



## 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 Weather & Environmental 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  $\pm 1.04\%$  within the airspeed range 706.6 to 3923.9 fpm (3.59 to 19.93 m/s), and  $\pm 1.66\%$  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 Weather & Environmental Meter calibrated weekly against the Eutechnics 4600. The Eutechnics 4600 is calibrated annually and is traceable to NIST with a system accuracy of  $\pm 0.05^\circ\text{C}$ .

#### 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  $\pm 5$  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  $25^\circ\text{C}$ . 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  $\pm 0.2\%$  RH.

#### Barometric Pressure:

Pressure response is verified against a Vaisala PTB210A Digital Barometer or a standard Kestrel 4000 Weather & Environmental Meter calibrated weekly against the Vaisala Barometer. The Vaisala Barometer is calibrated annually and is traceable to NIST with an accuracy of  $\pm 0.15$  hPa at  $+20^\circ\text{C}$  defined as the root sum of the squares (RSS) of end point non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.

#### Approved By:

Michael Naughton, Engineering Manager

SENSORS																	
SENSOR	1000	2000	2500	3000	3500	3500 DT	4000	4200	4250	4300	4500	Ballistics	ACCURACY (+/-)*	RESOLUTION	SPECIFICATION RANGE	OPERATIONAL RANGE	NOTES
Wind Speed   Air Flow	•	•	•	•	•	•	•	•	•	•	•	•	Larger of 3% of reading, less than significant digit or 20 ft/min	0.1 m/s 1 ft/min 0.1 km/h 0.1 mph 0.1 knots 1 ft/s 0.1 F/S*	0.6 to 60.0 m/s 118 to 7,874 ft/min 2.2 to 144.0 km/h 1.3 to 89.5 mph 1.2 to 77.8 knots 0 to 12.8" 2-131.2"	0.6 to 60.0 m/s 118 to 11,811 ft/min 2.2 to 216.0 km/h 1.3 to 134.2 mph 1.2 to 116.6 knots 0 to 12.8" 2-196.9 F/S*	1 inch/25 mm 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   9.9 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 5,763,753). Wind speed calibration and testing should be done with triangle on impeller located at the top front face of the Kestrel. *F/S only in Ballistics units. Beaufort not available in Ballistics units.
Ambient Temperature		•	•	•	•	•	•	•	•	•	•	•	0.9 °F 0.5 °C	0.1 °F 0.1 °C	-20.0 to 158.0 °F -29.0 to 70.0 °C	14.0 to 131.0 °F -10.0 to 55.0 °C	Hermetically sealed, precision thermistor mounted externally and thermally isolated (US Patent 5,939,645) for rapid response. Airflow of 2.2 mph/1 m/s or greater provides fastest response and reduction of insulation effect. Calibration drift negligible. Thermistor may also be used to measure temperature of water or snow by submerging thermistor portion into material -- remove impeller prior to taking submerged measurements and ensure humidity sensor membrane is free of liquid water prior to taking humidity-based measurements after submersion.
Relative Humidity				•	•	•	•	•	•	•	•	•	3.0 %RH	0.1 %RH	5 to 95% non-condensing	0 to 100%	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. Humidity sensor may be recalibrated at factory or in field using Kestrel Humidity Calibration Kit (NK PN-0802).
Pressure													0.03 inHg 1.0 hPa/mbar 0.01 PSI	0.01 inHg 0.1 hPa/mbar 0.01 PSI	8.86 to 32.49 inHg 300.0 to 1100.0 hPa/mbar 4.35 to 15.95 PSI and 32.0 to 185.0 °F 0.0 to 85.0 °C	0.30 to 48.87 inHg 10.0 to 1654.7 hPa/mbar 0.14 to 24.00 PSI and 14.0 to 131.0 °F -10.0 to 55.0 °C	Monolithic silicon piezoresistive pressure sensor with second-order temperature correction. Pressure sensor may be recalibrated at factory or in field. Adjustable reference altitude allows display of station pressure or barometric pressure corrected to MSL. Kestrel 4200 displays station pressure on a dedicated screen. 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. PSI display on Kestrel 4000 series only.
Compass											•	•	5°	1/16th Cardinal Scale	0 to 360°	0 to 360°	2-axis solid-state magnetoresistive sensor mounted perpendicular to unit plane. Accuracy of sensor 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). Readout indicates direction to which the back of the unit is pointed when held in a vertical orientation. Declination/variation adjustable for True North readout.

CALCULATED MEASUREMENTS																	
MEASUREMENT	1000	2000	2500	3000	3500	3500 DT	4000	4200	4250	4300	4500	Ballistics	ACCURACY (+/-)*	RESOLUTION	SPECIFICATION RANGE	SENSORS EMPLOYED	NOTES
Air Density													0.0002 lb/ft³ 0.0033 kg/m³	0.001 lb/ft³ 0.001 kg/m³	Refer to Ranges for Sensors Employed	Temperature Relative Humidity Pressure	Mass of air per unit volume
Air Flow													0.0671	1 cfm 1 m³/hr 1 m³/m 0.1 m³/s 1 L/s	Refer to Ranges for Sensors Employed	Air Flow User Input (Duct Shape & Size)	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.
Altitude			•	•	•	•	•	•	•	•	•	•	typical: 23.6 ft 7.2 m max: 48.2 ft 14.7 m	1 ft 1 m	typical: 750 to 1100 mBar max: 300 to 750 mBar	Pressure User Input (Reference Pressure)	Height above Mean Sea Level ("MSL"). Temperature compensated pressure (barometric) altimeter requires accurate reference barometric pressure to produce maximum absolute accuracy. Both accuracy specs corresponds to a reference pressure anywhere from 850 to 1100 mBar.
Barometric Pressure			•	•	•	•	•	•	•	•	•	•	0.07 inHg 2.4 hPa/mbar 0.03 PSI	0.01 inHg 0.1 hPa/mbar 0.01 PSI	Refer to Ranges for Sensors Employed	Pressure User Input (Reference Altitude)	Air pressure that would be present in identical conditions at MSL. Station pressure compensated for local elevation provided by reference altitude. Requires accurate reference altitude to produce maximum absolute accuracy.
Crosswind & Headwind/Tailwind												•	0.071	1 mph 1 ft/min 0.1 km/h 0.1 m/s 0.1 knots	Refer to Ranges for Sensors Employed	Wind Speed Compass	Effective wind relative to a target or travel direction. Auto-switching headwind/tailwind indication.
Delta T						•							3.2 °F 1.8 °C	0.1 °F 0.1 °C	Refer to Ranges for Sensors Employed	Temperature Relative Humidity 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 16 °F / 2 to 9 °C.
Density Altitude							•	•	•	•	•	•	226 ft 69 m	1 ft 1 m	Refer to Ranges for Sensors Employed	Temperature Relative Humidity Pressure	Local air density converted to equivalent elevation above sea level in a uniform layer consisting of the International Standard Atmosphere.
Dew Point			•	•	•	•	•	•	•	•	•	•	3.4 °F 1.9 °C	0.1 °F 0.1 °C	15 to 95 % RH Refer to Range for Temperature Sensor	Temperature Relative Humidity	Temperature that a volume of air must be cooled to at constant pressure for the water vapor present to condense into dew and form on a solid surface. Can also be considered to be the water-to-air saturation temperature.
Evaporation Rate													0.01 lb/ft³/hr 0.06 kg/m²/hr	0.01 lb/ft³/hr 0.01 kg/m²/hr	Refer to Ranges for Sensors Employed	Wind Speed Temperature Relative Humidity Pressure User Input (Concrete Temperature)	The rate at which moisture is lost from the surface of curing concrete. 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.
Heat Index				•	•	•	•	•	•	•	•	•	7.1°F 4.0°C	0.1 °F 0.1 °C	Refer to Ranges for Sensors Employed	Temperature Relative Humidity	Perceived temperature resulting from the combined effect of temperature and relative humidity. Calculated based on NWS Heat Index (HI) tables. Measurement range limited by extent of published tables.
Moisture Content   Humidity Ratio ("Grains")													.3 gpp .04 g/kg	0.1 gpp 0.01 g/kg	Refer to Ranges for Sensors Employed	Temperature Relative Humidity Pressure	Mass of water vapor in a mass of air.
Relative Air Density													0.0026	0.001	Refer to Ranges for Sensors Employed	Temperature Relative Humidity Pressure	The ratio, expressed as a percentage, of measured air density to the air density of a standard atmosphere as defined by the ICAO.
Wet Bulb Temperature - Psychrometric													3.2 °F 1.8 °C	0.1 °F 0.1 °C	Refer to Ranges for Sensors Employed	Temperature Relative Humidity Pressure	Temperature indicated by a sling psychrometer. Due to nature of the psychrometric ratio for a water-air system, this approximates the thermodynamic wet-bulb temperature. The thermodynamic wet-bulb temperature is the temperature a parcel of air would have if cooled adiabatically to saturation temperature via water evaporating into it.
Wind Chill		•	•	•	•	•	•	•	•	•	•	•	1.6 °F 0.9 °C	0.1 °F 0.1 °C	Refer to Ranges for Sensors Employed	Wind Speed Temperature	Perceived temperature resulting from combined effect of wind speed and temperature. Calculated based on the NWS Wind Chill Temperature (WCT) index, revised 2001, with wind speed adjusted by a factor of 1.5 to yield equivalent results to wind speed measured at 10 m above ground. Measurement range limited by extent of published tables.

ADDITIONAL SPECIFICATIONS													
Display & Backlight	•	•	•	•	•	•							Reflective 3 1/2 digit LCD. Digit height 0.36 in / 9 mm. Aviation green electroluminescent backlight. 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.
Max/Avg Wind	•	•	•	•	•	•							One-button clear and restart of Max Wind Gust and Average Wind measurement.
							•	•	•	•	•	•	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							4000 points	3200 points	3200 points	3600 points	2900 points	2500 points	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 off. Logs even when display off except for 2 and 5 second intervals (code version 4.18 and later). Data capacity shown.
Data Upload & Bluetooth® Data Connect Option							•	•	•	•	•	•	Requires optional PC interface (USB or RS-232) or Bluetooth data transfer option and provided software. <b>Bluetooth Data Transfer Option:</b> 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.
Clock / Calendar	•	•	•	•	•	•							Real-time hours:minutes:seconds clock, calendar, automatic leap-year adjustment.
Auto Shutdown	•	•	•	•	•	•							After 45 minutes of no key presses.
Languages							•	•	•	•	•	•	User-selectable -- 15 or 60 minutes with no key presses or disabled.
Certifications							•	•	•	•	•	•	English, French, German, Italian, Spanish.
Origin							•	•	•	•	•	•	CE certified, RoHS and WEEE compliant. Individually tested to NIST-traceable standards (written certificate of tests available at additional charge).
Battery Life							•	•	•	•	•	•	Designed and manufactured in the USA from US and imported components. Complies with Regional Value Content and Tariff Code Transformation requirements for NAFTA Preference Criterion B.
							•	•	•	•	•	•	CR2032, one, included. Average life, 300 hours. Battery life reduced by backlight use in 2000 to 3500 models.
							•	•	•	•	•	•	4000 Series Models: AAA Lithium, two, included. Average life, 400 hours of use, reduced by backlight or Bluetooth radio transmission use.
Shock Resistance	•	•	•	•	•	•	•	•	•	•	•	•	MIL-STD-810G, Transit Shock, Method 516.5 Procedure IV, unit only; impact may damage replaceable impeller.
Sealing	•	•	•	•	•	•	•	•	•	•	•	•	Waterproof (IP67 and NEMA-6).
Operational Temperature Limits	•	•	•	•	•	•	•	•	•	•	•	•	14° F to 131° F   -10 °C to 55 °C Measurements may be taken beyond the limits of the operational temperature range of the display and batteries by maintaining the unit within the operational range and exposing it to the more extreme environment for the minimum time necessary to take reading.
Storage Temperature	•	•	•	•	•	•	•	•	•	•	•	•	-22.0 °F to 140.0 °F   -30.0 °C to 60.0 °C.
	•	•	•	•	•	•	•	•	•	•	•	•	4.8 x 1.9 x 1.1 in   12.2 x 4.8 x 2.8 cm, 3.6 oz / 102 g (including slip-on cover).
Size & Weight	•	•	•	•	•	•	•	•	•	•	•	•	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 2.3 x 1.1 in   16.5 x 5.9 x 2.8 cm, 4.4 oz / 125 g.

\* NOTE: Accuracy calculated as uncertainty of the measurement derived from statistical analysis considering the combined effects from primary sensor specifications, circuit conversions, and all other sources of error using a coverage factor of k=2, or two standard deviations (2Σ).

\*\*NOTE: These specifications are valid for all Kestrel 4000 series with a serial number higher than 659340. If your product has a lower serial number, please reference the previous version of the specifications.