

Kestrel 4000 Pocket Weather Tracker REVIEW

► **The Kestrel provides the technically-minded backpacker much more useful information than a multi-function watch, and is easier to use.**

OVERALL RATING

Highly Recommended

The Kestrel is a precision weather instrument. It's lightweight, durable, waterproof and easy to use. It measures and records loads of useful information for outdoor enthusiasts who want to better know their playground (and how their gear performs). It's easier to use than a typical multi-function watch and provides more, and more-useful information for backpackers. On the downside, it's a little heavier than a multi-function watch, is easier to lose, and doesn't have stopwatch, alarm, or digital compass functions (but the model 4500 does).

ABOUT THE RATING: The rating above is a largely subjective rating proposed by the product reviewer to assess the quality and performance of products of interest to the lightweight backpacking community: 5 - Highly Recommended: The highest possible rating for a reviewed product. Indicates exceptional quality in materials and workmanship, outstanding field performance based on sound design principles, and a performance-to-weight ratio at the top of its class. 4 - Recommended: Solid performing products that provide good value for the money, quality materials and workmanship, and acceptable performance that should meet or exceed consumer expectations. Minor improvements in design or materials may be required to allow this product to be considered the best in its class and thus warrant a rating of HIGHLY RECOMMENDED. 3 - Above Average: Products that should meet consumer expectations, but against which other products in its class should also be considered. 2 - Average: Products in categories where better performance:weight and performance:value can be realized in several other competing products. 1 - Below Average: Products with performance:weight and/or performance:value ratios that would not meet the expectations of most consumers and are neither worth the weight nor the money for the vast majority of users.

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BY **Will Rietveld**

Introduction



The Kestrel 4000 Pocket Weather Tracker measures myriad parameters-including wind speed and elevation-and stores them in memory for field review and later downloading.

If you're a person who wants to know the actual numbers:

- What was the wind speed on top of that peak?
- What is the wind chill right now (wind chill is the combined effect of the wind and temperature)?
- Why does it feel so miserably hot right now (the heat index measures the combined effect of temperature and humidity)?
- Why did we get so much condensation in the tent last night, but not the night before?
- How cold did it get last night, and how much colder is it on the valley floor?
- How much warmer is it in my tent compared to outside?

If you "need to know," then you are a good candidate to own a Kestrel Pocket Weather Tracker. Nielsen-Kellerman makes a full line of Kestrel weather instruments ranging from a minimal feature set (model 1000) to the "top dog" (now the 4500) that measures a wide range of environmental conditions. The 4000 series stores data and uploads it to a computer for later evaluation, even charting. The 4000 even measures barometric pressure and has a barometric altimeter that is easy to set and use. Future generations will probably include a GPS!

This remarkable hand-held gadget weighs only 3 ounces, is rugged and waterproof, and is well worth

the weight if you're someone intrigued by the above questions and who wants to more fully document your trips. How useful is the Kestrel 4000, and what are the pros/cons of using it compared to a typical multi-function watch?

What's Good

- Lightweight and compact
- Measures numerous environmental conditions
- Easy user interface
- Long battery life (uses two inexpensive AAA batteries)
- Easy to record, upload, and graph data
- Waterproof and durable
- Fast equilibration

What's Not So Good

- No trekking pole attachment for use in camp
- Data storage parameters are not user-selectable
- No stopwatch function

Specifications

Manufacturer	Nielsen-Kellerman, Inc.
Year/Model	2006 Kestrel 4000 Pocket Weather Tracker
Weight	Measured weight 3.6 oz (102 g) with 2 AAA batteries, manufacturer specification 3.6 oz (102 g)
Dimensions	5 in high x 1.75 in wide x 0.75 in thick (13 x 4.5 x 2 cm)
Features	Measures wind speed, temperature, humidity, wind chill, heat index, dew point, wet bulb temperature, barometric pressure, altitude, and density altitude; displays minimum, maximum, and average for each parameter; displays graph for each parameter; backlit display; time and date; user customized screens to display selected measurements; flip-top impeller cover; automatically store up to 2,000 measurements, even when the unit is turned off; manually store measurements with the press of a button; exterior temperature, humidity, and pressure sensors for fast and accurate readings; upload, save, and graph measurements with data interface
What's Included	Instrument, wrist and neck lanyards, 2 AAA batteries, soft carry pouch, instruction manual
MSRP	\$329
Options	USB Data Interface \$109, serial Data Interface \$79, USB cable \$34, portable tripod \$25, carry case \$19

Performance

The Kestrel 4000 Pocket Weather Tracker, as the name implies, is a handheld device. Its capabilities are remarkable, measuring and recording virtually any weather-related parameter one might want to know. Its capabilities go far beyond those of the average multi-sensor watch (though a typical multi-sensor watch has a digital compass, which the Kestrel 4000 lacks. The new Kestrel 4500 adds that feature, and more).

User Interface

The Kestrel has a simple and straightforward user interface (finally, a manufacturer gets it right!). Displayed text can be set in one of five languages (English, French, German, Italian, and Spanish). I won't describe the navigation functions in detail (essentially re-writing the user manual) but suffice it to say it's easy to learn and very intuitive compared to a typical multi-function watch. Each screen tells the user what button to press to back up or go forward. The LCD screen itself is easy to read (crisp and high-contrast) and has a backlight button for night viewing.



The user interface on the Kestrel is simple and intuitive. The red power button is on the lower left. The upper left button manually stores data at any time. The upper right button illuminates the LCD screen. The center five buttons navigate through the various display screens. Overall, it's simple and easy to learn and use.

Measurement screens can be hidden from normal navigation by setting them to "on" or "off" in setup mode. For example, if heat index is not of interest it can be de-selected so the instrument doesn't cycle through it in navigation mode.

Measurements

Upon startup, the Kestrel 4000 displays the day, date, and time. It directly measures or calculates wind speed, temperature, relative humidity, wind chill, heat index, dew point, wet bulb temperature, barometric pressure, altitude, and density altitude (other models different sets of parameters). For each parameter it will display the minimum, maximum, and average. It will also graph each parameter within a user-selected range.



The Kestrel 4000 has three screens for each parameter: current condition (center), graph of recent conditions (left), and min-avg-max (right). On the graph screen (left), the user can access recent data for each parameter, for example the temperature was 40 °F on Mar 27 at 4:25 AM.

In addition, the Kestrel has three user screens, and each can be set to display three parameters at once. Charts and min-max-avg are not available for the user screens.

Sensors

The Kestrel is a scientific instrument. Documentation and data are provided on the type of sensors used and their accuracy. The temperature and humidity sensors are exposed to the air in an opening at the top of the instrument (see top-detail photos) to enable a faster response to changes. The pressure sensor is on the backside of the instrument. The impeller for wind speed measurements is protected by a swivel plastic cover to protect it when not being used. It has a precision axle and sapphire bearings for enhanced sensitivity.



To speed up the response time, the temperature and humidity sensors (left side) are located in an opening that exposes them directly to the air. The wind sensor (top right) is enclosed by a flip-open plastic cover to ward off dust and impacts when not in use.

Temperature and humidity response time is less than a minute—it helps to wave the instrument in the air to speed up the equilibration. The wind speed impeller will measure breezes as little as 0.8 mile per hour to hurricanes up to 135 miles per hour. Temperature accuracy is plus or minus 1.8 °F; humidity and wind speed accuracy is plus or minus 3%.

The Kestrel 4000 is completely waterproof, so can be used in weather of all kinds (as you'd hope a weather instrument would be). You can even dunk it in a stream to measure the water temperature or stick it into a snowbank to determine snow temperature.

Barometric Pressure and Altitude Adjustment

Since these parameters constantly change, the Kestrel must be set to a known value before it can deliver accurate measurements in the field. The best way to calibrate it before a trip is to visit a weather website and determine the current barometric pressure for your present location. It is easy to adjust the current barometric pressure and altitude on the Kestrel, and it's noteworthy that you only have to know ONE of the values in order to calibrate the Kestrel so it will show accurate readings for BOTH barometric pressure and elevation. This is much easier than any multi-sensor watch I have used!

Since a barometric altimeter bases changes in altitude readings on changes in barometric pressure, accuracy depends on how steady the barometric pressure is. I found the Kestrel's altimeter works very well, consistently providing readings within 50 feet of the actual value on the same day of calibration. In the field, a topographic map can be used to check and reset the altitude as needed.

Specific surveyed pass, peak and lake elevations are very helpful in this regard.

Battery Life

Two AAA batteries power the Kestrel 4000, and the opening screen lists the battery life remaining. I used the Kestrel for five months, with intensive use of the data storage function, and still had 85% of the battery life left. Suffice it to say that a pair of batteries will last a long time!

Data Storage

A unique feature of the Kestrel 4000 series is data storage to memory for later retrieval. It stores 480 data points for each parameter. For example, if you set the record rate interval to 20 minutes, you can store 28 days of uninterrupted data.

There are two ways to store data. The first is to push the Manual Memory button to store data instantaneously, for example, for a specific location or weather condition. The second method is to switch the Auto Store function “on.” The Kestrel will then store data at the set interval until it is switched off, or the memory becomes full. The Kestrel does not display memory use status, but it does have a user-selectable overwrite mode that enables data recording to continue (if desired) by discarding the oldest data.

Data Retrieval

The Kestrel Interface is required to upload stored data from a Kestrel 4000 series Weather Tracker to a computer. Doing so enables permanent data storage, in-depth analysis and charting. The interface and data cable are available for either a serial or USB port connection. It uses an optical reader that aligns with two transmission ports on the back of the instrument. The communication software included with the interface is easy to install and use.



Kestrel 4000 mounted on the Kestrel Interface. The data uploading process is simple and fast: turn the Kestrel on, put it on the interface, open the communication software, click on “communicate,” upload the data, and save it to a specified file. It’s very simple and fast. The data log can be cleared through the interface or manually, on the instrument itself.

File d:\our docs\will\bpl\electronics\kestrel File Created: 04/01/2007 at 14:51:52 Size 2.863 bytes

FORMATTED DATE-TIME YYYY-MM-DD HH:MM:SS	DT s	WS mph	TP °F	VC °F	RH %	HI °F	DP °F	WB °F	BP inHg	AL ft	DA ft
2007-04-01 11:05:00	228740700	1.1	54.6	54.7	34.1	52.2	26.9	41.4	30.06	6548	7720
2007-04-01 11:10:00	228741000	0.9	54.4	54.5	33.0	52.0	25.9	40.8	30.06	6539	7697
2007-04-01 11:15:00	228741300	1.0	54.5	54.5	33.6	52.0	26.4	41.0	30.06	6543	7706
2007-04-01 11:20:00	228741600	2.2	54.9	54.9	32.9	52.3	26.3	41.0	30.06	6547	7731
2007-04-01 11:25:00	228741900	0.0	55.4	55.4	32.8	52.7	26.6	41.4	30.06	6548	7765
2007-04-01 11:30:00	228742200	1.9	56.0	56.1	30.3	53.2	25.3	41.5	30.05	6549	7805
2007-04-01 11:35:00	228742500	0.0	55.7	55.8	32.6	53.1	26.8	41.5	30.06	6545	7785
2007-04-01 11:40:00	228742800	0.0	57.4	57.4	32.0	54.5	27.8	42.8	30.06	6543	7888
2007-04-01 11:45:00	228743100	0.0	56.3	56.3	30.3	53.4	25.5	41.5	30.05	6554	7825
2007-04-01 11:50:00	228743400	0.0	55.7	55.8	31.3	52.9	25.8	41.4	30.05	6553	7794
2007-04-01 11:55:00	228743700	0.0	56.8	56.8	29.6	54.0	25.4	41.7	30.04	6562	7868
2007-04-01 12:00:00	228744000	0.0	58.7	58.6	29.2	55.6	26.6	42.8	30.05	6556	7978
2007-04-01 12:05:00	228744300	0.0	59.0	59.0	29.9	55.8	27.5	43.3	30.05	6556	8004
2007-04-01 12:10:00	228744600	0.0	59.5	59.5	30.0	56.3	28.0	43.7	30.05	6552	8032
2007-04-01 12:15:00	228744900	0.0	59.7	59.7	29.4	56.5	27.8	43.7	30.04	6566	8058
2007-04-01 12:20:00	228745200	0.0	58.6	58.6	29.4	55.6	26.7	42.8	30.04	6565	7987
2007-04-01 12:25:00	228745500	0.0	59.4	59.4	28.8	56.1	27.0	43.3	30.04	6571	8041
2007-04-01 12:30:00	228745800	0.0	60.4	60.4	28.5	57.2	27.6	43.9	30.04	6572	8112
2007-04-01 12:35:00	228746100	0.0	61.7	61.7	26.5	58.1	27.0	44.2	30.03	6581	8201
2007-04-01 12:40:00	228746400	0.0	59.3	59.4	27.6	56.1	25.9	43.0	30.04	6572	8038
2007-04-01 12:45:00	228746700	0.0	60.6	60.6	28.5	57.4	27.7	44.1	30.03	6572	8123
2007-04-01 12:50:00	228747000	0.0	60.7	60.8	25.8	57.4	25.5	43.5	30.03	6577	8135
2007-04-01 12:55:00	228747300	0.0	61.8	61.7	26.6	58.1	27.1	44.2	30.03	6577	8195
2007-04-01 13:00:00	228747600	0.0	59.5	59.5	25.7	56.1	24.3	42.4	30.02	6586	8061

Sample data set uploaded from the Kestrel 4000. Data storage parameters are not user-selectable; the Kestrel records data for all parameters. Data are saved to a *.csv file (comma delimited text file) that is easily imported into Microsoft Excel for management and graphing. The software also allows you to save remarks about the data in a *.rem file.

Utility

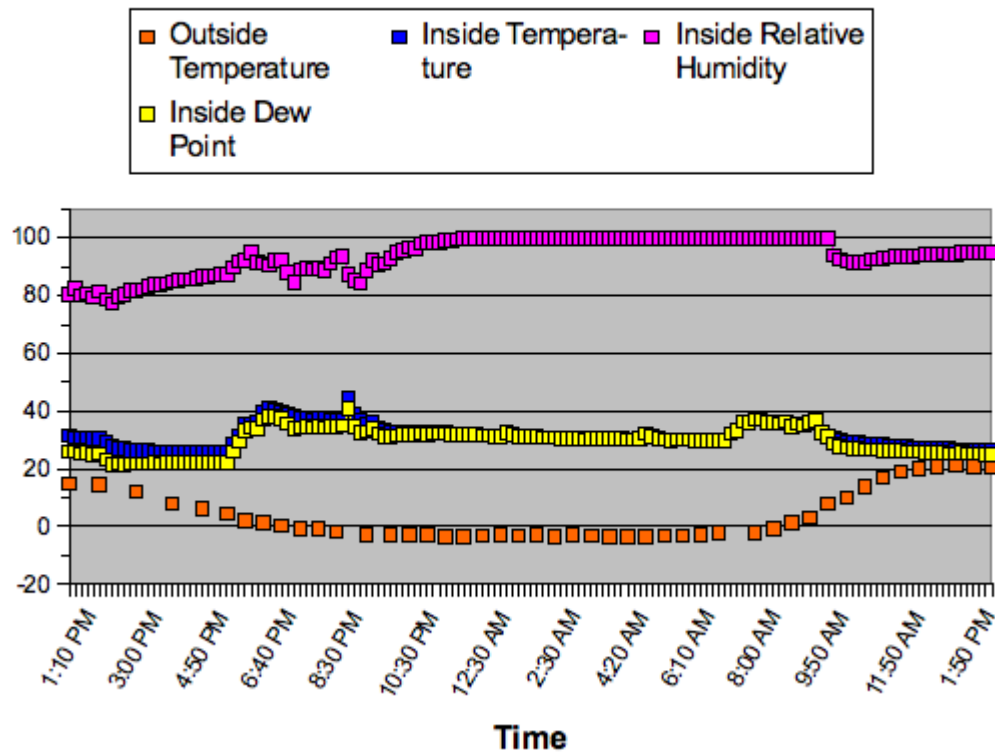
I found the Kestrel 4000 and its data storage function invaluable when field-testing outdoor gear. In the field I can read the actual temperature, wind speed, etc. any time I need to. Armed with the Kestrel, it's also fun to challenge my hiking companions to "guesstimate" the wind speed and find out who's closest. We do the same for air temperature, water temperature, snow temperature, surface temperature, the overnight low temperature, etc. Fun!

To evaluate the environment inside a shelter at night, I routinely suspend the Kestrel from the ceiling and record conditions. The temperature, humidity, and dew point measurements are most relevant for this purpose. At home I upload the data, graph it in Microsoft Excel, and evaluate the data in relation to my notes on the weather conditions, observed condensation, amount of venting, etc.



(Left) The Kestrel 4000 suspended from the ceiling of an igloo to record interior conditions. (Right) Measuring wind speed with the Kestrel.

Inside Large Igloo - Clear Cold Night



An example of graphed data taken with the Kestrel 4000. The Kestrel was set to record data at 10-

minute intervals overnight in an 11-foot diameter igloo. The data show interior humidity (purple line) was high when the igloo was occupied between 5:30 PM and 9:50 AM. The inside temperature (blue line) reached the dew point (yellow line) about 9:30 PM, at which time condensation formed on the interior walls. The outside temperature (orange line) was recorded using a separate device and added to the graph.

A remote temperature sensor accessory for the Kestrel (which will hopefully be available at some point) would enable it to be used to simultaneously record temperatures inside and outside (or at any two remote locations). In the above graph, for example, it would have been very handy to place a remote temperature sensor outside the igloo and transmit data to the Kestrel, rather than using a separate device and merging the data. An immersible remote thermometer might even help in the mountain kitchen.

Assessment

The Kestrel 4000 is a superb instrument for measuring field environmental conditions. It is lightweight (for such a complete and sophisticated device), rugged, waterproof, easy to use and accurate. Importantly, it stores data for later in-depth analysis or charting. For the more technically inclined backpacker, this 3-ounce powerhouse provides loads of useful information.

Compared to most multi-function watches, the Kestrel 4000 has the following advantages:

- It has additional functions (wind speed, wind chill, humidity, dew point, heat index, wet bulb temperature, density altitude)
- The temperature reading is accurate (on a watch the temperature is influenced by the user's body temperature)
- The user interface is much simpler and easier to navigate
- It records data, and uploads it to a computer

However, there are a few disadvantages:

- It does not have chronometer (stopwatch), alarm, and digital compass functions
- Its heavier, 3 ounces compared to about 2 to 2.5 ounces
- It's easier to lose (I recommend getting it with an orange case so it's more visible)
- It's more expensive, \$329 compared to \$150-\$200 for many multi-function watches

The new Suunto X6 (\$329) multifunction watch is probably the closest comparison to the Kestrel 4000. It has a limited memory function to store lap times and an altitude profile. The number of features embedded into the X6 is remarkable, but one has to navigate through layer upon layer of menus to get to desired functions.

The Kestrel 4000 can be used with an optional portable vane mount to allow the unit to spin freely in the slightest of breezes and perform as a miniature weather station. In fact, it has served that purpose on expeditions. The new Kestrel 4500 would be a better choice for that application because it

includes a digital compass that enables it to calculate crosswinds and headwinds/tailwinds (all in reference to a user-set direction or target).

Overall, the Kestrel 4000 (and other, less expensive Kestrel models) is especially suited to measuring environmental parameters related to outdoor sports, and is the perfect companion for the technical-minded backpacker. In many ways, the Kestrel 4000 is much more useful to a backpacker than a GPS. You may even want to drop a hint to your spouse to get you the Kestrel 4000 for your birthday or Christmas, instead of a GPS!

What's Unique

The Kestrel 4000 provides more useful information and is easier to use than a multi-function watch, and will store data for uploading to a computer and charting.

Recommendations For Improvement

- Add a stopwatch function, and perhaps an alarm clock and altitude alarm
- Provide a Velcro strap so the Kestrel can be attached to a trekking pole in camp
- Allow stored data parameters to be user-selectable
- Offer a remote temperature sensor so temperature can be recorded in two (or more) locations at the same time

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