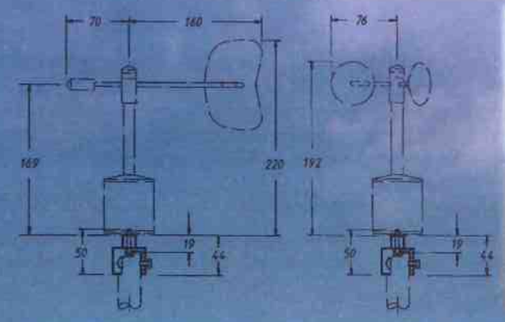

What price good wind data? Why risk compromising your data by using an inferior or unproven sensor which promises more than it can deliver?

Vector Instruments First Class A100 series Anemometers, engineered in the UK, are preferred by many of the leading players in the wind assessment industry. Together with the W200P Series Windvanes, they offer a reliable and durable solution to your high-precision wind measurement needs.

Measuring the wind world-wide for over 35 years, Vector Instruments sensors have a proven record of accuracy and reliability.

Instruments are custom-built to your requirements, however selected A100 Series Anemometer models are now available ex-stock bundled with a standard mounting adaptor and MEASNET calibration certificate to help you get your wind masts installed and start collecting wind data sooner.

Now you can get advice & support, and buy wind sensors, direct from the manufacturer: Vector Instruments.

Vector Instruments specialize in the manufacture and sale of quality, professional wind speed and wind direction measuring equipment together with other weather sensors and associated equipment.

Recognized for many years as a leading name in the field of wind instrumentation for scientific research, Vector Instruments sensors have many uses in environmental monitoring, alternative energy, utility, wind assessment and industrial applications. Our policy is one of continuous improvement of the whole product range, with periodic updating of specifications, while maintaining compatibility with superseded products wherever possible.

Vector Instruments
115 Marsh Road, RHYL, Denbighshire, LL18 2AB, United Kingdom
Tel: +44 1745 350700 Fax: +44 1745 344206
Email: sales@windspeed.co.uk Web: http://www.windspeed.co.uk

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Vector Instruments

Anemometers & Windvanes

A100 Series Anemometers

▶ ACCURATE

Precision instruments for
SUPERIOR PERFORMANCE IN
ACTUAL FIELD CONDITIONS
(not just in wind tunnels)

▶ FIRST CLASS

For TRUE wind speed measurements

▶ PROVEN

The preferred anemometer of many
leading players in Wind assessment

▶ ROBUST & DURABLE

Engineered from Anodized Aluminium,
Stainless Steel & weather resistant plastics

▶ RELIABLE

Over 35 years experience in the field
Made in the UK, used World-wide

▶ CALIBRATED

Every Anemometer Individually Calibrated
Also available with: MEASNET, IEC 61400-12-1

▶ HEATED

Optional Anti-Icing Heater

W200P Series Windvanes

Precision potentiometer windvanes
to measure wind direction

www.windspeed.co.uk

A100 SERIES ANEMOMETERS - FIRST CHOICE FOR FIRST CLASS

Anemometers

Suitable for a wide range of applications where accuracy and sensitivity are important. The A100 series anemometers all share the same basic construction and all use the same R30 series 3-cup Rotors. Different internal modules and components are used to provide various output signals. The use of a precision ball-race mounted shaft ensures the essential low threshold speed and good repeatability.

The outline and mechanical design, common to all the A100 series, remains largely unchanged since the introduction of the original Porton™ Anemometer in 1972, the electronics modules being continuously developed during this time to provide a well tried, durable and reliable product.

Anemometers have, until recent years, only been calibrated/evaluated in wind tunnels. Investigations by the wind power industry have shown that anemometer types/designs behave differently in field conditions where there is considerable turbulence. The Vector Instruments A100 design is one of a very few which has been subjected to field trials, and these have shown that Vector Instruments' A100L2, A100LK, A100K, A100LM and A100R/K anemometers (using the R30/K2, R30/K and R30/M3 rotors) are amongst the very few cup anemometer designs which can be classified as having "First Class" performance according to the requirements of the IEC61400-12-1 when suitably sited and operated.

This high performance classification means that A100 series anemometer measurements are accurate in the actual wind conditions experienced in the field (as opposed to just being accurate in the artificial conditions of a low-turbulence wind tunnel) making them the clear choice for wind assessment applications.

A100 Series Anemometers, Features:

Type	Pulse/Frequency Output	Resolution	Power Supply Required	Additional Features
A100L2	0..1500Hz = 0..150Knots (10Hz per Knot) nominal)	0.05m	6.5 to 28V DC powered (@1.5mA typical)	Low power, Analog/Voltage Output : 0..2.5v = 0..150Knots nominal (& 5v pulses)
A100LK	0..1500Hz = 0..150Knots (10Hz per Knot nominal)	0.05m	4.75 to 28V DC powered (@1mA typical)	Low power (4v pulses)
A100LM	0..750Hz = 0..75m/s (10Hz per m/s nominal)	0.1m	4.75 to 28V DC powered (@1mA typical)	Low power (4v pulses)
A100M	0..750Hz = 0..75m/s (10Hz per m/s nominal)	0.1m	10 to 30V DC powered (@35mA max)	10 to 30v pulses, AntiSurge built-in
A100K	0..1500Hz = 0..150Knots (10Hz per Knot nominal)	0.05m	10 to 30V DC powered (@35mA max)	10 to 30v pulses, AntiSurge built-in
A100S	1 pulse per revolution (1.25m wind-run = 0.8Hz per m/s nominal)	1.25m	10 to 30V DC powered (@35mA max)	10 to 30v pulses, AntiSurge built-in
A100R	1 pulse per revolution (1.25m wind-run = 0.8Hz per m/s nominal)	1.25m	No power required	bounce-free mercury-wetted reed switch
A100R/K	1 pulse per revolution (1.287m wind-run = 0.777Hz per m/s nominal)	1.25m	No power required	bounce-free mercury-wetted reed switch (& improved cosine response vs. A100R)

Windvanes

The W200 series windvanes are high quality wind direction sensors which have proven themselves over many years in applications from general meteorology to wind assessment. Two basic types are available: The W200P and W200P/L.

The W200P is a high resolution instrument fitted with a 1K ohm potentiometer of robust design

The W200P/L is a "Light-Duty" instrument fitted with a low-torque 2K ohm potentiometer which is more responsive to light winds.

W200 Series Windvanes, Features:

Type	Potentiometer	Electrical Continuity Angle	Electrical Variation Angle	Life	Threshold
W200P	1K Ohms (1%), wire-wound (latest "-01" type)	357.7±1.5° (typ. 2.3° gap at North)	356.5±1.5° (typ. 3.5° deadband)	5x10^7 cycles (10 years typ.)	0.6m/s (0.5m/s with /LV)
W200P/L	2K Ohms, "Light-Duty", wire-wound	357±2° (typ. 3° gap at North)	355±3° (typ. 5° deadband)	2x10^7 cycles (4 years typ.)	0.5m/s (0.35m/s with /LV)

(Consult the latest product specification sheets available from our sales office for full details of A100 series anemometers and W200 series windvanes)

Anti-Icing Heaters

Our A100 Series Anemometers and W200 Series Windvanes can optionally be fitted with "internal" or "external" anti-icing heaters to help alleviate problems due to icing conditions.

The "internal" (/HE-4 type) heater is fitted inside the instrument meaning there are NO extra cables and NO change to the instrument shape, dimensions or appearance so it does not affect the airflow around the instrument, and the calibration and performance characteristics (and classification) of the instrument remain unaffected. For this reason, the /HE-4 heater is recommended for applications requiring the highest accuracy where an anti-icing heater is also necessary.

The /HE-4 heater option is now available in both 12V 6W and 24V 6W versions.

HE-1 and HE-2 "external" heater kits are available which users can fit to existing instruments, however these heaters are not advised for high-accuracy applications as they affect the airflow around the instrument and will affect both calibration and off-axis performance.

Instrument Mounts and Mast Adaptors

A range of mounts and adaptors are available to simplify fixing of the instruments to a mast. Single mast mounts for anemometers and windvanes are the preferred solution, but if mounting both sensors at the same height, there will be some interference to the airflow which will reduce accuracy of reading, depending on the mast top diameters and separation distance. Dual mounting arms are available, but are not suitable for wind assessment applications due to the relatively close spacing of the instruments and the likelihood of interference. For quoted/highest accuracy, and MEASNET calibrations, use the 405 single mounts with A100 series anemometers.

For best accuracy in all applications, it is preferable to mount the anemometer in such a way that the mast/structure does not interfere with the airflow "seen" by the anemometer.

IEA-11 and IEC 61400-12-1 have guidance on masts, and anemometer/windvane mounting to obtain the best results in wind assessment and wind turbine testing applications. Typical recommendations include mounting the top-most anemometer on a thin round pole at least 6 mast-diameters above the main structure of the mast, and in the case of instruments mounted part-way up the mast, mount on side booms (with a round cross-section) such that the instruments are at least 6 mast-diameters away from the mast structure (to get <1% distortion, 10 to 15 mast diameters preferred) and 15 to 25 boom-diameters above the boom while also taking into account the prevailing wind direction.

Consult a specialist or the standards mentioned for full details, many mast manufacturers can offer suitable booms.

Outside Air Temperature Shields & Probes

A range of naturally ventilated louvred housings/shields is available with/without thermistor or RTD/PRT probes. They provide shielding from direct solar radiation during the day, and outward radiation to clear skies at night, while also protecting the probe from the weather and physical damage.

Precision aspirated temperature sensors are also available.

Anemometers for Wind Turbine Testing and Wind Farm Site Assessment

Vector Instruments has over 35 years experience in the manufacture and development of wind sensors and has a proven record of accuracy and reliability which is vital for the prediction of return on investment for the wind power generation industry.

To obtain the best results when evaluating prospective wind farm sites (or when performing wind turbine testing) requires cup anemometers which have undergone extensive performance testing and which are optimised to obtain the best results in real-world situations.

Many cup anemometers designed for general meteorological applications are not sufficiently accurate, even though they may be quoted as "1% accurate". Their quoted accuracy only applies to "ideal" wind tunnel conditions and they do not acheive that level of performance in "real world" turbulent conditions.

Industry testing has shown that sonic anemometers are difficult to calibrate and can fail to give an accurate measure of mean wind speed as required for these applications. Similarly, the dynamic response of propellor anemometers in the turbulent conditions experienced on many prospective wind farm sites means that they also fail to give sufficiently accurate measurements of mean wind conditions.

By comparison, the A100 Series cup anemometers ARE accurate enough for the most demanding applications.

Because wind farms today are generally large financial investments, it is essential to make every effort to predict the likely generating capacity for a site as accurately as possible in order to best calculate the likely viability of a proposed wind farm on that site. The available power from the wind is proportional to the CUBE of the mean wind speed, so it follows that any errors in the measurement of mean wind conditions will be magnified and produce much larger errors in any estimates/predictions of a site's power generating potential.

All wind turbine manufacturers test their products to provide curves of power output versus windspeed. Over the years they have discovered that their results can vary wildly unless they use cup anemometers which have specific closely defined performance characteristics. A number of publicly funded research projects have been carried out (CLASSCUP, ACCUWIND etc) which have ultimately led to the development and refinement of the international standard IEC 61400-12-1 which specifies these cup anemometer performance characteristics as well as details of mast/tower design requirements and anemometer mounting requirements. It is logical, therefore, that the same requirements for high quality anemometer performance, accuracy and mounting apply to the gathering of wind information for proposed sites for those turbines, as these measurement (and any errors) will be combined with those same power performance curves to predict likely generating potential.

IEC 61400-12-1, CLASSCUP and ACCUWIND describe "classification figures" for anemometer performance. These figures are intended to be a measure of the likely overall accuracy of the measurements of mean wind conditions obtained using a specific type of anemometer, with small class figures indicating better results. The "perfect" cup anemometer would have a classification of 0.0, however the best cup anemometers available at present have class figures typically between 0.5 and 5.0 depending on the range of site/environmental conditions, including type of terrain, turbulence and temperature. Determining the classification figure for an anemometer is a difficult task involving lengthy measurements of the cup anemometer properties in both the field and wind tunnels followed by extensive calculations.

For the commonly used 'Horizontal Definition' of wind speed, a good "cosine response" to off-axis winds is essential to obtaining a good classification figure. The Vector Instruments A100 series cup anemometer is one of a very few designs suitable for use under this definition. In some of the hilly sites favoured for many wind farms, it is often the case that turbines are likely to be sited at or near the top of a hill/ridge so many of these sites will have significant off-axis winds/turbulence. Most cup anemometers from other manufacturers have either a flat response to off-axis winds, or one which "peaks" in the event of winds with an up/down component, resulting in a poor classification figure, as a consequence they will produce inferior measurements in these situations compared to the A100 Series.

Many prospective wind farm sites are likely to be subject to "Class B conditions" where there is likely to be significant turbulence (hilly country, or areas with trees/hedges/buildings etc. which can interfere with the airflow). Only purpose-designed (and none of the lower-cost cup anemometers) perform well enough in these conditions and achieve acceptably low class B figures. The recent independent ACCUWIND report includes an assessment of five cup anemometers. The results of that report show that the A100 series anemometers are amongst a group of three which perform similarly, and significantly better than the others in the more arduous "Class B" conditions likely to be encountered on many prospective wind farm sites. Of that "group of three anemometers", the A100 series anemometer has built up a good track record in wind assessment, and is the only type which has been used in significant numbers around the world over many years.

The A100, also known as the "Porton Anemometer", was first developed for atmospheric diffusion studies in the 1960s for accurate measurement in turbulent air near the ground. The basic geometry remains unchanged, while developments over the years have resulted in a reliable and versatile range of instruments. The A100 series cup anemometer achieves "Class 1.0" performance under certain special conditions ("Class S" conditions, see the independent certification document which is available detailing this), however the A100 series also performs well in the standard "Class A" and "Class B" conditions. ACCUWIND indicates that the A100 series can be classified as 1.8 for "Class A" conditions, and 4.5 for "Class B" conditions which is amongst the best (i.e. "Class 1.8A" and "Class 4.5B")

Reliability and consistency of the A100 series calibrations are addressed in a number of ways:

- Every A100 series anemometer (cup rotor) is tested as standard practice in our own wind tunnel, with regular checks for consistency against accurate calibrations performed at other reputable wind tunnels.
- The A100 series anemometers (and their cup rotors) have been shown by independent research to retain their calibration and produce consistent measurements for extended periods.
- Individual MEASNET calibrations are routinely provided from various wind tunnels in the MEASNET group as required for IEC61400-12-1.

Obtaining an individual MEASNET calibration for a cup anemometer is now generally considered in the industry to be essential if the anemometer is to be used for wind farm site measurements (or for turbine power performance testing). Over a period of several years, the MEASNET group of independent wind tunnels and test-houses have developed a test procedure and "round-robin" checking procedure to ensure that cup anemometer calibrations can be performed accurately, producing consistent results across all of the wind tunnels within the MEASNET group. The MEASNET calibrations are directly traceable to basic international standards, rather than being "traceable to another wind tunnel" or "standard anemometer". The MEASNET procedure is in line with the calibration requirements of international standard IEC61400-12-1 mentioned earlier, and IEC 17025.

Using high quality "purpose designed" cup anemometers may initially appear costly, but in fact does not really add much to the overall cost of installing a met mast on a site compared to one using inferior anemometers. Using high-performance cup anemometers does, however, significantly improve the confidence the wind farm developer can have in the mean wind conditions data and any estimates of generating capacity they may calculate from that data. The cost of the high-performance wind sensors themselves typically represents a relatively small percentage of the total cost of a wind assessment project when the costs of masts, dataloggers, installation, maintenance and data analysis are taken into account. Hence we believe the A100 Series of cup anemometers to be the best choice for these applications.

For these applications, it is recommended that the /PC3 Anti-Surge circuit is specified for the A100L2 and A100LK anemometers. While it cannot protect against a direct lightning strike, it greatly reduces the incidence of failure due to nearby lightning strikes or surges from sources such as static discharge or induced voltages from power cables. Should icing be a problem, the newly available HE-4 internal anti-icing heater option can be used while retaining full anemometer accuracy and performance.