



USER GUIDE
Kestrel 5400 Heat Stress Tracker



Your Kestrel Weather/Environmental Meter is designed to provide accurate measurement of current conditions only. Depending on your location and environment, conditions may change rapidly.

Rapid temperature and humidity changes (i.e., moving your meter from indoors to outdoors) may cause inaccurate readings of temperature and humidity as well as all readings that rely on either of these values. Before relying on readings from your Kestrel Meter, be sure to either a) force air flow over the sensors by waving or slinging your meter through the air; or b) wait until your unit's readings have stabilized, indicating it has equilibrated to its new environment.

To maximize the accuracy and reliability of your readings:

- **Ensure that your Kestrel Meter is in good repair and within factory calibration.**
- **Take readings frequently and carefully according to the guidelines above.**
- **Allow your meter's readings to stabilize after significant changes in temperature or humidity (i.e., changing location from indoors to outdoors).**
- **Allow a margin of safety for changing conditions and reading errors (2-3% of reading is recommended).**

Use care and good judgment when referring to your Kestrel Meter to make any decisions regarding safety, health or property protection.



To reduce the risk of injury or death to persons, read and follow these guidelines!

Your Kestrel Weather/Environmental Weather Meter may provide one or more of these measurements relating to estimation of danger of injury to people or animals from heat or cold: Heat Stress Index, Wind Chill Index, Wet Bulb Globe Temperature ("WBGT"), Thermal Work Limit ("TWL"). Note that guidance tables based on these values are based on typical physiological response. Certain individuals or animals may be more susceptible to harm relating to environmental conditions and require additional precautions. For example, very young or elderly individuals, individuals with asthma, and individuals who have not become acclimatized to hot conditions are likely to be more prone to heat injury.


- **Know yourself and the individuals and items you are responsible for.**
- **Where appropriate, seek the guidance of a medical professional.**
- **Know what to do in the event of heat or cold injury and be prepared with supplies.**
- **In the case of heat illness, remember the rule – "Cool first, transport second." An inexpensive ice bath can mean the difference between life and death.**


Your Kestrel Weather/Environmental Meter is not a medical device. It is only one source of information and must be employed with care and good judgment.

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BATTERIES











We recommend that ONLY Lithium AA batteries be used in your Kestrel Weather/Environmental Meter to provide the widest operating temperature range and to avoid damage caused by leaking lead-acid batteries. If you must use conventional AA batteries, please do not store your Kestrel Meter with the batteries in place. Damage caused by battery corrosion is not covered under warranty.

 **WARNING:** Lithium is a toxic substance and ingestion may cause serious injury or death. Keep lithium batteries out of the reach of children. If swallowed, immediately seek medical help. Have doctor phone 24-hour hotline at (202) 625-3333, call collect if necessary. Dispose of batteries properly and according to local regulations. Do not puncture or burn batteries. If the battery compartment does not close securely, stop using the product and keep it away from children.

 **WARNING:** Utilizing the alert light and buzzer in your Kestrel Heat Stress Tracker places a higher demand on the battery. To ensure the alert light and buzzer operate when needed, replace the battery when a third or less of battery life remains, as indicated on start up.

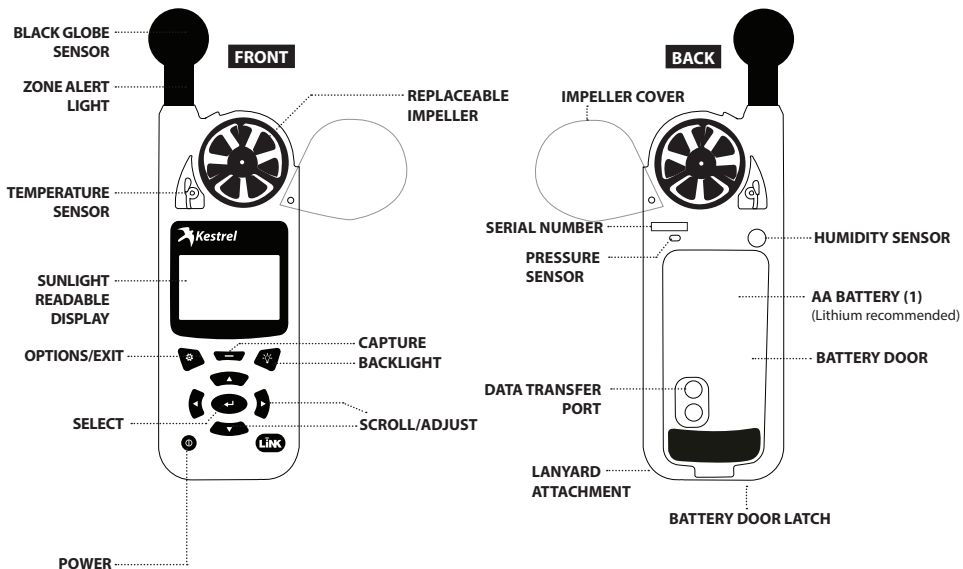
MEASUREMENTS	Icon	5000 Environmental	5100 Racing	5200 Professional	5500 Weather	5400 HST
Wind Speed Air Speed (mph fpm Bft m/s km/h kt)		•	•	•	•	•
Temperature (°F °C)		•	•	•	•	•
Wind Chill (°F °C)		•	•	•	•	•
Relative Humidity (%)		•	•	•	•	•
Heat Stress Index (°F °C)	HI	•	•	•	•	•
Dewpoint Temp (°F °C)	DP	•	•	•	•	•
Wet Bulb Temp (°F °C)	WB	•	•	•	•	•
Station Pressure (inHg hPA psi mb)		•	•	•	•	•
Barometric Pressure (inHg hPA psi mb)		•	•	•	•	•
Altitude(m ft)		•	•	•	•	•
Density Altitude (m ft)	DA	•	•	•	•	•
Wind Direction (Cardinal Points, Degrees)					•	◉
Crosswind (mph fpm Bft m/s km/h kt)					•	◉
Headwind Tailwind (mph fpm Bft m/s km/h kt)					•	◉

◉ *optional*








MEASUREMENTS		Icon	5000 Environmental	5100 Racing	5200 Professional	5500 Weather	5400 HST
Moisture Content Humidity Ratio (Grains) (gpp, g/kg)				•	•		
Air Density (lb/ft ³ , kg/m ³)				•	•		
Relative Air Density (RAD) (%)				•	•		
Evaporation Rate (lb/ft ² /hr, kg/m ² /hr)					•		
Volume Air Flow (%)					•		
Delta T (°F °C)					•		
Wet Bulb Globe Temperature (WBGT) (°F °C)							•
Thermal Work Limit (TWL) (°F °C)							•
Globe Temperature (°F °C)							•
Naturally Aspirated Wet Bulb Temp (°F °C)							•
FEATURES			5000 Environmental	5100 Racing	5200 Professional	5500 Weather	5400 HST
LiNK Connectivity & Kestrel LiNK Mobile App	N/A		•	•	•	•	•
Backlit Display switchable white or Night-Vision preserving red	N/A		•	•	•	•	•

• optional


GETTING TO KNOW YOUR KESTREL



BUTTONS

Button	Name	Function
	POWER	Turns Kestrel on and off. Press for on, hold for two seconds to turn off.
	OPTIONS/ EXIT	Enter the main Options menu or exit a menu.
	SELECT	Access Settings on any measurement screen or select a menu option to enter its submenu or confirm a task.
	UP/DOWN	Scroll up and down through measurement screens or menus. Adjust values when entering text in name menus.
	LEFT/ RIGHT	Scroll options left and right. Adjust values in combo menus and setting submenus.
	CAPTURE	In Weather Mode, manually capture all environmental values.
	BACK- LIGHT	Turn backlight on or off. (Also turns off automatically after one minute.)

KESTREL OPTIONS MENU

Most system-wide and weather setup options are accessed from the main Options menu by pressing the  button from any Weather Measurement Screen.

BLUETOOTH

- » Bluetooth On/Off
- » Conct

• DATA PORT

• MEMORY OPTIONS

- » Clear Log
- » Auto Store
- » Store Rate
- » Overwrite

• GRAPH SCALE

• DISPLAY

- » Auto Shutdown
- » Contrast
- » Backlight

• SYSTEM

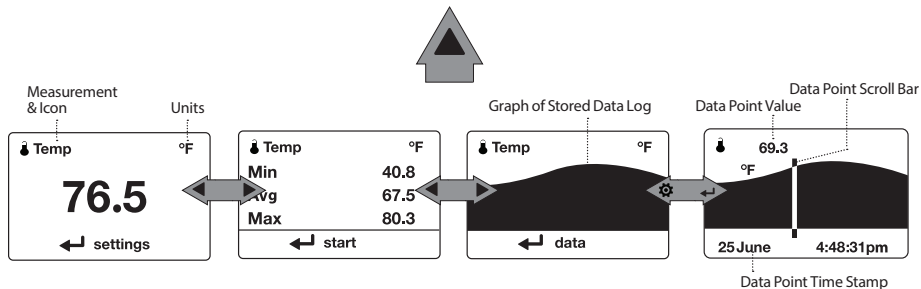
- » Time & Date
- » Compass Cal
- » Measurements
- » Units
- » Lang
- » Batt
- » Factory Restore

• ABOUT

- » Version
- » Legal

WEATHER MODE SCREENS

MORE MEASUREMENTS



Current Measurement Screen

Press **SELECT** to enter settings menu for that measurement.

Min Ave Max Screen

Press **SELECT** to start, stop and clear the Min/Avg/Max tracking.

Data Graph Screen

Press **SELECT** to enter the Data Log Detail Screen to view logged data points.

Data Points Screen

Press **LEFT/RIGHT** to scroll through data points. Press **OPTIONS** to exit Data Log Details Screen.

MORE MEASUREMENTS

- » The **▲▼ UP/DOWN** buttons navigate between all weather measurements set to "On" in Options|Measurements.
- » The **◀▶ LEFT/RIGHT** buttons scroll between the three display screens for the measurement.
- » The **⚙️ OPTIONS** button exits the **settings** submenu and Data Log Detail Screen.

KESTREL MENU NAVIGATION

TYPES OF MENU ITEMS

The diagram shows a list of menu items with callouts explaining their functions:

- Task Go**: »Tasks are executed by highlighting the field and pressing Select.
- Submenu...**: »The presence of a submenu is indicated by a "... " following a field.
- Setting On**: » Highlight the field and press Select to enter a submenu.
» Adjust a setting by pressing left or right.
- Combo Field... Yes▼**: » An arrow indicates there are additional fields off screen.
- exit ◀▶ adjust**: » Adjust the value of a Combo Field by pressing left or right.
» Enter the Combo Field sub menu by pressing select.
- Locked Value**: » Navigation buttons indicate available actions on the current screen.
- Locked Value...**: » Locked values are either driven by another value or cannot be edited on the current screen.
» Locked values may have submenus which are entered by pressing select.

WBGT MEASUREMENT SCREEN

The diagram shows the WBGT Measurement Screen with callouts explaining its components:

- WB**: »Units
- WBGT Out °F**: »Indoor/Outdoor Setting
- 88.5**: »WBGT Measurement
- Zone : Red**: »Zone/"Selected Guideline": Current Zone
- Setting**: » Note! While WBGT is measured in Fahrenheit and Celsius, the scale of WBGT values is not comparable to standard temperature readings.

- 1. INSTALL BATTERY.** Slide the battery door latch and open door. Insert the provided AA lithium battery as indicated by the label. Replace the battery door, ensuring it “clicks” fully into place.
- 2. POWER ON KESTREL.** Press **⏻** to power on Kestrel.
- 3. CONFIGURE WBGT SETTINGS.**
 1. Scroll to the WBGT Current Measurement Screen and press select.
 2. Set **Type** to either **Indoor** or **Outdoor**, depending on your environment.
 3. To use the colored WBGT zones (also known as Flag Settings), scroll to **Zones...** and set to **On**. The zones increase from White to Black in order of severity of risk of heat injury.
 4. To access one of the pre-saved WBGT guidelines, scroll to **Zones...** and press select, then scroll to Guide... and press select. Follow the menu options to find your organization's WBGT guidelines. If additional workload or clothing inputs are required, set **Workload** and **Clothing** to appropriate values for your situation.
 5. For information on setting custom threshold flag settings see page 13.
 6. To receive light or buzzer alerts when WBGT is above a zone threshold, scroll to and select **Alerts...** in the WBGT Settings menu. You may set **Light** and **Buzzer** individually. Selecting a zone for **Light** or **Buzzer** will cause that alert to activate when conditions reach the threshold for the selected zone.

Warning: In addition to monitoring WBGT values, please refer to your state or organization's requirements for measuring WBGT, heat acclimatization guidelines, work/rest ratios and water consumption.


- ❑ *Note: To highlight the severity of conditions, if the Red Warning Zone is reached, the line indicating the current zone will flash. If the Black Warning Zone is reached, the measurement value will flash inverted.*
- ❑ *Note: If an alert is activated, pressing **⏻** on the WBGT Measurement Screen will deactivate the alert until the next higher threshold is reached or until the WBGT measurement dips below the threshold and then raises above it again.*
- ❑ *Note: In the Options Menu under **Display**, there is an **Alerts Test** function which will activate the light and buzzer. When using the unit in a new situation, test the alerts to familiarize yourself with their intensity.*

HOW TO MEASURE WBGT ACCURATELY:

- » When changing environments (moving from an air conditioned room to outdoors or removing the unit from your pocket) the unit requires between 8-15 minutes to equilibrate to its surroundings before taking readings.
- » Take measurements at least 3 feet off the ground and in the same wind or air flow conditions as the people you are monitoring. Ensure the Kestrel is oriented into the wind and able to measure the full wind value. A tripod or pole mount and the Kestrel Rotating Vane Mount are ideal for ensuring accurate measurements.

- » Differences in the reflectivity of ground surfaces such as grass or asphalt will impact measurements. Be sure to take measurements in the same solar/radiant heat environment as the people you are monitoring.

ADDITIONAL SETTINGS

- 1. ENTER OPTIONS MENU.** Press  to enter the Options Menu.
- 2. SET AUTO STORE RATE.** Scroll to and select **Memory Options**. Scroll to **Auto Store** and ensure it is set to **ON**. Scroll to **Store Rate** and adjust to desired frequency of automatic weather data logging.
- 3. SET OVERWRITE.** Scroll to and select **Memory Options**. Scroll to **Overwrite** and set to **On** to allow the data log to wrap once full and to **OFF** to stop logging when full.
- 4. SET GRAPH SCALE.** Scroll to and select **Graph Scale**. Scroll to and select the desired measurement type. Adjust the **Set High** and **Set Low** values to bound the desired display values.
- 5. SET AUTO SHUTDOWN.** Scroll to and select **Display**. Scroll to **Auto Shtdwn** and choose a time window



after which the Kestrel will shut down without any button presses.

- 6. CALIBRATE THE COMPASS.** (If available) Scroll to and select **System**. Scroll to and select **Compass Cal**. Follow the on-screen instructions:

- » Place the base of the Kestrel on a flat surface at least 3 feet from any large metal objects.
- » Start the calibration routine. Rotate the Kestrel around its vertical axis 3 times, keeping the unit as vertical as possible and taking approximately 10 seconds per full rotation. You may need to restart the routine a few times until you get the timing correct.

□ *Note: When taking compass readings, keep the Kestrel as vertical as possible for maximum accuracy.*

- 7. SET BACKLIGHT COLOR.** Scroll to and select **Display**. Scroll to **Backlight** and set to either **White** or **Red**. White is very bright and ideal for any dim light use. Red is reduced brightness and a wavelength selected to preserve adapted night vision for true dark operations.
- 8. SET DATE AND TIME.** Scroll to and select **System**. Scroll to and select **Time & Date**. Adjust the time and date.
- 9. TURN MEASUREMENT SCREENS ON/OFF.** Scroll to and select **System**. Scroll to and select **Measurements**. Set measurement screens to either **On** or **Off** as desired.
- 10. SET UNITS.** Scroll to and select **System**. Scroll to and select **Units**. To change all units select **Global**, then set **Global to Imperial** or **Metric**, and then scroll to **Apply** and select **Go**. To set units individually, scroll to each measurement type in the **Units** submenu and set to the desired units. Units can also be set in the **Settings** menu for each measurement.
- 11. SET LANGUAGE.** Scroll to and select **Lang**. Adjust to desired language: **English, Deutsche, Francais, Espanol**.

CUSTOM FLAG SETTINGS

If you do not wish to follow one of the WBGT guidelines pre-loaded into the Kestrel Heat Stress Tracker, you may set custom zones and zone thresholds. Your Kestrel Heat Stress Tracker allows you to activate and set up to six customized heat stress warning zones identified by color names on screen.

SETTING CUSTOM WBGT ZONES:

1. In the Settings Menu of the WBGT Current Measurement Screen, scroll to and select **Zones**.
2. Scroll to the colored zones you wish to edit and press select. Editing any value from a preset guideline in the Zone Settings Menu will automatically change the name of the guideline to **Custom**.
3. In the Zone submenu you can turn zones on or off by setting **Status** to **ON** or **OFF** as well as change the lower temperature bound of the zone by adjusting the **Threshold** value.
4. The threshold for a zone cannot be greater than the zone above or less than the zone below it.
5. Zone thresholds cannot be adjusted if the **Status** is set to **Off**.
6. If the **Status** of a zone is set to **OFF** and the thresholds of the zones above and below are set one tenth of a degree apart (the minimum resolution available) the **Status** of the intermediary zone cannot be set to **On**.

Warning: While the Kestrel LiNK app for mobile devices (compatible with LiNK enabled units only) does have a threshold alerts feature, it does not currently synch with the zone thresholds set in the Kestrel 5400 which must be set separately.

MEASURING DIRECTION

- » The Kestrel's compass is intended for measuring wind direction. The Kestrel must be held vertically with the back of the unit pointed towards the direction to be determined.
- » Using a Kestrel Vane mount adjusted to level will provide the most accurate wind and direction measurements.

The Kestrel employs a stable, accurate pressure sensor to measure station pressure, the unadjusted air pressure in your location.

- » To use your Kestrel to measure barometric pressure (station pressure adjusted for local elevation), you must enter a correct reference value for your altitude. Accurate barometric readings require that no elevation changes be made while taking measurements.
- » To use your Kestrel to measure altitude changes (changes in station pressure associated with changes in elevation), you must enter a correct reference value for your starting barometric pressure. Accurate altitude readings depend on stable, weather related barometric air pressure while measurements are taken.
- » Synched values between the Altitude and Barometer measurement screens allow reference value updates on either screen to automatically update reference values on the other.

□ *Note! You cannot use your Kestrel as a barometer and altimeter simultaneously.*

SETTING REFERENCE VALUES ON BARO MEASUREMENT SCREEN:

- » Scroll to the **Baro** measurement screen and select **Settings**.
- » Adjust either the Altitude or the Barometric Pressure value to a local, known value obtained from a mapping reference, GPS, or accurate weather station in the same location.

SETTING REFERENCE VALUES ON ALTITUDE MEASUREMENT SCREEN:

- » Scroll to the **ALTITUDE** measurement screen and select **Settings**.
- » Adjust either the Altitude or the Barometric Pressure value to a local, known value obtained from a mapping reference, GPS, or accurate weather station in the same location.

□ *Note! You should enter new reference values whenever you are using the Altimeter or Barometer functions and your reference value is no longer accurate (Ref Baro for Alt, Ref Alt for Baro) due to a change in weather or location.*

USING MIN/ AVG/ MAX

Pressing the right scroll button from any Current Measurement Screen will open the Min/Avg/Max Screen. The capture process is linked for all measurement screens, capturing Min/Avg/Max values on one measurement screen will capture Min/Avg/Max values over the same time period for all measurements. Each new Min/Avg/Max capture overwrites the previously captured value from all measurements.

CAPTURING MIN/AVG/MAX VALUES:

- » Scroll to the Min/Avg/Max Screen of the desired measurement. This can be done by scrolling right from the desired Current Measurement Screen or scrolling vertically from another measurement's Min/Avg/Max Screen.
- » Press Select to **Start** a new Min/Avg/Max capture.
- » Press Select to **Stop** the capture time period and view Min, Avg, and Max values.
- » Press Select to **Clear** the Min/Avg/Max values.

CONNECTING TO DEVICES USING LINK

If your Kestrel is marked LiNK on the bottom front label, it can be connected wirelessly to other LiNK-compatible devices. LiNK is powered by *Bluetooth Smart*®, also known as *Bluetooth*® LE, which is available in most iOS devices released after 2014 and Android devices released after 2015, as well as in a USB Dongle available from Kestrel that supports connectivity to Windows and Mac OS devices. LiNK-enabled Kestrel units can connect to mobile devices running Kestrel LiNK to install firmware updates. LiNK-enabled units can be run wirelessly to computers using the Kestrel Dongle.

CONNECTING TO A COMPUTER, MOBILE PHONE OR TABLET:

- » On your phone or tablet, follow the links at **www.kestrelinstruments.com** to locate Kestrel LiNK for iOS or Android in the App or Play store and install on your mobile device.

OR

- » On your computer, follow the links at **www.kestrelinstruments.com** and install on your computer. Insert your Kestrel USB Dongle (available separately) into an open USB port.
- » On the Kestrel, open the Options Menu and select **Bluetooth**. Set **Bluetooth** to **On**.
- » On your Kestrel select **Conct** from the Bluetooth Options menu and set to **PC/Mobile**. In **PC/Mobile mode**, the Kestrel's Status will change to **Available**, indicating that it is available for pairing with a computer or mobile device.

- » Ensure the computer or mobile device is searching and in range. When **Status** changes from **Available** to **Connected**, the pairing is active and your Kestrel is ready to communicate.

CONNECTING TO A NEW LINK-COMPATIBLE DEVICE:

- » Follow directions for your LiNK-compatible Device to power it on and put it in pairing mode.
- » On the Kestrel, open the Options Menu and select **Bluetooth**. Set **Bluetooth** to **On**.
- » Set **Conct** to **Device**.
- » Scroll to **Name** and select **New**, then wait for the list of available devices in range to populate.
- » Select a device from the available list. Once connected, the settings menu for that device will open, allowing you to manage the device's settings.
- » Exit to the Bluetooth menu. **Status** should indicate **Connected**, meaning the pairing is active and your Kestrel is ready to communicate.

CONNECTING TO/ADJUSTING A PREVIOUSLY PAIRED LINK-COMPATIBLE DEVICE:

- » Follow the directions for connecting to a new device except instead of selecting **New** in the **Name** field, scroll left or right to find the desired device.
- » **Status** will change to **Searching**. If the device is in range and in active pairing mode, a

connection will be made and **Searching** will change to **Connected**, indicating that the pairing is active and your Kestrel is ready to communicate.

□ *Note! LiNK range is typically 100 ft/30M line of sight. Shorter distances should be expected if there are obstacles such as walls or metal enclosures. Range is also impacted by the signal strength of the other device.*

CONNECTING TO COMPUTERS USING USB CABLE:

All Kestrel 5 Series units can connect to a computer via the Data Transfer Port using the USB Data Transfer Cable available separately. Kestrel LiNK software is available for Windows and Mac for downloading logged weather data and installing firmware updates.

In addition to taking live measurements, your Kestrel 5 Series weather meter is a powerful data logger. The Kestrel will automatically create a time stamped data log of all measurements at the logging interval you set. Additional log points can also be captured manually. Logged data can be accessed four ways:

- » Viewed on the Kestrel Meter on the Data Graph Screen and Data Log Detail Screens.
- » Exported to an iOS or Android mobile device using the Kestrel LiNK mobile apps available in the App Store and Google Play Store. Requires a Kestrel LiNK-enabled meter and a compatible Bluetooth® Smart/LE devices.
- » Exported to a PC or Mac using Kestrel LiNK software and a Kestrel USB Dongle (available separately). Requires a Kestrel LiNK-enabled meter
- » Exported to your Windows or Mac computer using Kestrel LiNK software and a Kestrel USB Data Transfer Cable (available separately). All 5 Series Kestrel meters can connect to Kestrel LiNK using a Kestrel USB Data Transfer Cable.

TURNING ON AND ADJUSTING AUTOMATIC DATA LOGGING:

- » In the main Options menu, scroll to and select **Memory Options**. Scroll to and select **Auto Store** and set to **ON**. Scroll to **Store Rate** and adjust to desired frequency of automatic weather data logging.
- » In the Memory Options sub menu scroll to **Overwrite** and set to **On** to allow the data log to wrap once full and **Off** to stop logging when full.
- » When **Auto Store** is set to **On**, the Kestrel unit will automatically begin logging at the rate set in **Store Rate**.

MANUAL DATA LOGGING:

- » Individual data points can be added to the log at any time by pressing the Capture button.
- » Manual capture simply adds every measurement to the data log at the capture time/date.

VIEWING LOGGED DATA ON THE KESTREL METER:

- » Scroll to the Graph Data Screen of the desired measurement. This can be done by scrolling right from the desired Current Measurement Screen or scrolling vertically from another measurement's Graph Data Screen.
- » A graph of the most recently logged data points will be displayed and continue to grow at the selected store rate.
- » To view individual data log points, or to view graph data older than what is shown in the Graph Data Screen, press Select to open the Data Log Detail Screen. Scrolling left or right will move the bar highlighting individual data points. Log values are shown in the upper left and the time stamp is shown along the bottom. Press Exit to return to the Graph Data Screen.
- » To change the resolution of the graph, scroll to and select **Graph Scale** in the Options menu. Scroll to and select the desired measurement type. Adjust the **Set High** and **Set Low** values to bound the desired display values.

EXPORTING DATA LOGS TO A MOBILE DEVICE:

- » Follow the links at www.kestrelinstruments.com

to locate Kestrel LiNK in the App or Play store and install on your mobile device.

- » Follow the directions in the Kestrel LiNK app and in the section of this manual titled Pairing with a Computer, Mobile Phone or Tablet: to connect the mobile device to the Kestrel.
- » The Kestrel's new logged data will automatically be added to the app's log whenever the devices are connected.
- » To export logged data to a .csv file for further analysis, go to the **Stats** page of the app or the **Manage Data Logs** screen on the **Manage** page.
- » Hit the **Export Data** button. Choose a method for exporting the data and follow the in-app prompts to send.

EXPORTING DATA LOGS TO A COMPUTER:

- » Follow the links at www.kestrelinstruments.com to download Kestrel LiNK to a PC or Mac computer. Install.

Use one of the following two methods to connect your Kestrel to your computer.

1. Connect your LiNK-enabled Kestrel Meter to your computer wirelessly:

- » Purchase a Kestrel LiNK Dongle and install in your computer's USB port.
- » Follow the instructions in the "Pairing with a Computer, Mobile Phone or Tablet" section of this manual along with the Kestrel LiNK program to pair the Kestrel and your computer.

2. Connect your Kestrel 5 Series Meter to your computer using a Kestrel USB Data Transfer Cable:

- » Purchase a Kestrel USB Data Transfer Cable.
- » In the main Options menu, scroll to and select **Data Port** and set to **On**.
- » Insert the USB Data Transfer Cable into an open USB port and the Data Transfer Port on the back of the Kestrel unit.

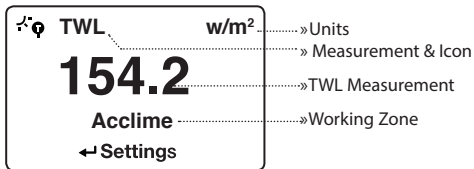
Once connected

- » Follow the directions in the Kestrel LiNK program to confirm the connection.
- » In the Kestrel LiNK software, choose a data log from the Logs window and click on the Export to File button.
- » Choose a file export directory on your computer and click on the Ok button.

THERMAL WORK LIMIT (TWL)

The Kestrel 5400 also displays a measure of human heat stress known as “Thermal Work Limit,” or “TWL.” Unlike WBGT, which is a measure of the environment, TWL is an estimate of the cooling capacity of a human body in given conditions. Accordingly, a higher TWL is safer because a person is able to eliminate more heat from their body. TWL provides four work level recommendations (Unrestricted, Acclimatization, Buffer, and Withdraw) to help guide work management in thermally dangerous conditions.

TWL CURRENT MEASUREMENT SCREEN



TWL (w/m ²)	> 220	140-220	115-140	< 115
Working Zone	Unrestricted	Acclimatization	Buffer	Withdrawal
Interventions	<p>No limits on self-paced work for trained, hydrated workers.</p>	<p>No restriction for acclimatized workers Workers with uncertain acclimatization status should not work alone in this zone</p> <ul style="list-style-type: none"> Be aware of increased risk of heat illness Dehydration test for first two shifts back from leave 	<p>Buffer zone exists to identify situations in which environmental conditions may be limiting to work</p> <ul style="list-style-type: none"> Any practicable intervention to reduce heat stress should be implemented e.g. provide shade, improve ventilation etc Working alone to be avoided if possible Unacclimatized* workers not to work in this zone Use the technical information sheets 'Work-rest cycling – sample schedules' and 'Fluid requirements for working in heat' to prescribe maximum exposure time, work/rest cycling and fluid intakes appropriate for type of work and conditions 	<p>Work limited to essential maintenance or rescue operations</p> <ul style="list-style-type: none"> No person to work alone No unacclimatized* person to work Documentation required authorising work in hostile thermal conditions for specific purpose Specific induction required emphasizing hydration and identifying signs of heat strain Apply 20 minutes of work – 40 minutes rest schedule Required fluid intake exceeds 600 ML per 30 minutes Personal water bottle (2 liter capacity) must be on the job at all times Mandatory dehydration testing at end of shift

*Unacclimatized workers are defined as new workers who have been off work for more than 14 days due to illness or leave (outside the tropics).

TWL values, working zones, and interventions. Source: health Authority, Abu Dhabi. If available, refer to TWL standards for your organization or for more information see <http://www.tandfonline.com/doi/abs/10.1080/104732202753438261>.

CONFIGURING TWL:

- » In the Settings Menu of the TWL Current Measurement Screen, scroll to and select the clothing setting that most closely reflects the clothing worn by the people you are monitoring. A check mark will appear next to the chosen clothing setting.
- » Clothing Setting Options:
 - » Men's business suit: Long sleeve shirt/tweed suit jacket & long, loose trousers
 - » Short sleeve shirt/denim shorts
 - » Work Clothes: Short sleeve shirt/long trousers (denim)
 - » Work Clothes & Coveralls
- » Pressing select a second time will open a sub menu displaying the preset values defining that clothing setting.
- » If none of the four provided clothing settings reflect the clothing worn by the people you are monitoring, a custom clothing setting can be configured. To create a custom clothing setting, scroll to Custom and press select.
- » Press select a second time to open the custom setting submenu. Scroll to the parameter you wish to customize and adjust it up or down to match your situation.

□ *Note: To highlight the severity of conditions, when the meter detects that Acclimatization is the current recommendation zone, **Acclim** will flash on the TWL Current Measurement Screen. In the Buffer or Withdrawal zones, the measurement value will flash inverted.*

DIRECTION – Compass heading in true or magnetic

WIND SPD – Wind Speed is the measurement of the wind passing through the impeller. For greatest accuracy, point the back of the Kestrel directly into the wind.

CROSWND – Crosswind uses the internal compass and a user selected heading to calculate the crosswind component of the full wind.

HEADWND – Headwind uses the internal compass and a user selected heading or target direction to calculate the headwind component of the full wind.

TEMP – Ambient Temperature is the temperature measured at the thermistor. For best results, ensure the thermistor is not exposed to direct sunlight and is exposed to good airflow.

CHILL – Wind Chill is a calculated value of the perceived temperature based on temperature and wind speed.

HUMIDITY – Relative Humidity is the amount of moisture currently held by the air as a percentage of the total possible moisture that the air could hold.

HEAT INDEX – Heat Index is a calculated value of the perceived temperature based on temperature and relative humidity.

GLOBE TEMP – Globe Temperature is defined as the temperature measured inside a 6-inch copper globe painted black. On the Kestrel HST, the temperature inside the 1-inch|25 mm globe is converted to the equivalent temperature for a standard globe. The closest equivalence will be obtained with airflow greater than 2.2 mph|1 m/s.

NWB TEMP – Natural Wet Bulb Temperature is a measure of evaporative cooling in an environment with unforced, naturally occurring air flow.

WBGT – Wet Bulb Globe Temperature is a measure of human heat stress resulting from the combination of effects due to temperature, humidity, wind speed (wind chill), and visible and radiant heat. Outdoor WBGT is calculated from a weighted sum of Natural Wet Bulb Temperature, Globe Temperature and dry bulb Temperature.

TWL – Thermal Work Limit is a measure of the heat energy a person can dissipate from their surface area in Watts per square meter (w/m²). For more information on TWL see <http://www.tandfonline.com/doi/abs/10.1080/104732202753438261>.

DEW POINT – Dew Point is the temperature at which water vapor will begin to condense out of the air.

WET BULB – Wet Bulb is the lowest temperature that can be reached in the existing environment by cooling through evaporation. Wet Bulb is always equal to or lower than ambient temperature.

BARO – Barometric Pressure is the local station (or absolute) pressure with the pressure differential associated with the locations altitude above sea level subtracted. An accurate reading depends on an accurate initial altitude input and unchanging altitude while measuring.

ALTITUDE – Altitude is the change in vertical distance associated with a change in atmospheric pressure. An accurate reading depends on an accurate initial barometric pressure input and stable barometric pressure while measuring.

STATION – Station Pressure (Absolute Pressure) is the pressure exerted by the earth's atmosphere at any given point.

DENS ALT – Density Altitude is the altitude at which the density of the theoretical standard atmospheric conditions (ISA) would match the actual local air density.

IMPELLER REPLACEMENT

- ❑ Press only the sides of the impeller when removing and inserting to avoid damaging the precision hub bearing. [Figure 1].
- » Press FIRMLY on the impeller module to remove it.
- » Insert the new impeller so the side that has the small triangle (close to the perimeter) faces the front of the Kestrel when installed.

Figure 1



- » Orient one "arm" of the module straight up . [Figure 2]. The impeller can be pushed in from either side.

Figure 2



WARRANTY CERTIFICATE

Your Kestrel Weather/Environmental Meter is warranted to be free of defects in materials and workmanship for a period of FIVE YEARS from the date of its first consumer purchase. NK will repair or replace any defective meter or part when notified within the warranty period, and will return the meter via domestic ground shipping or NK's choice of method of international shipping at no charge. The following are excluded from warranty coverage: damage due to improper use or neglect (including corrosion); damage caused by severe or excessive impact, damage caused by failed or leaking batteries, crushing or mechanical harm; modifications or attempted repairs by someone other than an authorized NK repair agent; impeller failure not caused by a manufacturing defect; normal usage wear and failed batteries. Measurement accuracy is warranted to be within the specifications on the supplied Certificate of Conformity including specified drift since date of manufacture. If no warranty registration or proof of purchase is provided, the warranty period will be measured from the meter's date of manufacture.

Except for the warranties set forth herein, NK disclaims all other warranties, expressed, implied or statutory, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose. Any implied warranties that may be imposed by applicable law are limited to the term of this warranty. In no event shall NK be liable for any incidental, special or consequential damages, including, but not limited to, loss of business, loss of profits, loss of data or use, whether in an action in contract or tort or based on a warranty, arising out of or in connection with the use or recalibration, performance of an NK product, even if NK has been advised of the possibility of such damages. You agree that repair, and (upon availability) replacement, as applicable, is your sole and exclusive remedy with respect to any breach of the NK Limited Warranty set forth herein.

All product liability and warranty options are governed exclusively by the laws of the Commonwealth of Pennsylvania.



By **NK**

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