

I2C Configuration Setup

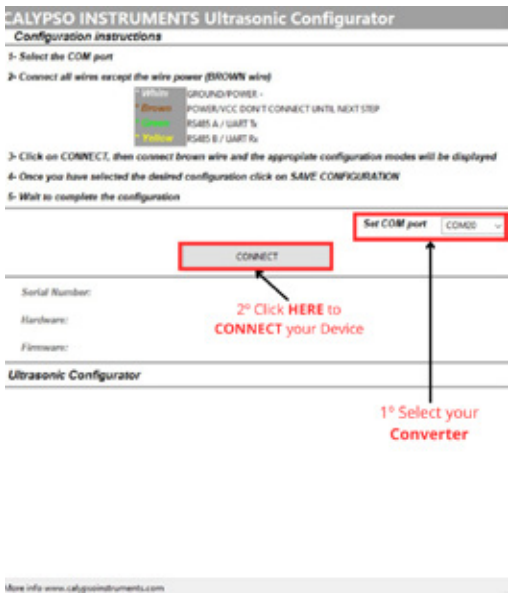
The ULP PRO can be set up by using a special configuration app made by Calypso Instruments. In order to use the app, you should download the configurator from our website at **www.calypsoinstruments.com**.

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

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

This are the STEPS to FOLLOW to Configurate your DEVICE Successfully:

1. Use a USB to UART Converter cable to connect your wind sensor to your computer.
2. Connect all the cables to the USB converter cable EXCEPT for the BROWN cable.
3. Open the Configurator app, select your COM port and Click on “Connect button”



4. Connect the brown cable when the configurator tells you to.

5. Wait a few seconds and Configure your Anemometer. In this case, select “Stream” and configure your anemometer. When you’ve finished the configuration click on “Start Configuration” (”SAVE Configuration” in the image)

I2C Configuration Setup (II)

6. Wait to complete configuration and when the system advises that it is finished, disconnect the USB and cables.

7. Your unit is now configured.

3.4.3 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).

3.5 Analog 4-20 mA

3.5.1 Analog 4-20 mA Wiring

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

CHANNEL 1
- YELLOW --> VDC+
- GREEN --> VDC-

Yellow **V+ (Channel 1)**	**Green** **V - (Channel 1)**

CHANNEL 2
- WHITE --> VDC+
- BROWN --> VDC-

White **V + (Channel 2)**	**Brown** **V - (Channel 2)**

CONNECTION INSTRUCTIONS

*Channel 2 connection is mandatory.

We connect channel 2* to the power supply, you will have 10 seconds to connect channel 1 if you want to use it in parallel. If not connected, only the first of the named channels will be configured. The default configuration is the following:
- Channel 1 --> Address Mode
- Channel 2 -->Tunnel Mode

These configurations can be modified according to needs thanks to the configurator that we have available.

3.5.2 Analog 4-20 mA Configuration

To configure the equipment, Channel 2 (White/Brown cables) must be connected to the power, Thus, the device will appear in the configurator application (via Bluetooth).
At this point we can choose between different modes:

• Speed Mode: In this configuration, speed reading (0-45m/s), scaled in a range of 4-20mA, is given through the channel we select.

• Address Mode: In this configuration, wind reading [0-359º] , scaled in a range of 4-20mA.

• Tunnel Mode: In this configuration you select the combination of wind speed and direction. As in many purposes it is not necessary to know the direction of wind but the direction of the same, the tunnel mode has been implemented.

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

3.5.2 Analog 4-20 mA Configuration (II)

This protocol divides the measurement range into two parts. When the wind direction is between 0º and 180º the dimensioning used is 4mA-12mA;
while between the angles [180º - 359º] the dimensioning is between 12mA - 20mA.

OPERATION

For the correct operation of the equipment, it is required that channel 2 must be powered.

Once the device is connected, it will take approximately 10 seconds to start. Once the 10 seconds have passed, the equipment will begin to launch the relevant currents through the wires (Depending on the configuration established).

3.6 SDI 12

3.6.1 SDI 12 Connections

Brown 3.3V - 18V (Power +)	White GND (Power -)
Green SDI 12 Data, UART TX I2C SCL	Yellow UART Rx, I2C SDA

Output signal: SDI-12 version1.4; address factory set to 0 (default) , Uart (configurable), I2c (configurable)

Output variables: wind direction raw, wind speed raw, wind direction/speed/gust average since last request, wind direction/speed/gust 2,5,10 min

Measurement frequency: 1 Hz

Ultrasonic ULP SDI-12 commands and data format option (0 address by default)

SDI-12 Command	Output	Units	Format
0R0!, 0R0C!	curr_speed+curr_direction+avg_speed+avg_direction+gust<CR><LF>	m/s degrees	current_speed: raw wind speed curr_direction: raw wind direction avg_speed: wind speed average (since last request) avg_direction: wind angle average (since last request) gust: wind speed gust(since last request)
0R1!, 0R1C!	curr_speed+curr_direction+avg_speed2+avg_direction2+gust2<CR><LF>	m/s degrees	current_speed: raw wind speed curr_direction: raw wind direction avg_speed2: 2 min wind speed average avg_direction2: 2 min wind angle average gust2: 2 min wind speed gust
0R2!, 0R2C!	curr_speed+curr_direction+avg_speed2+avg_direction2+gust2<CR><LF>	m/s degrees	current_speed: raw wind speed curr_direction: raw wind direction avg_speed2: 5 min wind speed average avg_direction2: 5 min wind angle average gust2: 5 min wind speed gust
0R3!, 0R3C!	curr_speed+curr_direction+avg_speed10+avg_direction10+gust10<CR><LF>	m/s degrees	current_speed: raw wind speed curr_direction: raw wind direction avg_speed2: 10 min wind speed average avg_direction2: 10 min wind angle average gust2: 10 min wind speed gust

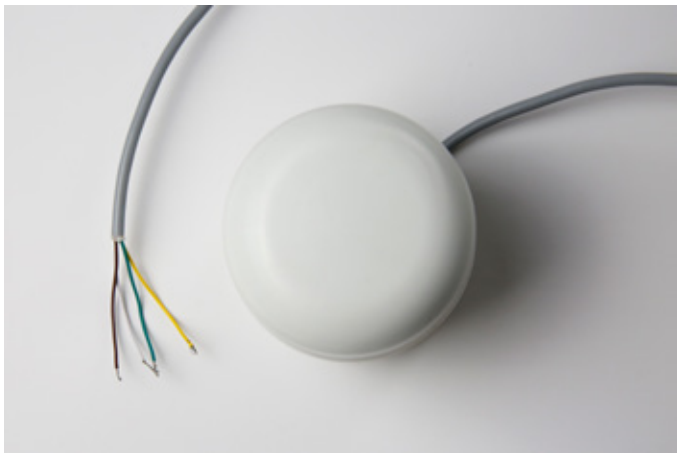
Example:
Tx -> 0R0!
Rx -> 0+1.0+90+1.1+89+2.2<CR><LF>

addr: 0, curr_speed: 1.0 m/s, curr_direction: 90°, avg_speed: 1.1m/s, avg_direction: 89°, gust: 2.2m/s

4. Technical specifications

The ULP has the following technical specifications:

4.1. Dimensions	· Diameter: 68 mm (2.68 in.) · Height: 65 mm (2.56 in.)
4.2. Weight	200 grams (7 ounces)
4.3 Power	· 3.3 - 18 VDC



4.4. Sensors	Ultrasonic transducers (4x) Sample rate: 0.1 Hz to 10 Hz
4.5 Wind Information	· Wind speed · Wind direction

Sample rate: 0.1 Hz to 10 Hz (Configurable)

Wind Speed
Range: 0.5 to 45 m/s (1.12 to 100 mph) or 0.5 to 25m/s (1.12 to 56 mph)
Accuracy: ±0.1 m/s at 10m/s (0.22 at 22.4 mph)
Threshold: 0.5 m/s (1.12 mph)

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

4. Technical specifications (II)

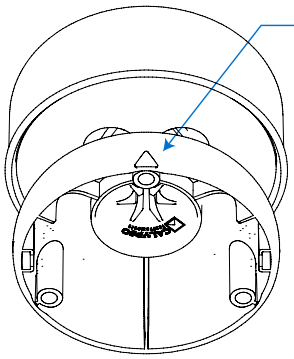
4.6. Easy mount

- 3 x M4 lateral female tripod thread
- 3 x M4 base female tripod thread UNC 1/4" - 20

It can be mounted either on a plate (inferior screws) or on a tube (lateral screws).

North Mark Position

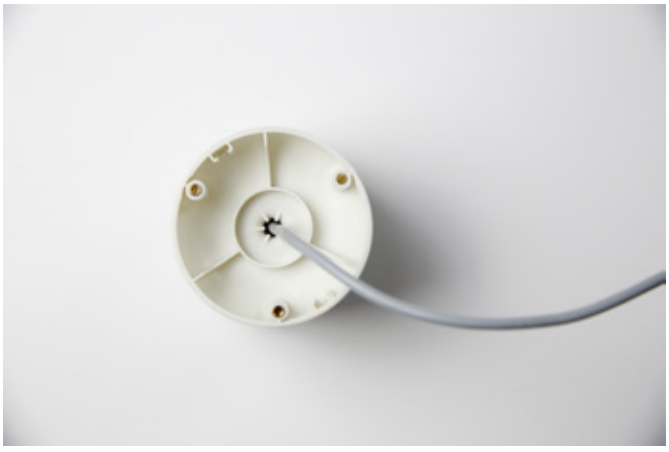
Make sure the north mark is perfectly aligned to the north.



4.7. 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 at **www.calypsoinstruments.com**.



4. Technical specifications (III)

4.8. Firmware	Upgradable via RS485 or UART/-TTL

4.9 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 locks the wave path. The input wires are protected by Transient Voltage Suppression (TVS) diodes. The instrument body is inject molded.

4.10 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.

5. Firmware

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

6. General information

6.1. General recommendations

Wind Speed Gust is that value that measures abrupt and sudden change in wind speed.
Regarding mounting the unit, align the north mark of the ULP towards the natural north, bow of a boat, or the marker used as a reference

.
Regarding mounting the unit, the mast head has to be prepared for the mechanical installation. Align the North mark of the Ultrasonic Ultra-Low-Power to the north. Make sure to install the sensor in a location free from wind perturbation, usually on the mast head.

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 allow to be submerged fully or partially in water.

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

6.2. Maintenance and repair

The ULP does not require great maintenance given the new design of non-moveable parts.

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

6.3 Warranty

This warranty covers the defects resulting from defective parts, materials and manufacturing, if made known to the manufacturer within 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 by the user will not incur any responsibility on part of Calypso Instruments; therefore, any harm caused to the ULP by a mistake will not be covered by the waranty. Using assembly elements different from those delivered with the product will void the waranty.

Changes on transducers position/alignment will void any warranty.

For further information please contact Calypso Technical Support through **sales@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.

Address	Register	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.

CALYPSO instruments

Ultra-Low-Power Ultrasonic wind meter STD (ULP STD)

User manual English version 3.0

30.05.23