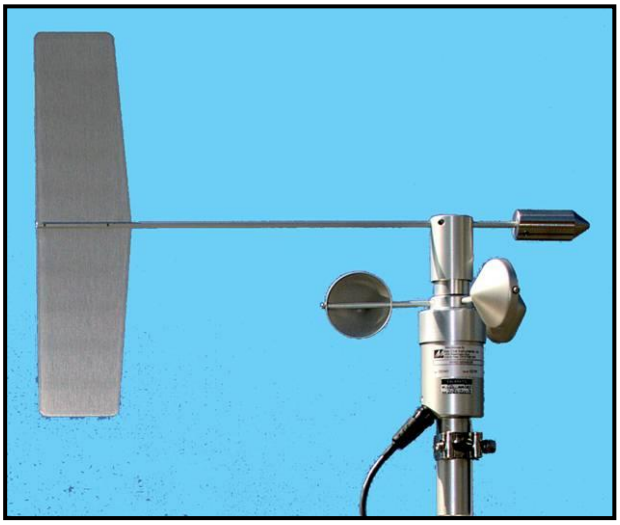
User Manual for the

AN-WD2
Wind Sensor



AN-WD2 UM v2.0

Delta-T Devices Ltd

Notices

Copyright

CE conformity

Wind Sensor AN-WD2 as described in this document is only approved for EU use as part of the WS-GP2 Weather Station.
See also the following documents on the Software and Manuals CD and are also installed on your PC in the DeltaLINK, Document Library::

- WS-GP2 Weather Station EMC certificate.pdf
- WS-GP2 Advice.pdf

If the sensor is used with any other measuring equipment, it is the responsibility of the user to ensure the compliance of any such measuring systems.

FCC Class A Device

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 a commercial 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.

Design changes

Delta-T Devices Ltd reserves the right to change the designs and specifications of its products at any time without prior notice.

User Manual Version: 2.0 9 Feb 2017

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Contents

Introduction

General Information

The AN-WD2 measures the horizontal wind speed and direction.
Wind speed is measured by the rotation of a three-cup anemometer which closes a magnetic reed switch at a rate proportional to the wind speed.
Wind direction is measured by a wind vane connected to a 10K potentiometer.

Scope of this Manual

This manual contains the specifications and performance of the AN-WD2 wind sensor.

Other sources of information

GP2 logger users.

See the Software and Manuals DVD and also the WS-GP2 Weather Station Program documents folder installed on the PC along the DeltaLINK PC program for the following:
WS-GP2 Quick Start Guide
DeltaLINK GP2 Sensor Library Info for AN-WD2
Met One 034B Operations Manual.pdf
Met One O34B Service.pdf
Product Summary.pdf
Example Calibration Certificate.pdf

GP1 Logger Users

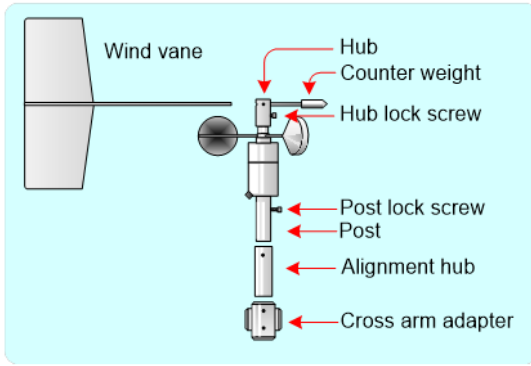
Note: The AN-WD2 does **not** work on a GP1 logger.
Use the D-034B-CA wind sensor instead.
See also the **WS-GP1 Quick Start Guide** at www.delta-t.co.uk and on the Software and Manuals DVD.

Installation

Unpacking

This sensor is shipped in its original packing for maximum protection and for use if returning the sensor for servicing.
Save all the wind sensor packaging. Use it to support the sensor during maintenance, and when returning it to the factory for servicing.

Parts



Note: The cross-arm adapter is included for use with the Delta-T 1m cross-arm type M2-CA.

Choose the Location

Results depend not just on sensor accuracy and reliability but also on how representative the site is – so choose the site carefully.
Where data is to be compared to a "standard" meteorological site, the sensors should be exposed in a similar way to sensors at the standard sites, i.e. over a level surface of short grass and away from trees or buildings.

These are rough guidelines. Refer to meteorological publications for further advice.
e.g. https://www.wmo.int/pages/prog/www/IMOP/publications/IOM-55_Part-I.pdf

Rules of thumb

Near a building, mount the sensors outside the zone of influence. Horizontally this extends roughly twice the height of the building upstream and ten times downstream. Vertically it extends to about twice the height of the structure.
If the requirement is to measure the true local conditions, e.g. a field of newly planted corn, select a relatively uniform area of the terrain. Be aware that, as a crop grows up towards the sensors, the measured wind speed decreases as the canopy approaches.
Sensors are also influenced by the changing local thermal and humidity microclimate above the crop. There are no simple rules to follow – but be aware of the following:
Clothes line effect: vegetation upwind may affect vapour gradients and heat transfer.
Oasis effect: If an isolated source of water, e.g. a lake or glacier, is surrounded by a relatively arid area, then the relative humidity may be affected if the wind direction draws air from the water source.
Leading Edge effect: When air moves over the boundary between two surfaces that differ in temperature, moisture content, roughness or some other characteristic, it takes time for the air to adjust. The line of discontinuity is known as the leading edge. The boundary layer will vary in vertical extent with distance from the leading edge as it adjusts to the new conditions.

Thermal plume effect: Avoid placing objects directly under the air humidity and temperature sensor, such as a solar panel, which can create a rising thermal plume when warmed by the sun.

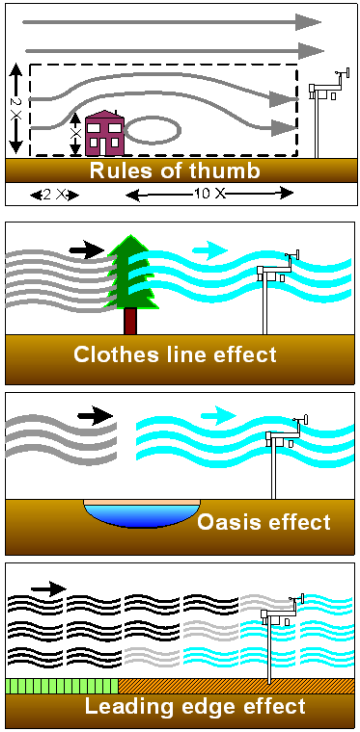
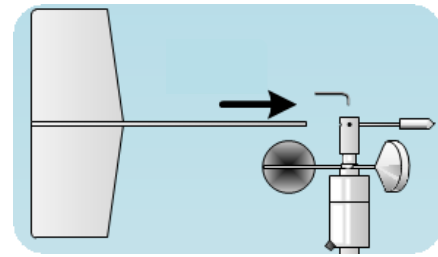


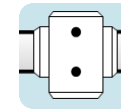
Figure 2: Location

Assembly

Step 1. Fully insert wind vane arm into the hub at the top of the wind sensor. Align the vane with the centre axis of the sensor. Using the 5/64 inch Allen key, tighten the set/grub screw at the top of the hub to lock the windvane in place.

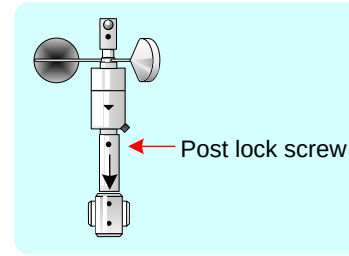


Step 2. Slide the cross-arm adapter onto the cross arm.
This requires the 5/32 inch (~4mm) Allen key.



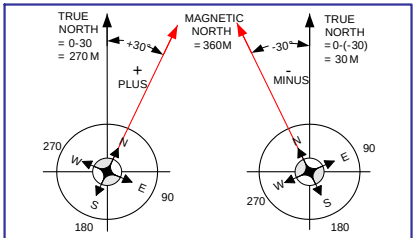
Step 3. Remove the socket head post lock screw using a 5/32” (or 4mm) Allen key. Insert the post into the alignment hub replace the screw, so joining the two together.

Step 4. Sit the wind sensor + alignment hub into the cross-arm adapter, ensuring the sensor axis is vertical.



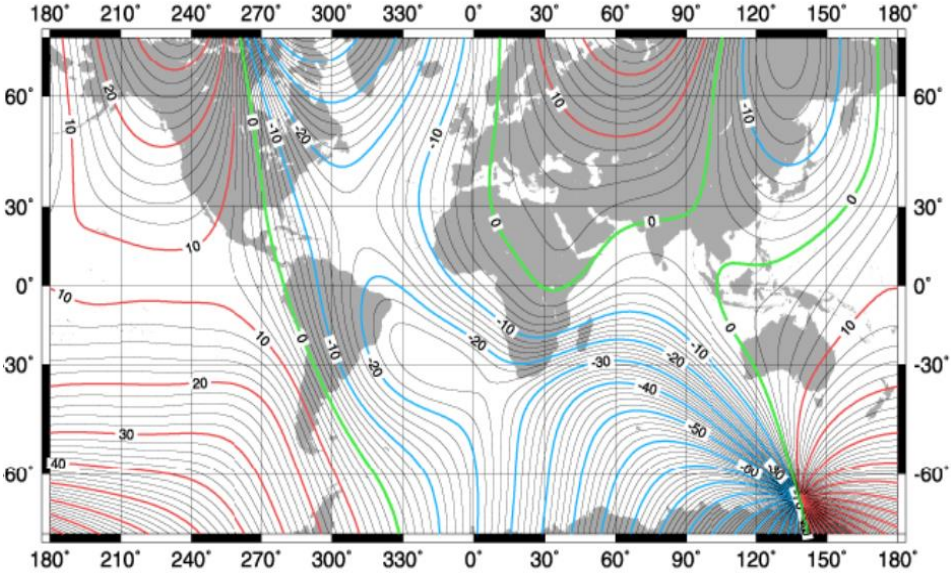
Step 5. Find true north
Set the wind direction sensor to true north, not magnetic north.

Compass Method:
Get a compass and the local angle of magnetic declination – either from a map, local airport - or use an online calculator e.g. http://www.ngdc.noaa.gov/geomag-web/#declination ...and enter your latitude and longitude.



Example: How to find true north given a compass and the angle of magnetic declination

Magnetic declination (or variation) is the angle between magnetic north and true north. It is positive when the angle measured is east of true north and negative when west. So, if the declination is positive, true north is left of magnetic north.



Typical map of magnetic declination for year 2000
(reproduced courtesy of NOAA)

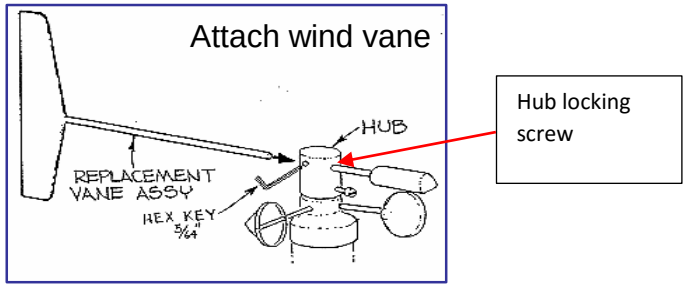
The magnetic variation around the world can be quite large. Magnetic north also drifts over time, so it is best to refer wind direction to true north.

Star Method: Find the North Star or the Southern Cross.

Whichever method you use, establish where true north intersects the horizon.

Step 6. Orient the body of the wind vane

6.1 Ensure that the hub lock screw is in place on the hub.
In this state the wind vane cannot rotate and, if read, the sensor should indicate 180 degrees, i.e. south.
(Save the hub locking screw, and use it to immobilise the shaft of the wind vane during transport)



6.2 Rotate the body of the sensor until the counterweight and the black arrow on the housing actually point to true south (and the wind vane tail points to true north).

6.3 Tighten the two vertically paired grub screws on the cross-arm adapter and then remove the hub lock screw - to release the wind vane and allow it to rotate freely.

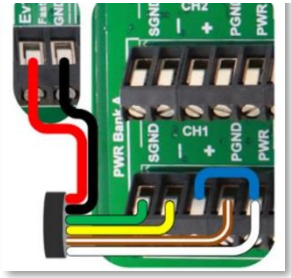
6.4 Attach the sensor cable to the socket on the housing.

Wire-up the sensor

GP2 Logger wiring

	AN-WD2 wiring for GP2			
Pin 1	Red		Wind Speed Signal	Ev1
Pin 2	Black		Wind Speed GND	Ev GND
Pin 3	Yellow		Wind Dir HI	CH7 (-)
Pin 4	Green		Wind Dir LO	SGND
Pin 5	White		Wind Dir V+ REF	CH7 (PWR) and CH7(+)*
	White/brown		Shield	CH7 (PGND)

* link inputs together



DL2e Logger wiring

This requires use of a LAC1 input card

	AN-WD2 wiring for DL2e logger				
Pin 1	Red		Wind Speed Signal	CH61/62 IN(+)	
Pin 2	Black		Wind Speed GND	CH61/62 IN(-)	
Pin 3	Yellow		Wind Dir HI, Track High	IN(+)	Input channel on LAC1
Pin 5	White		Wind Dir REF, Wiper R	IN (-)	with 1M parallel resistor to IN(+)
Pin 4	Green		Wind Dir Common, Track Low	AGND	
	White/brown		Shield	61 or 62(-)	

* link inputs together

Use with a GP2 Logger

Install DeltaLINK3

Install and start the GP2 software DeltaLINK3 on your PC as instructed in the GP2 Quick Start Guide and connect to your GP2 logger using the GP2-USB cable provided, or connect to the Simulator.

Create a new program

1. Select the **Program** window.
2. Click **Change** on the Program window
3. Under **Measurements** select "click to enter a new item"
4. Select **Wind**
5. Select AN-WD2 (complete)

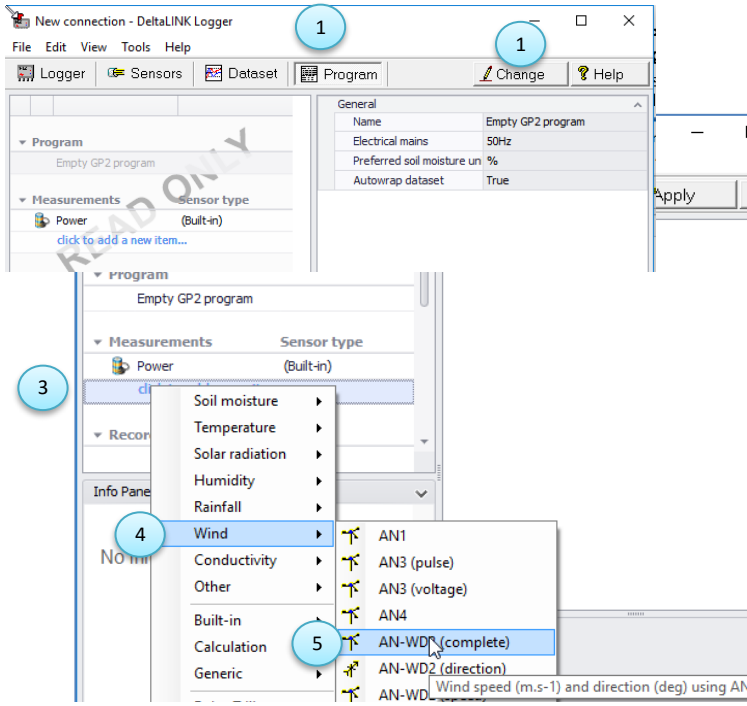


Figure 1 5 steps to create "Measurements" in DeltaLINK for wind speed and direction. Next we need to create "Recordings" - which includes the rate and the maths.

6. Under **Recordings** select "click to enter a new item" and select **Wind**

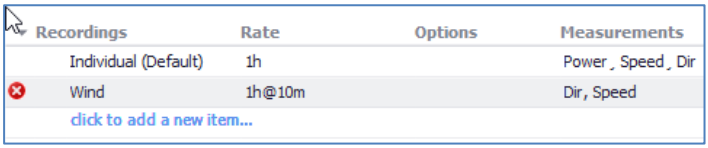


Figure 2 Recordings, showing the default settings for Wind sensors

Note the red cross,signifying the default recording information is not yet right.
DeltaLINK is waiting for some more information, as below.

7. Select a Direction measurement option and a recording option as set out in Figure 3 and 4 below

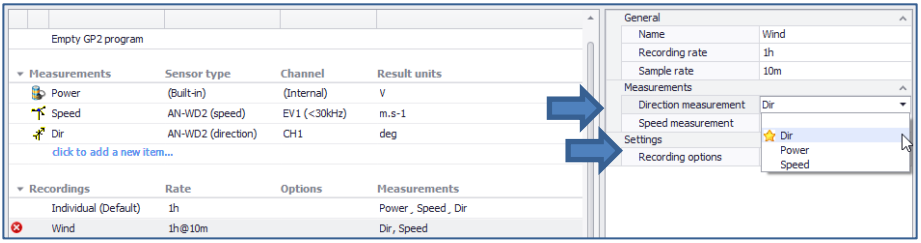


Figure 3 On the right-hand side the parameters associated with the default wind recording measurement are shown. It this instance it is necessary to select two undefined options:- the Direction measurement (choose "Dir" – the star beside it means it is recommended) and the select one or more of the Recording options from the choice shown below in Figure 4

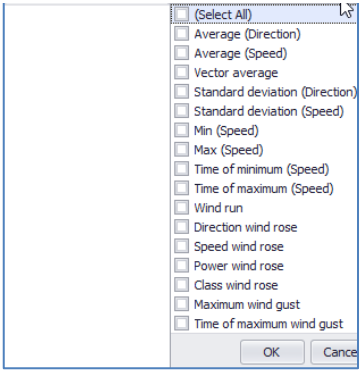
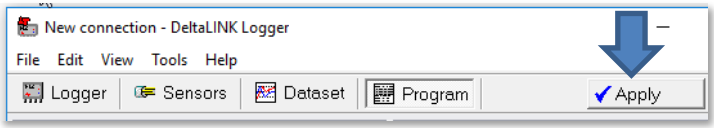


Figure 4 Recording options for the wind direction sensor measurement in DeltaLINK3.
(If unsure what they do, you might like to select them all, and look at the results graphed up when running the program on the GP2 simulator)

8. Click on **Apply.**



This sends the program to either your GP2 logger or the simulator, depending on what you are connected to.

- Use the simulator to check your program.
- Connect to your logger to check your AN-WD2 is working OK

For further details on the use of your GP2 see the following
GP2 Quick Start Guide
WS-GP2 Quick Start Guide

For sensor checks see **Operational Checks** on page 14

Operational Checks

Wind Direction Sensor Tests

Rotate the sensor clockwise as seen from above. The output should go from 0 to 360 degrees and restart at 0.
Note: In the air gap in the potentiometer between 356 and 360 degrees the sensor should indicate 358 degrees.

GP2 logger controller users
Check the sensor via the real-time Sensors display in DeltaLINK - as described in the **WS-GP2 Quick Start Guide**.

DL2e logger users
Check the readings using the DL2e keypad and LCD - as described in the **DL2e Quick Start Guide**

Wind Speed Sensor Tests

Testing the anemometer accuracy in the field is difficult without access to a calibrated wind tunnel. Check that readings are plausible, and if possible, compare them over a time against a reference anemometer of know provenance.

GP2 users
Spin the cups and observe the real time Sensors tab while running WS-GP2 Weather Station Program or your own custom program in DeltaLINK – as described in the **WS-GP2 Quick Start Guide.**

DL2e users
Check the readings using the DL2e keypad and LCD - as described in the **DL2e Quick Start Guide.**

Inspection for Physical Damage

The AN-WD2 wind sensor should be inspected periodically for physical damage to the vane assembly and cable connections.
Inspect all vane assembly parts for security and damage.
Inspect the cup assembly for loose cup arms or other damage. The cup assembly cannot change calibration unless a mechanical part has loosened, or has been bent, damaged or broken.
Note that severe dust can eventually damage the bearings and this may affect the accuracy – see also the Maintenance Schedule on page 17.

Specifications

Wind Speed

Range: 0-75 m/s (0 - 167 mph)
Starting Threshold: 0.4 m/s (0.9 mph)
Accuracy :
±0.12 m s^{-1} (±0.25 mph) for wind speed < 10.1m s^{-1} (22.7 mph)
±1.1% of reading for wind speeds > 10.1m s^{-1} (22.7 mph)

Wind Direction

Range: Mechanical: 0-360°
Electrical: 0-356°
Starting Threshold: 0.9 mph (0.4 m/s)
Accuracy: ±4°
Damping Ratio: .25 standard (.4 to .6 optional)
Resolution: < 0.5°

Output Signal

Wind Speed: Pulsed contact closure
Wind Direction: Potentiometer output (0-10K ohms) = 0-356 degrees

Temperature Range

-30° C to +70° C (Minimal icing conditions)

Environmental

IP 54
Note the following explanation from the manufacturer:
"*The IP rating on the 034B sensor is closest to 54. They are intended to run in rain, of course, and rain splashing from tower hardware (cross-arm, etc.) is not harmful. They are also intended to function in blowing dust conditions. Baffles minimize dust intrusion, but extreme blowing dust will shorten the life of the bearings. We recommend annual bearing replacement. However, experience has shown that in the most extreme dusty environments (constant high wind on a dry desert lakebed with very fine dust), the bearings may need to be replaced in as little as six months. Under actual conditions, even in*

normally dusty environments, dust intrusion is not a problem, and therefore the rating of 54."

Mounting

The sensor is mounted via an alignment hub and cross arm adapter to fit onto the M2 mast cross arm.
See also WS-GP2 Quick Start Guide

Weight

Sensor Weight: 1 lb 12.5 oz (0.81 kg)
Shipping Weight: 4 lbs 3 oz (1.90 kg)Installation

Maintenance

Maintenance Schedule

6-12 months

Inspect the sensors for proper operation .
See Operational Checks on page 10.
Replace the wind speed sensor bearings in extremely adverse environments.

12-24 months

Replace the wind speed sensor bearings

24-36 months

Return the whole sensor to Met One for a complete factory overhaul.

Replacement Parts and Service

Delta-T can supply a spares kit comprising a set of two replacement bearings and a reed switch assembly for the AN-WD2.
See Contact Details on page 22

Met One service and parts

A complete range of replacement parts and services are available directly from the manufacturer MetOne.
Full details of their services and part charges see Service 034B.pdf
For repair instructions see the Met One 034B Operations Manual.pdf.
Copies of these can be found as follows:

- on the Delta-T Software and Manuals DVD.
- in the WS-GP2 Weather Station Program documents folder installed on the users PC along the DeltaLINK PC program
- online at MetOne.com

See Met One Contact Details on page 22.

Trouble Shooting

Wind Direction Sensor

Symptom: incorrect reading

1. Check sensor wiring

Check the wind sensor is correctly wired to the logger.

2. Check logger and software

GP2 users: Check you have a WS-GP2 logger running the WS-GP2 Weather Station Program or a similar program and using the DeltaLINK3 or later.

DL2 Users: Check you have service release SR version 11 or later of theLs2Win logger software, with a LAC1 card is correctly fitted and connected up to the sensor wiring terminals.

3. Check voltages

With the logger program running and taking continuous readings in realtime, measure the voltages at the logger terminals with a voltmeter, with the sensor connected.
3.1 Measure the voltage between 3V (ref) [white wire] and PGND terminal [white and brown wire]. It should be 3V ± 0.2mV.
3.2 Measure the voltage between the Wind Dir HI [yellow wire] and Wind Dir LO [green wire]. It should go between 0 and 3 V when the vane rotates between 0 and 356 degrees.
Note: In the air gap between 356 and 360 degrees the output Win Dir HI should be pulled up to +3V by a 1M resistor. The Weather station software interprets this as 358 degrees.

4: Check the sensor resistance values

4.1 Disconnect the wind vane wires from the data logger screw terminals and use an ohm meter to check the sensor resistance as follows.
4.2 Measure the resistance between yellow and green wires. The resistance should vary from about 1K to 11K ohms, depending on the angle.

4: Inspect bearings

If the wind vane does not rotate freely the bearings may need replacing.

Refer to the **MetOne 034B Operation Manual.pdf** and **MetOne O034B Service. pdf** for part numbers and information about their spares and repair and calibration service.

Wind Speed Sensor

Symptom: incorrect wind speed

1. Check sensor wiring

Check the wind sensor is correctly wired to the logger .
See **Wire-up the sensor** on page10**.**

2. Check logger and software

GP2 users: Check you have a WS-GP2 logger running the WS-GP2 Weather Station Program or a similar program and using the DeltaLINK3 or later.

DL2 Users: Check you have service release SR version 11 or later of theLs2Win logger software, with a LAC1 card is correctly fitted and connected up to the sensor wiring terminals.

3. Check the wind sensor switch

Disconnect the wind speed sensor wiring from the logger.
Measure the resistance across the red [Wind Speed Signal] and black [Wind Speed GND] wires with an ohm meter.
Rotate the cup slowly. The resistance should jump from less than 1 ohm to infinity each time the switch opens.

4: Inspect bearings

If the anemometer cups not rotate freely the bearings may need replacing.

Refer to the **MetOne 034B Operation Manual.pdf** and **MetOne O034B Service. pdf** for part numbers and information about their spares and repair and calibration service

Warranty and Service

Terms and Conditions of Sale

Our Conditions of Sale (ref: COND: 1/07) set out Delta-T's legal obligations on these matters. The following paragraphs summarise Delta-T's position but reference should always be made to the exact terms of our Conditions of Sale, which will prevail over the following explanation.

Delta-T warrants that the goods will be free from defects arising out of the materials used or poor workmanship for a period of **two years** from the date of delivery.

Delta-T shall be under no liability in respect of any defect arising from fair wear and tear, and the warranty does not cover damage through misuse or inexpert servicing, or other circumstances beyond their control.

If the buyer experiences problems with the goods they shall notify Delta-T (or Delta-T's local distributor) as soon as they become aware of such problem.

Delta-T may rectify the problem by replacing faulty parts free of charge, or by repairing the goods free of charge at Delta-T's premises in the UK during the warranty period.

If Delta-T requires that goods under warranty be returned to them from overseas for repair, Delta-T shall not be liable for the cost of carriage or for customs clearance in respect of such goods. However, Delta-T requires that such returns are discussed with them in advance and may at their discretion waive these charges.

Delta-T shall not be liable to supply products free of charge or repair any goods where the products or goods in question have been discontinued or have become obsolete, although Delta-T will endeavour to remedy the buyer's problem.

Delta-T shall not be liable to the buyer for any consequential loss, damage or compensation whatsoever (whether caused by the negligence of the Delta-T, their employees or distributors or otherwise) which arise from the supply of the goods and/or services, or their use or resale by the buyer.

Delta-T shall not be liable to the buyer by reason of any delay or failure to perform their obligations in relation to the goods and/or services if the delay or failure was due to any cause beyond the Delta-T's reasonable control.

Service, Repairs and Spares

Users in countries that have a Delta-T distributor or technical representative should contact them in the first instance.
Spare parts for our own instruments can be supplied and can normally be despatched within a few working days of receiving an order.
Spare parts and accessories for products not manufactured by Delta-T may have to be obtained from our supplier, and a certain amount of additional delay is inevitable.
No goods or equipment should be returned to Delta-T without first obtaining the return authorisation from Delta-T or our distributor.
On receipt of the goods at Delta-T you will be given a reference number. Always refer to this reference number in any subsequent correspondence. The goods will be inspected and you will be informed of the likely cost and delay.
We normally expect to complete repairs within one or two weeks of receiving the equipment. However, if the equipment has to be forwarded to our original supplier for specialist repairs or recalibration, additional delays of a few weeks may be expected.
For contact details see page.22.

Technical Support

Users in countries that have a Delta-T distributor or technical representative should contact them in the first instance.
Technical Support is available on Delta-T products and systems. Your initial enquiry will be acknowledged immediately with a reference number. Make sure to quote the reference number subsequently so that we can easily trace any earlier correspondence.
In your enquiry, always quote instrument serial numbers, software version numbers, and the approximate date and source of purchase where these are relevant.

Contact Details:

Tech Support Team
Delta-T Devices Ltd
130 Low Road, Burwell, Cambridge CB25 0EJ, UK
email: tech.support@delta-t.co.uk
email: repairs@delta-t.co.uk
web: www.delta-t.co.uk
Tel: +44 (0)1638 742922
Fax: +44 (0)1638 743155

Returns and Shipping Instructions

To minimise shipping costs, particularly for non UK customers, it is advisable to ship return sensors for service, repair and calibration directly to Met One

Met One Contact Details

Contact Met One direct for a Returns Number, quotation and terms and conditions and shipping instructions *before* you send the sensor.
Met One Service:
1600 Washington Blvd., Grants Pass, Oregon 97526
Phone 541/471-7111, Fax 541/471-7116

e-mail: service@ Metone.com

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