Kestrel® 1000 POCKET ANEMOMETER

www.r-p-r.co.uk

WIND SPEED • MAXIMUM WIND SPEED • AVERAGE WIND SPEED

Know your conditions
Measure environmental conditions quickly and accurately
Wide range of wind speeds and a low start-up speed
Reliable, portable and easy to use

- **Small, robust design**
- **Data hold function**
- **Large easy to read display**
- **Waterproof and floats**
- **High precision jewel mounted impeller**
- **Replaceable impeller assembly**
- **Long life lithium battery**
- **Low cost**
- **Includes protective cover, lanyard and battery**
- **5 year warranty**
- **Choice of measurement units: Knots, Metres per second, Kilometres per hour, Miles per hour, Feet per minute and Beaufort Force**

Measurement	Units of Measure	Accuracy	Range
Current, Max and Average Wind speed	knots, m/s, km/h, mph, ft/min, Beaufort (B)	±3% of reading or ±0.1 m/s	0.4 to 40 m/s

DESCRIPTION

The Kestrel 1000 pocket anemometer is the first and entry level of the Kestrel range, providing the user with accurate wind speed readings. It has three buttons below the display, making operation simple and allowing the user to view data in current, maximum or average displays, the buttons also allow operation of the data hold function.

The Kestrel 1000 is a small electronic rotating vane type anemometer, easily carried in a pocket. It uses high precision jewel bearings and a light weight impeller to provide accurate air flow measurements even at low speeds. The impeller assembly can be replaced by the user if damaged.

Low power microprocessor technology is used to provide speed, maximum speed, average speed and units selection; functions normally only found on more expensive instruments. The liquid crystal display has large 9mm high digits for a clear readout.

Power is from an easily replaceable standard lithium coin cell battery, which will typically give up to 300 hours of operation. The instrument automatically switches off if no keys are pressed for 45 minutes.

The Kestrel 1000 is made from high impact injection moulded plastic and corrosion resistant materials with the electronics fully sealed. It will float if accidentally dropped into water. There is a hard cover for protection when not in use and a lanyard is provided for added security.

All Kestrels have a 5 year warranty.

APPLICATIONS

Agriculture – checking conditions prior to crop spraying or burning
Aviation – gliders, para-gliders, micro-lights, parachutists and ballooning
Construction – site safety, working conditions, working at height in cranes or access vehicles
Education – air flow experiments, environmental studies, outdoor sports
Heating and ventilation – air flow through fans, checking condition of filters
Industry – air flow measurements, pollution control
Science – aerodynamics, environmental science and meteorology
Fire fighters – checking fire spreading hazard
ALL - sailors, walkers, model boats/air craft, kite flyers, archery, shooting, fishing, golf & athletics

SPECIFICATION

Physical	Dimensions		122mm x 42mm x 20mm
	Cover dimensions		122mm x 46mm x 26mm
	Weight		65g
	Cover weight		37g
	Lanyard		0.5m
	Case colour		Blue
Display	Display type		Reflective 3½ digit LCD.
	Digit height		9mm
	Display update		1 second
	Functions		Current wind speed (3 second average)
			Average speed since power on (AVG)
			Maximum 3 second gust since power on (MAX)
			Data hold (HOLD)
	Speed units		kt, m/s, km/h, mph, ft/min, Beaufort Force (B)
Performance	Speed (1 sec response)	Operational range	0.4m/s to 60m/s (0.8 to 135.0mph)
		Specification range	0.4m/s to 40m/s (0.8 to 89.0mph)
		On axis accuracy	Larger of ± 3% of reading or least significant digit. (Some loss of accuracy from bearing wear may occur with sustained operation at or near maximum speed)
		Off-axis response	-1% @ 5°, -2% @ 10°, -3% at 15°
		Calibration drift	<1% after 100hrs operation at 7m/s
		Resolution	0.1 kt, m/s, km/h, mph. 1 FPM below 1999 FPM, 10 FPM above 2000 FPM. 1 Beaufort (0 to 12)
Sensor	Impeller		Diameter 25mm. High precision axle and jewel (sapphire) bearings. User replaceable impeller assembly
Environmental	Sealing		Electronics enclosure IP67 [Water resistant]
	Shock		Drop tested (MIL.STD.810F - unit only)
	Temperature		Operating range: -10°C to +55°C (for LCD readability and batteries) Storage range: -30°C to +60°C
	EMC		CE marked
Miscellaneous	Battery		Lithium coin cell CR2032, included, user replaceable
	Battery Life		300 hours of use, typical
	Auto switch off		45 minutes after last key press
	Cover		Snap on hard cover for protection
	Certification		Wind speed measurements are tested during manufacture. A certificate of conformity (C of C) is included with each Kestrel. A calibration certificate is available for an additional fee.
	Guarantee		5 years

The manufacturer reserves the right to amend the specification and therefore the information in this document may be subject to change. Please check our website www.r-p-r.co.uk for details

Richard Paul Russell Ltd
New Harbour Building, Bath Road, Lymington, SO41 3SE, UK
Tel +44 (0) 1590 679755 Fax +44 (0) 1590 688577
e-mail: sales@r-p-r.co.uk www.r-p-r.co.uk

Kestrel®
Pocket Weather® Meters

Certificate of Conformity

This instrument was produced under rigorous factory production control and documented standard procedures. It was individually visually inspected, leak tested and function tested for display, backlight, button and software performance. The accuracy of each of its primary measurements was individually calibrated and/or tested against standards traceable to the National Institute of Standards and Technology ("NIST") or calibrated intermediary standards. This instrument is certified to have performed at the time of manufacture in compliance with the following specifications as they apply to this meter's specific model, measurements and features.

Methods Used in Calibration and Testing

Wind Speed:

The Kestrel Pocket Weather Meter impeller installed in this unit was individually tested in a subsonic wind tunnel operating at approximately 300 fpm (1.5 m/s) and 1200 fpm (6.1 m/s) monitored by a Gill Instruments Model 1350 ultrasonic time-of-flight anemometer. The Standard's maximum combined uncertainty is +/–1% within the airspeed range 270.6 to 3923.9 fpm (1.35 to 19.93 m/s), and +/–2% within the airspeed range 166.6 to 706.6 fpm (0.85 to 3.59 m/s).

Temperature:

Temperature response is verified in comparison with a Eutechnics 4600 Precision Thermometer or a standard Kestrel 4000 Pocket Weather Tracker calibrated weekly against the Eutechnics 4600. The Eutechnics 4600 is calibrated annually and is traceable to NIST with a system accuracy of +/– 0.05 ˚C.

Direction / Heading

The sensitivity of the magnetic directional sensor is verified at the component level by applying a magnetic field to the sensor and measuring the signal output at 4 points, as well as after assembly by orienting the unit to the cardinal directions and measuring the magnetic field output. In both cases the compass output must be accurate to within +/– 5 degrees.

Relative Humidity:

Relative humidity receives a two-point calibration in humidity and temperature controlled chambers at 75.3% RH and 32.8% RH at 25° C. The calibration tanks are monitored with an EdgeTech Model 2002 DewPrime II Standard Chilled Mirror Hygrometer. Following calibration, performance is further verified at an RH of approximately 43.2% against the Edgetech Hygrometer. The Edgetech Hygrometer is calibrated annually and is traceable to NIST with a maximum relative expanded uncertainty of +/– 0.2% RH.

Barometric Pressure:

Pressure response is verified against a Mensor Series 6000 Digital Barometer or a standard Kestrel 4000 Pocket Weather Tracker calibrated weekly against the Mensor Barometer. The Mensor Barometer is calibrated annually and is traceable to NIST with a maximum relative expanded uncertainty of +/– 0.02% F.S.

Approved By:

Michael Naughton, Engineering Manager

The enclosed Kestrel Pocket Weather Meter was manufactured by Nielsen-Kellerman Co. at its facilities located at 21 Creek Circle, Boothwyn, PA 19061 USA.

K_CERT_001_11.11.30

Primary Measurement	1000	2000	2500	3000	3500	3500 DT	4000	4200	4250	4300	4400	4500	4300 HOR	Units	Resolution	Accuracy (+/-)	Range* Max Operational *Specification (if less)*	Notes
Wind Speed or Air Velocity	•	•	•	•	•	•	•	•	•	•	•	•	•	m/s	0.1	Larger of 3% of reading, least significant digit or 20 ft/min	0.6 to 60.0 m/s *0.5 to 40.0 m/s*	1 inch diameter impeller with precision axle and low-friction Zytel® bearings. Startup speed stated as lower limit, readings may be taken down to 0.4 m/s | 79 ft/min | 1.5 km/h | .9 mph | .8 kt after impeller startup. Off-axis accuracy -1% @ 5° off-axis; -2% @ 10°; -3% @ 15°. Calibration drift < 1% after 100 hours use at 16 MPH | 7 m/s. Replacement impeller (NK PN-0801) field installs without tools (US Patent 5,783,753).
														ft/min	1		118 to 11,811 ft/min *118 to 7,874 ft/min*	
														km/h	0.1		2.2 to 216.0 km/h *2.2 to 144.0 km/h*	
														mph	0.1		1.3 to 134.2 mph *1.3 to 89.5 mph*	
														knots	0.1		1.2 to 116.6 knots *1.2 to 77.8 knots*	
														Beaufort	1		0 to 12 B	
Temperature		•	•	•	•	•	•	•	•	•	•	•	•	°F	0.1	1.8 °F	-49.0 to 257.0 *-20.0 to 158.0*	Air, water or snow temperature. Hermetically-sealed, precision thermistor mounted externally and thermally isolated (US Patent 6,929,645) for rapid response. Airflow of 2.2 mph | 1 m/s or greater provides fastest response and reduction of insolation effect. Calibration drift negligible.
														°C	0.1	1.0 °C	-45.0 to 125.0 *-29.0 to 70.0*	
Relative Humidity				•	•	•	•	•	•	•	•	•	•	%RH	0.1	3.0 %RH	0.0 to 100.0% *5.0 to 95.0%* *non-condensing*	Polymer capacitive humidity sensor mounted in thin-walled chamber external to case for rapid, accurate response (US Patent 6,257,074). To achieve stated accuracy unit must be permitted to equilibrate to external temperature when exposed to large, rapid temperature changes and be kept out of direct sunlight. Calibration drift +/- 2% over 24 months. RH may be recalibrated at factory or in field using Kestrel Humidity Calibration Kit (NK PN-0802).
Pressure			•		•	•		•	•	•	•	•	•	inHg	0.01	typical 0.04 inHg *max 0.07 inHg*	0.30 to 32.48 inHg	Air pressure at the location. Adjustable reference altitude allows display of station pressure or barometric pressure corrected to MSL. Monolithic silicon piezoresistive pressure sensor with second-order temperature correction. Pressure sensor may be recalibrated at factory or in field. Kestrel 2500 and 3500 display continuously updating three-hour barometric pressure trend indicator: rising rapidly, rising, steady, falling, falling rapidly. Kestrel 4000 series displays pressure trend through graphing function.
														hPa (mb)	0.1	typical 1.5 hPa *max 2.5 hPa*	300.0 to 1100.0 hPa *10.0 to 1100.0 hPa*	
														PSI	0.01	typical 0.02 PSI *max 0.04 PSI*	0.14 to 15.95 PSI	
Wind Direction Forward Heading												•	•	°	1	5°	0 to 360°	3-axis solid-state magnetoresistive sensor mounted perpendicular to unit plane to permit operation while measuring wind speed. Declination/variation adjustable for True North readout. Accuracy of measurements dependent upon unit's vertical position. Self-calibration routine eliminates magnetic error from batteries or unit and must be run after every full power-down (battery removal or change).
														Cardinal	16 Points	5°	0 to 360°	
Air Flow								•						cfm	1	Larger of 3% of reading, least significant digit or 20 ft/min	0 to 99,999 cfm	Volume of air flowing through an opening. Automatically calculated from Air Velocity measurement and user-specified duct shape (circle or rectangle) and dimensions (units: in, ft, cm or m). Maximum duct dimension input: 258.0 in | 21.5 ft | 655.3 cm | 6.55 m.
														m^3/hr	1		0 to 99,999 m^3/hr	
														m^3/m	1		0 to 99,999 m^3/m	
														m^3/s	0.1		0.0 to 9,999.9 m^3/s	
														L/s	1		0 to 99,999 L/s	
Crosswind & Headwind/Tailwind												•	•	mph	1	10%	Refer to stated ranges for wind speed.	Effective wind relative to a target or travel direction. Calculated from wind speed, wind direction and target heading. Auto-switching headwind/tailwind
														ft/min	1	10%		
														km/h	0.1	10%		
															0.1	10%		
															0.1	10%		
Wind Chill		•	•	•	•	•	•	•	•	•	•	•	•	°F	0.1	.8 °F	Refer to stated ranges for wind speed and temperature.	Perceived temperature resulting from combined effect of wind speed and temperature. Calculated based on the NWS Wind Chill Temperature (WCT) Index, revised 2001. Wind speed adjusted by a factor of 1.5 to yield equivalent results when wind speed measured at 10 m above ground. Specification temperature limits established by WCT Tables.
														°C	0.1			
Heat Index														°F	0.1	3.6 °F	Refer to stated ranges for temperature and relative humidity.	Perceived temperature resulting from the combined effect of temperature and relative humidity, calculated based on NWS Heat Index (HI) tables. (Specification temperature limits established by HI tables.)
														°C	0.1	2.0 °C		
Wet Bulb Temperature (Psychrometric)					•	•	•	•	•	•	•	•	•	°F	0.1	3.6 °F	Refer to stated ranges for temp., relative humidity and pressure.	Temperature indicated by a wet bulb psychrometer under forced aspiration. Calculated from temperature, relative humidity and pressure.
														°C	0.1	2.0 °C		
Dewpoint				•	•	•	•	•	•	•	•	•	•	°F	0.1	3.6 °F	Refer to stated ranges for temp. and relative humidity.	Temperature to which the air must be cooled at a constant pressure for water vapor to condense into water. Calculated from temperature and relative humidity.
														°C	0.1	2.0 °C		
Delta T						•								°F	0.1	5.4 °F	Refer to stated ranges for temp., relative humidity and pressure.	Difference between dry bulb temperature and wet bulb temperature. When spraying, indicates evaporation rate and droplet lifetime. Safe range for pesticide spraying is 4 to 18 °F / 2 to 8 °C.
														°C	0.1	3.0 °C		
Evaporation Rate										•				$lb/ft^2/hr$	0.01	typical 0.02 $lb/ft^2/hr$ *typical 0.06 $lb/ft^2/hr$*	0.00 to 1.00 $lb/ft^2/hr$	The rate at which moisture is lost from the surface of curing concrete. Calculated from wind speed, temperature, relative humidity and concrete temperature. Requires user measurement and entry of concrete temperature obtained with an accurate IR or probe thermometer (°F or °C, not included). Readings should be taken 20 inches above pour surface with the thermistor shaded, and averaged for 6-10 seconds using built-in averaging function.
														$kg/m^2/hr$	0.01	typical 0.1 $kg/m^2/hr$ *max 0.1 $kg/m^2/hr$*	0.00 to 5.00 $kg/m^2/hr$	
Altitude			•		•	•	•	•	•	•	•	•	•	ft	1	typical 50 ft *max 98 ft*	-2,300 to 85,000 ft	Height above Mean Sea Level ("MSL"). Temperature compensated pressure (barometric) altimeter requires accurate reference barometric pressure to produce maximum absolute accuracy.
														m	1	typical 15 m *max 30 m*	-700 to 26,000 m	
Density Altitude							•	•	•	•	•	•	•	ft	1	246	Refer to stated ranges for temp., relative humidity and pressure.	Air density converted to equivalent sea level elevation at the International Standard Atmosphere. Calculated from temperature, pressure and relative humidity.
														m	1	75		
Max/Avg Wind	•	•	•	•	•	•								One-button clear and restart of Max Wind Gust and Average Wind measurement by powering down and restarting unit.				
							•	•	•	•	•	•	•	Max and average wind calculation may be started and stopped independently of data logging of other values, along with all other wind-related functions: air velocity, crosswind, headwind/tailwind, wind chill, WBGT, TWL, evaporation rate.				
Data Storage & Graphical Display, Min/Max/Avg History							•	•	•	•	•	•	•	Minimum, maximum, average and logged history stored and displayed for every measured value. Large capacity data logger with graphical display. Manual and auto data storage. Min/Max/Avg history may be reset independently. Auto-store interval settable from 2 seconds to 12 hours, overwrite on or off. Logs even when display off except for 2 and 5 second intervals (code version 4.18 and later). Data set capacity by model shown.				
							4000	3600	3000	3200	2400	2900	2500					
Data Upload							•	•	•	•	•	•	•	Requires optional PC interface (USB or RS-232) or Bluetooth enabled model and provided software.				
Available Bluetooth® Data Connect							•	•	•	•	•	•	•	Adjustable power consumption and radio range from up to 30 ft | 9 meters. Individual unit ID and 4-digit PIN code preprogrammed for easy identification and data security when pairing and transmitting. Employs Bluetooth Serial Port Protocol for data transmission.				
Display & Backlight	•	•		•										Reflective 3 1/2 digit LCD. Digit height 0.36 in / 9 mm. Aviation green electroluminescent backlight (except in Kestrel 1000). Manual activation with auto-off.				
			•		•	•								Reflective 5 digit LCD. Digit height 0.36 in / 9 mm. Choice of aviation green or visible red (NV models only) electroluminescent backlight. Manual activation with auto-off.				
							•	•	•	•	•	•	•	Multifunction, multi-digit monochrome dot-matrix display. Choice of aviation green or visible red (NV models only) electroluminescent backlight. Automatic or manual activation.				
Response Time & Display Update	•	•	•	•	•	•	•	•	•	•	•	•	•	All measurements except those based on relative humidity respond accurately within 1 second. Relative humidity and all measurements which include RH in their calculation may require as long as 1 minute to fully equilibrate to a large change in the measurement environment. Display updates every 1 second.				
Clock / Calendar			•		•	•								Real-time hours:minutes clock.				
							•	•	•	•	•	•	•	Real-time hours:minutes:seconds clock, calendar, automatic leap-year adjustment.				
Operational & Storage Temperature Range	•	•	•	•	•	•	•	•	•	•	•	•	•	The operational temperature range of the liquid crystal display and batteries is 14° F to 131° F / -10 °C to 55 °C. Measurements beyond the operational range can be taken by briefly exposing unit to extreme conditions such that the display and batteries remain within the operational range. Storage range -22 °F to 140 °F / -30 °C to 60 °C.				
Auto Shutdown	•	•	•	•	•	•								After 45 minutes of no key presses.				
							•	•	•	•	•	•	•	User-selectable --15 or 60 minutes with no key presses or disabled.				
Languages							•	•	•	•	•	•	•	English, French, German, Italian, Spanish.				
Certifications	•	•	•	•	•	•	•	•	•	•	•	•	•	CE certified, RoHS and WEEE compliant. Individually tested to NIST-traceable standards (written certificate of tests available at additional charge).				
Battery	•	•	•	•	•	•								CR2032, one, included. Average life, 200 hours. Battery life reduced by backlight use in 2000 to 3500 models.				
							•	•	•	•	•	•	•	AAA Alkaline, two, included. Average life, 400 hours of use, reduced by backlight or Bluetooth® radio transmission use.				
Environmental	•	•	•	•	•	•	•	•	•	•	•	•	•	Waterproof (IP67 and NEMA-6). MIL-STD-810F, Transit Shock, Method 516.5 Procedure IV; unit only; impact may damage replaceable impeller.				
Size & Weight	•	•	•	•	•	•								4.8 x 1.8 x 1.1 in / 12.2 x 4.6 x 2.8 cm, 3.6 oz / 102 g (including slip-on cover).				
							•	•	•	•		•	•	5.0 x 1.8 x 1.1 in / 12.7 x 4.5 x 2.8 cm, 3.6 oz / 102 g.				
											•			6.5 x 2.2 x 1.1 in / 16.5 x 5.9 x 2.8 cm, 4.4 oz / 125 g.				