SPECIFICATIONS: Kestrel® 4400 Heat Stress Tracker by NK®

SENSORS

SENSOR	ACCURACY (+/-)*	RESOLUTION	SPECIFICATION RANGE	OPERATIONAL RANGE	NOTES
Wind Speed Air Flow	Larger of: 3% of reading, least significant digit or 20 ft/min	0.1 m/s 1 ft/min 0.1 km/h 0.1 mph 0.1 knots 1 B	0.6 to 40.0 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 B	0.6 to 60.0 m/s 118 to 11,811 ft/min 2.2 to 144.0 km/h 1.3 to 134.2 mph 1.2 to 116.6 knots 0 to 12 B	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 mph | .8 kt after impeller startup. Off-axis accuracy -1% @ 5º off-axis; -2% @ 10º; -3% @ 15º. 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). Wind speed calibration and testing must be done with triangle on impeller located at the top front face of the Kestrel.
Ambient Temperature	0.9 ºF 0.5 ºC	0.1 ºF 0.1 ºC	-20.0 to 158.0 ºF -29.0 to 70.0 ºC	14.0 to 131.0 ºF -10.0 to 55.0 ºC	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 insolation 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.
Globe Temperature (Tg)	2.0 ºF 1.1 ºC	0.1 ºF 0.1 ºC	-20.0 to 158.0 ºF -29.0 to 70.0 ºC	14.0 to 131.0 ºF -10.0 to 55.0 ºC	Temperature inside 1in|25 mm black powder coated copper globe converted to Tg equivalent for standard 6 in|150 mm globe. Closest equivalence obtained with airflow greater than 2.2 mph|1 m/s.
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 ºF 0.0 to 85.0 ºC	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 ºF -10.0 to 55.0 ºC	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. Pressure trend displayed through graphing function.
Compass ***Model 4400C Only***	5°	1° 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	ACCURACY (+/-)*	RESOLUTION	SPECIFICATION RANGE	SENSORS EMPLOYED	NOTES
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.
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.
Dewpoint	3.4 ºF 1.9 ºC	0.1 ºF 0.1 ºC	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.
Heat Index	7.1 ºF 4.0 ºC	0.1 ºF 0.1 ºC	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.
Thermal Work Limit (TWL)	10.9 W/m^2	0.1 W/m^2	Refer to Ranges for Sensors Employed	Wind Speed Temperature Globe Temperature Relative Humidity Pressure User Input (Reference Altitude)	Estimated safe maximum continuously sustainable human metabolic rate (W/m2) for the conditions and clothing factors. Based off of estimated metabolic output of typical human. On-screen zone warnings.
Outdoor Wet Bulb Globe Temperature (WBGT)	1.3 ºF 0.7 ºC	0.1 ºF 0.1 ºC	Refer to Ranges for Sensors Employed	Wind Speed Temperature Globe Temperature Relative Humidity Pressure	Measure of human heat stress defined as the combination of effects due to radiation, convection, and conduction. Outdoor WBGT is calculated from a weighted sum of natural wet bulb (Tnwb), globe temperature (Tg), and dry bulb temperature (Td). User settable on-screen warning zones.
Wet Bulb Temperature - Naturally Aspirated (Tnwb)	1.4 ºF 0.8 ºC	0.1 ºF 0.1 ºC	Refer to Ranges for Sensors Employed	Wind Speed Temperature Globe Temperature Relative Humidity Pressure	Similar to psychrometric wet-bulb temperature (see below). However, Tnwb only undergoes forced convection from the ambient air velocity. Tnwb is a measure of the evaporative cooling that the air will allow. This is accounted for by combining the effects of, mainly, relative humidity and windspeed.
Wet Bulb Temperature - Psychrometric	3.2 ºF 1.8 ºC	0.1 ºF 0.1 ºC	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 ºF 0.9 ºC	0.1 ºF 0.1 ºC	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	Multifunction, multi-digit monochrome dot-matrix display. Choice of aviation green or visible red (NV and tactical 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	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
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 when display off except for 2 and 5 second intervals. Data capacity 2300 automatically or manually stored data sets.
Data Upload & Bluetooth® Data Connect Option	Requires optional PC interface (USB or RS-232) or Bluetooth data transfer option and provided software. **Bluetooth Data Transfer Option:** 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	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).
Origin	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.
Batteries & Battery Life	**Standard Models:** AAA Alkaline, two, included. Average life, 400 hours of use, reduced by backlight or Bluetooth radio transmission use. **Tactical 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 ºC to 55 ºC - limited by battery and display performance. Measurements may be taken beyond 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 ºF to 140.0 ºF | -30.0 ºC to 60.0 ºC Damage to the unit and/or batteries is likely with any prolonged exposure to temperatures exceeding these limits.
Size & Weight	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 comined effects from primary sensor specifications, circuit conversions, and all other sources of error using a coverage factor of k=2, or two standard deviations (2S).