PowerTap Joule™ GPS

User Guide

Joule GPS is compatible with any ANT+™ power meter, speed sensor, cadence sensor, or heart rate sensor.

Supporting FW 19.087

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Modifications

Saris Cycling Group, Inc. reserves the right to make improvements and/or updates to the products described herein at any time without notice.

This device complies with part 15 of FCC Rules and Rss-210 of IC Rules. Operation is subjected to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. The manufacturer is not responsible for any radio or tv interference caused by unauthorized modifications to this equipment. Such modifications could void the user authority to operate the equipment.

TABLE OF CONTENTS

CHAPTER 1: STARTING OUT

Thank you for purchasing the PowerTap Joule GPS. This user guide is just one of the resources to help you understand all the features the Joule GPS has to offer.

Please visit www.PowerTap.com to:

- Learn more about the Joule GPS and the PowerTap system of products
- Register all PowerTap products and activate warranty
- View instructional videos
- Sign up for the PowerTap newsletter-your source for the latest news and technical updates from PowerTap

UNPACKING JOULE GPS

PACKAGE CONTENTS:

PART	QTY
Joule GPS computer	1
Heart rate strap (select models)	1
Stem/Handlebar mount	1
Out-Front mount	1
Mount o-rings (2 sm, 2 lg)	4
Micro USB cable	1

COMPATIBILITY

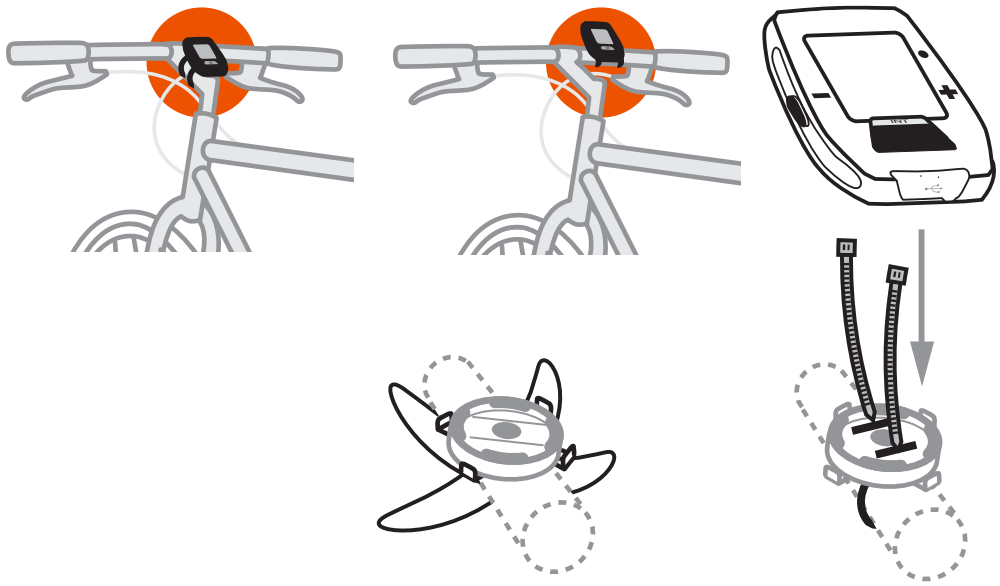
Joule GPS is compatible with any ANT+™ power meter, heart rate sensor, cadence sensor, speed sensor, or combination speed/cadence sensor.

CHAPTER 1: STARTING OUT

INSTALLATION

Installing the PowerTap Joule GPS

STEM/HANDLEBAR MOUNT

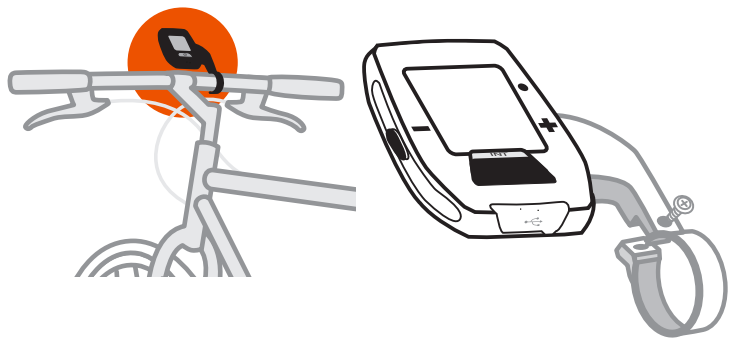


O-Rings: Crisscross under stem/handlebar, latch on hooks

OR

Zip tie around stem, through slots

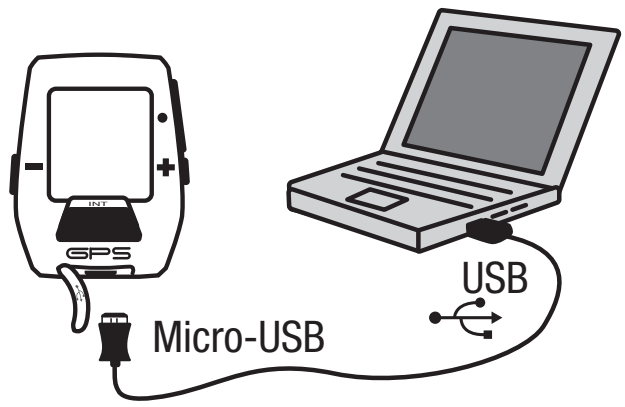
OUT-FRONT MOUNT



CHARGING

The Joule GPS is powered by a high-capacity rechargeable battery. To charge the battery, plug into a computer or AC wall adapter (#7060 not included). Typical battery charge lasts approximately 20 hours of operation.

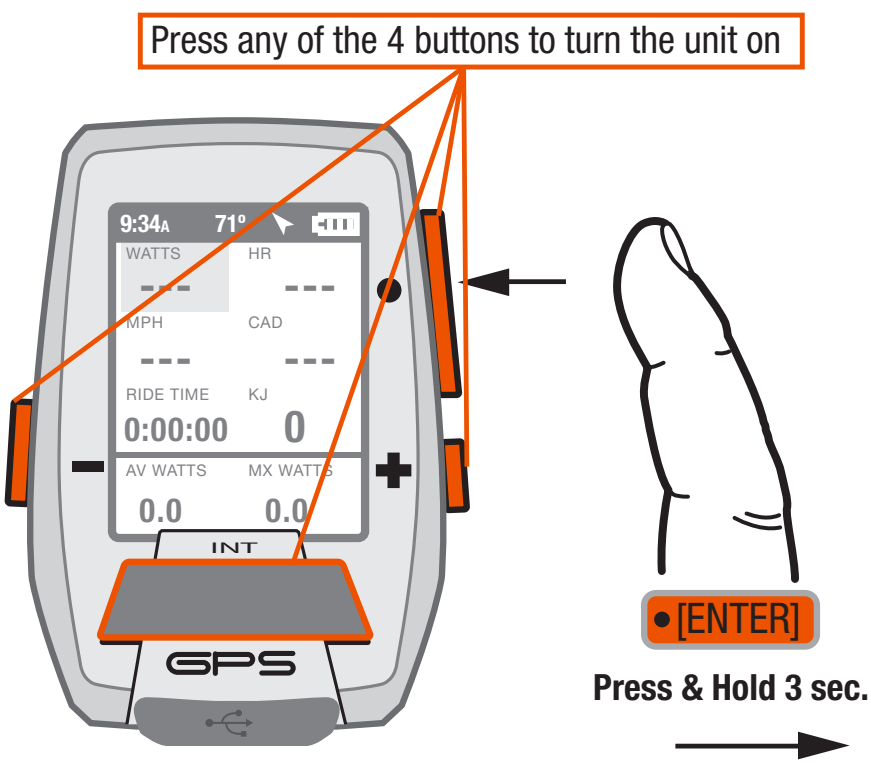
Should the battery become completely discharged (no partial charge remaining), plug the Joule GPS into a computer or AC wall adapter, press the reset button on the back panel of the Joule GPS, and the charging process will begin.

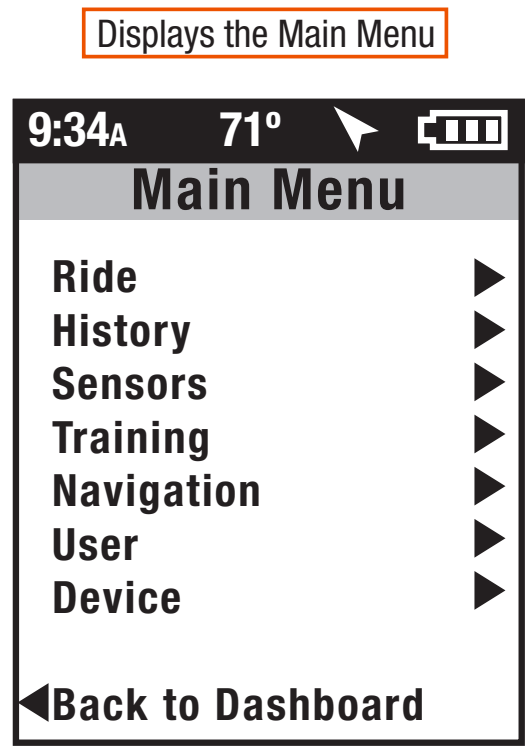


DASHBOARDS and BUTTONS

Press any button on the Joule GPS to turn the unit on. The display will briefly show the date, time, some user totals and the firmware version, then begin acquiring the GPS fix on your current location. One of 5 Dashboard screens will be displayed at this time. By default, there are 3 dashboards displaying various Metrics, 1 dashboard displaying completed intervals, and 1 dashboard displaying the GPS map. Pressing the ENTER button will advance the display to the next of the 5 Dashboard screens. Dashboard 1, by default, is initially set to display 6 metric windows in the configurable area. Other screens can appear between the Metric Dashboards and the Navigation dashboard, depending on which features you are using (e.g. Screens related to Training and Workouts, Navigating to a Waypoint, Following a Route, etc.).

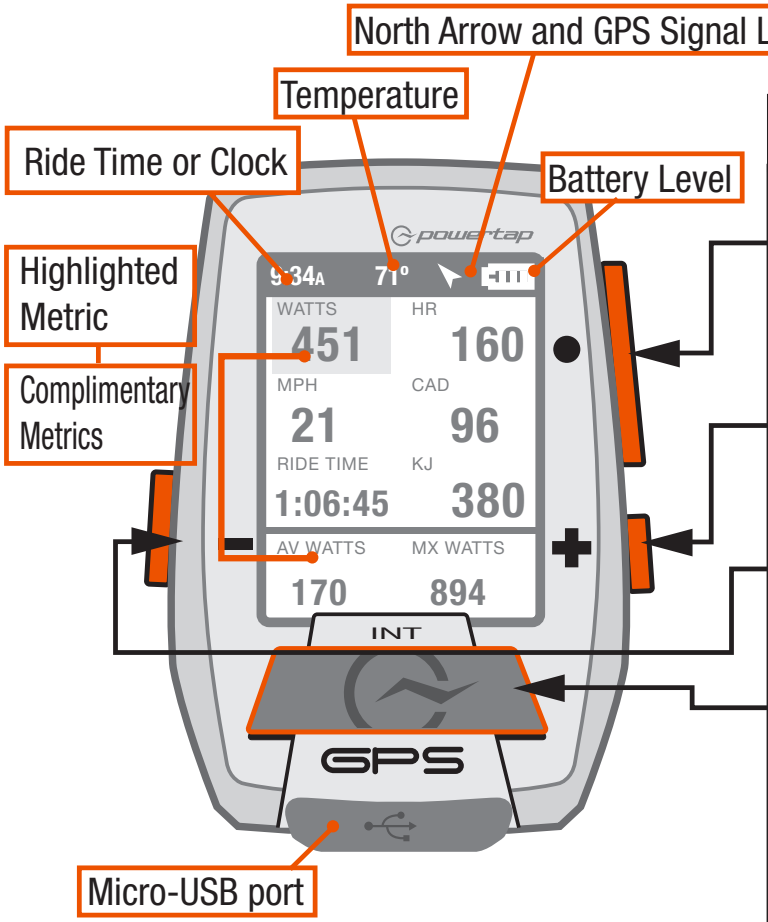
- To view the Main Menu from any Dashboard, press and hold the ENTER button for 3 seconds.
- To return to the Dashboard from any Menu press and hold the ENTER button for 3 seconds.





more BUTTON and DASHBOARD DETAIL

There are three buttons on the sides of the Joule GPS and one large button below the screen. The screen is divided into 3 display areas. The Title Bar, displays time, temperature, compass, and battery level. The large middle section displays user-selected metrics and can be configured to show 3 to 6 windows. The lower section shows complimentary metrics associated with the highlighted metric.



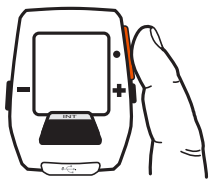
BUTTONS	FUNCTION
[ENTER] button ●	* Press once to advance through Dashboards * Hold for 2 seconds - Go to Main Menu * In Menus, press once to select menu item * In Menus, hold 2 seconds to return to Dashboard
[PLUS] button ✚	* Shifts selected metric or "highlight box" to the right and down * Hold for 3 seconds to begin metric rotation
[MINUS] button ▬	* Shifts selected metric or "highlight box" to the left and up
[INTERVAL] button	* Press to mark intervals * Hold for 2 seconds to display Interval view * Hold for 2 seconds to display Ride view * In Menus, press once to return to previous screen
[INTERVAL] button [PLUS] button ✚	* Press together and hold for 3 seconds to put the Joule GPS to sleep
[MINUS] button ▬ [PLUS] button ✚	* Press together and hold for 2 seconds to "find" sensors that may have been lost or were not awake when the Joule powered up.

TIP: See Appendix E for all button combinations, short cuts and quick links.

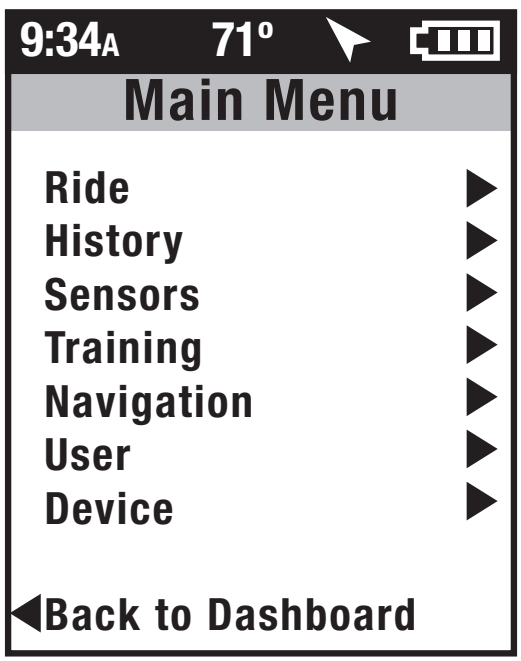
MAIN MENU

The Main Menu is your home base. Enter the Main Menu to stop and save rides; review ride history; create, edit, select, and pair Sensors; activate Training features; define individual Users; and configure the Device. Access to the Main Menu can be gained while viewing any Dashboard by pressing and holding the ENTER button. Use the (+) and (-) buttons to advance through the options to your selection.

FROM DASHBOARD



• [ENTER]
Press & Hold 2 sec.



RIDE
- Resume Ride
- Stop and Save
- Stop and Delete
- Reset Pacer

HISTORY
- Last Ride
- Select a Ride
- Report - Max
- Report - Totals

SENSOR
- Select a Bike
  - NEW BIKE
- Add a Bike
- Manual Zero

TRAINING
- Workouts
- Auto Lap
- Countdown

NAVIGATION
- Routes
- Waypoints
- GPS Status
- Compass

USER
- Select a User
  - NEW USER
- Add a User

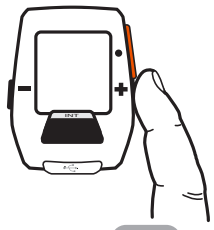
DEVICE
- Date and Time
- Display
- Record Control
- Memory
- Averages
- Altimeter
- About Joule

TIP: Once you have entered the Menu system (by holding ENTER button down for 2 seconds) the INTERVAL button will act as the “back” button. Each button press will return to the previous screen. Additionally, there is a “Back to...” choice at the bottom of every Menu screen, which will also return the display to the previous screen.

USER

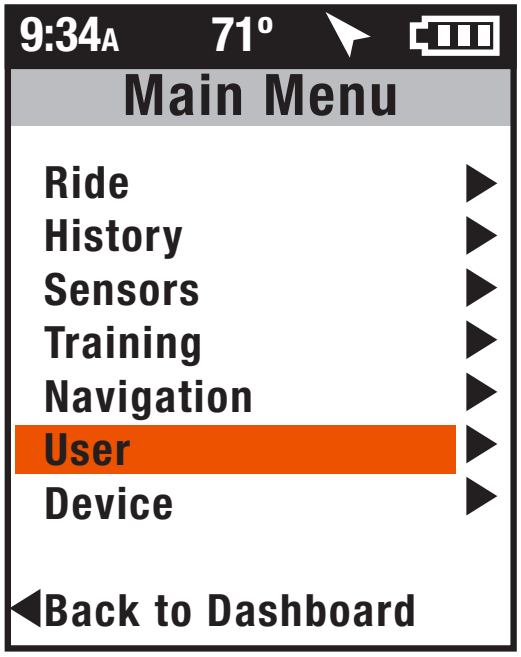
Because the Joule GPS is multi-user compatible, it's easy to share the device among several riders (e.g. Rachel, Jim, Bob). Each user can have multiple bikes (e.g. TT bike, Road bike, MTB); each bike can have multiple sensors associated with it (e.g. PowerTap, Cadence, HR strap, Speed). A default User is already defined within the Joule GPS. You can either edit the settings associated with that User or create a new user by selecting Add a User.

FROM MAIN MENU

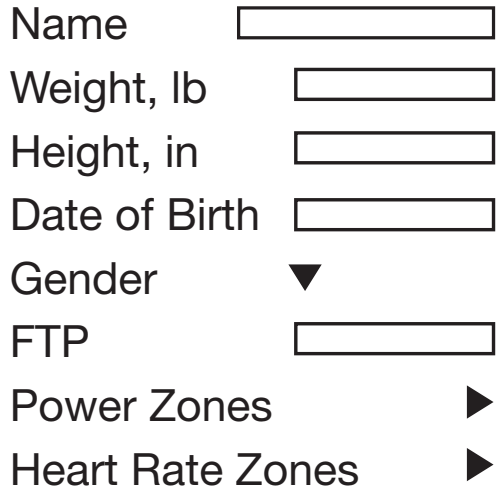


Press + **to scroll to User.**

Press •[ENTER] →



USER Multiple users can be stored on each Joule GPS. (e.g. Jim, Bob, Rachel can all share same device with unique information). To add another user, select Add a User, enter the name, weight, height and date of birth for the new user. If the training data is known for this particular user it can be entered now or enter it later, after a few rides.



TIP: When editing within a data field, the ENTER button allows you to enter, then move forward in the field; the INTERVAL button allows you to move backward; the PLUS/MINUS buttons allow you to pick a letter or number. Moving to the end of the field and pressing ENTER twice exits the field.

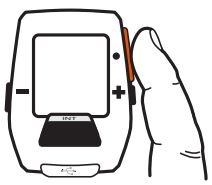
SENSORS & PAIRING

Pairing is a term used to describe the association of your Joule GPS with a particular sensor that is broadcasting an ANT+™ signal (e.g. a PowerTap hub, a Heart Rate strap, a remote cadence sensor, a remote speed sensor, etc.). Sensors can be shared between bikes (e.g. a heart rate strap). Each User can define multiple bikes. Each bike may have one or more sensors associated with it. Use unique names when creating additional bikes. For example: Jim's Racing Bike, Jim's MTB, My TT Bike, etc.

To add another bike:

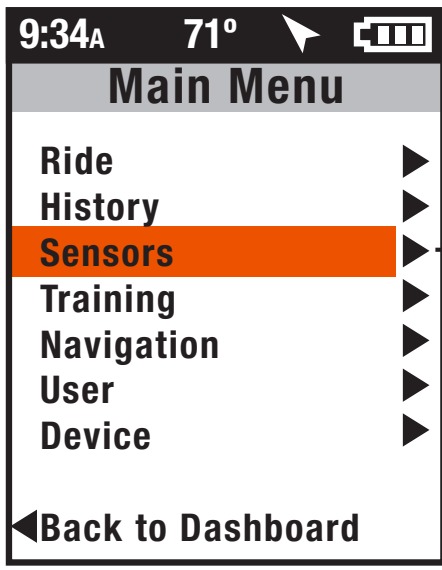
- Select "Add a Bike," enter a unique name and the weight of the bike.
- Associate the sensors with the bike. Make sure all the sensors are awake and broadcasting (briefly spin PowerTap wheel, wear HR strap).
- Select "Pair All" to pair all awake sensors in broadcast range (PowerTap hub, Heart Rate strap). Sensors can also be paired individually by selecting it within the Sensors menu.

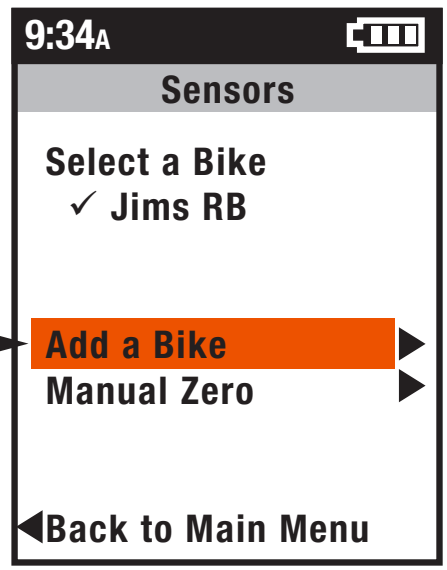
FROM DASHBOARD

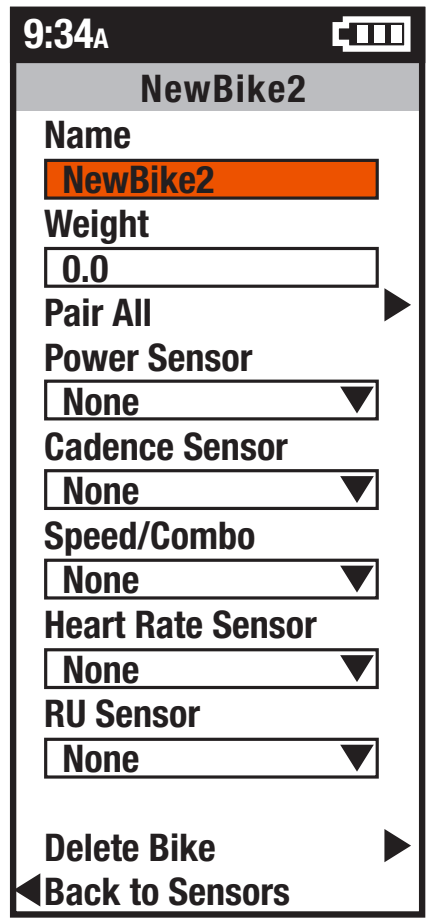


• [ENTER]

Press & Hold 2 sec. to enter Menus. Scroll to Sensors; Press •[ENTER]; Select "Add a Bike," Press •[ENTER] ;

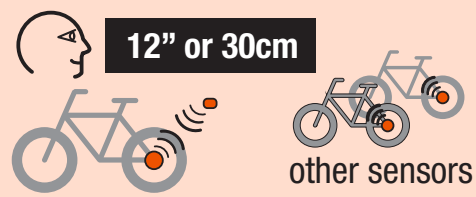






TIP: The Joule GPS pairs to the sensor(s) closest to the device first. Hold the Joule within 12" of PowerTap hub when pairing in the presence of other sensors.

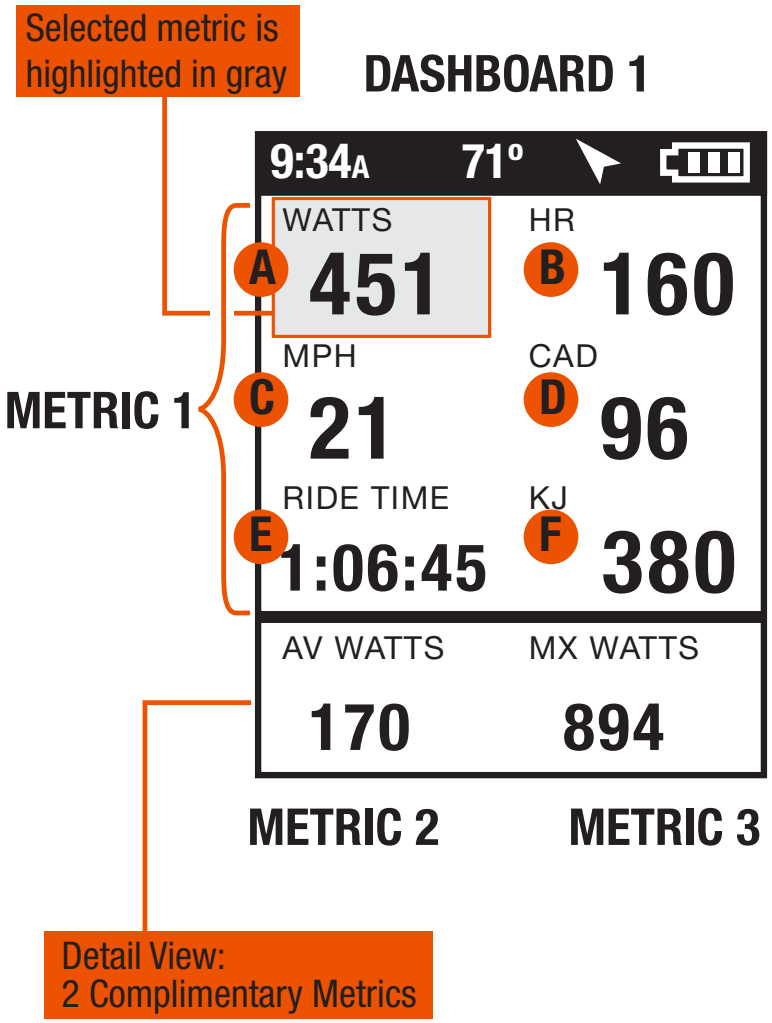
For more information on Sensors, see chapter 4



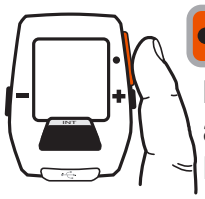
CHAPTER 3: DASHBOARDS

DASHBOARD 1

The Dashboards display various metrics, summaries and navigation information that can be easily customized. When a new metric is highlighted, the detailed view changes to show the related complimentary metrics.



Selected Metric	Detail Views	
METRIC 1	**METRIC 2**	**METRIC 3**
A WATTS	AV WATTS	MX WATTS
B HR	AV HR	MX HR
C MPH	AV MPH	MX MPH
D CAD	AV CAD	MX CAD
E RIDE TIME	MILES	Kilojoules
F KJ	KJ/HR	TSS



•[ENTER]

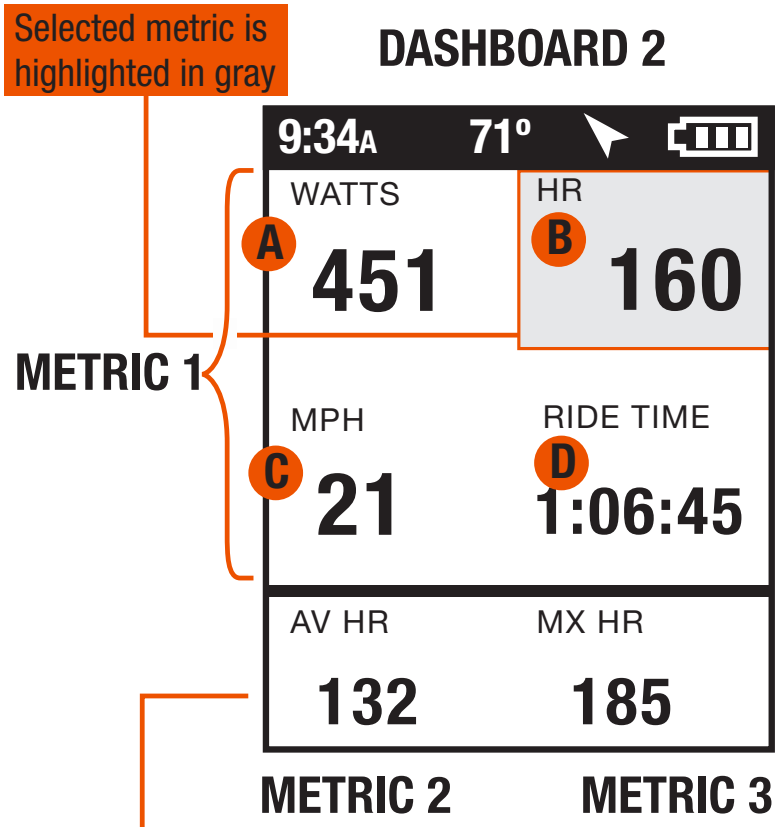
Press • [ENTER] to advance through Dashboards

TIP: Dashboards are fully customizable. 3 to 6 of the 23 available metrics can be displayed in each dashboard. See Chapter 8 for display options and Appendix C for a full list of metrics.

DASHBOARD 2

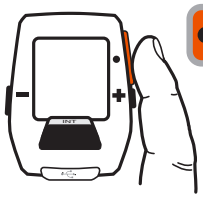
Dashboards can be customized to display from 3 to 6 metric windows. The example on previous page displayed 6. The example below, Dashboard 2, displays 4 metric windows. Each window can display any of 23 metrics, plus related/complimentary metrics. See Appendix C for a full list of metrics.

Selected metric is highlighted in gray



Detail View:
2 Complimentary Metrics

Selected Metric	Detail Views	
METRIC 1	METRIC 2	METRIC 3
A WATTS	AV WATTS	MX WATTS
B HR	AV HR	MX HR
C MPH	AV MPH	MX MPH
D RIDE TIME	Total Miles	Kilojoules

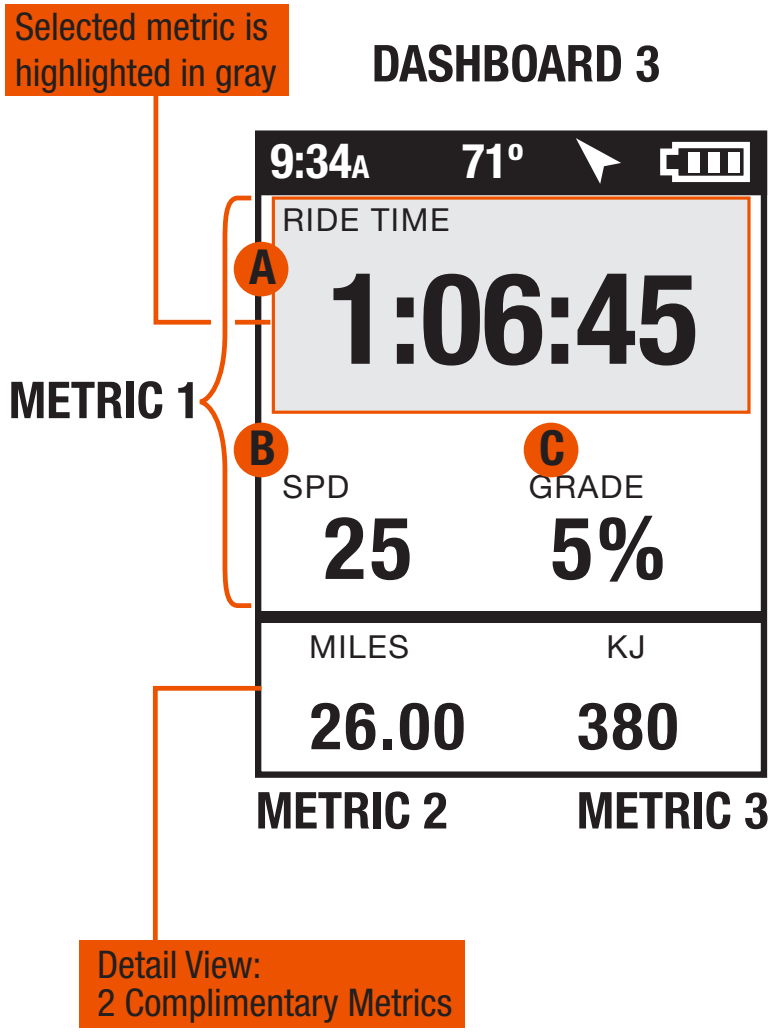


•[ENTER]

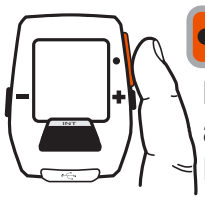
Press • [ENTER] to advance through Dashboards

DASHBOARD 3

Dashboard 3 is configured to display 3 metric windows (default configuration). Press the PLUS (+) or MINUS (-) button to highlight a different metric. See Appendix C for a full list of metrics.



Selected Metric		Detail Views	
	METRIC 1	**METRIC 2**	**METRIC 3**
A	RIDE TIME	MILES	KJ
B	SPEED	AV MPH	MX WATTS
C	GRADE	AV GRADE	FT GAIN



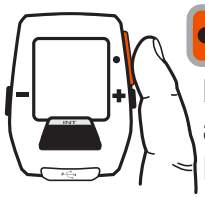
•[ENTER]

Press • [ENTER] to advance through Dashboards

TIP: By holding down the + [PLUS] button for 3 seconds, any of the three related metrics can be rotated into the primary dashboard metric position. For example: To see total distance traveled as the main metric, instead of Ride Time, press the [PLUS] button until the highlighted metric is Ride Time. Next, hold the [PLUS] button down for 3 seconds, continue holding the button down while the metrics are rotating. Release the button when the desired metric is the primary or highlighted metric.

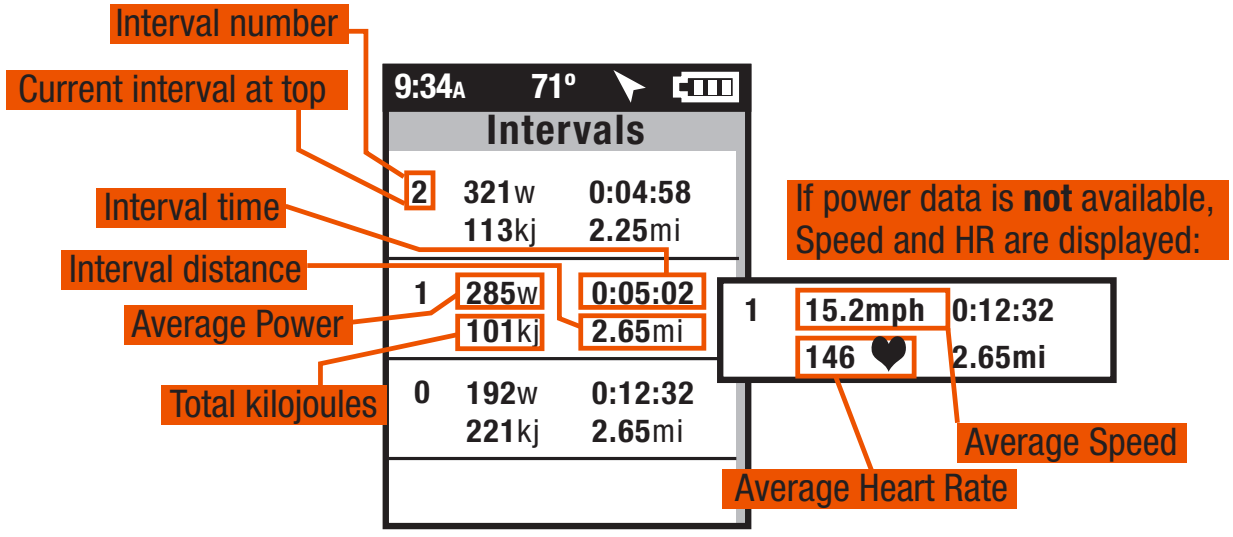
INTERVALS DASHBOARD

Intervals are useful for viewing ride data specific to a section of a ride, such as a hill or other period of high intensity riding. The Interval Summary dashboard contains a summary of each interval completed up to that point in the ride.

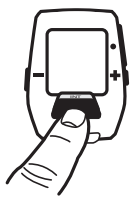


•[ENTER]

Press • [ENTER] to advance to the Intervals Dashboard.



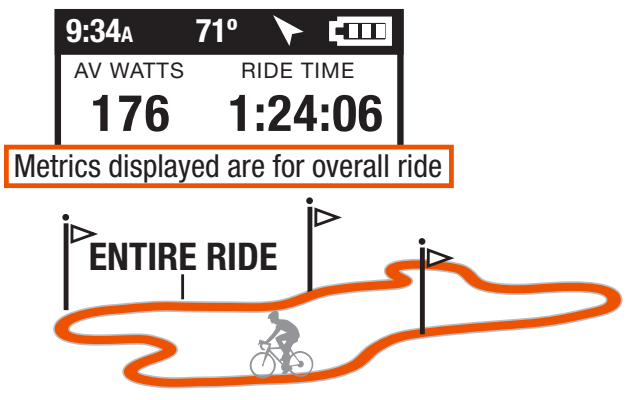
[INTERVAL]



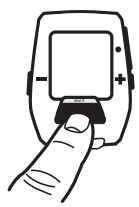
To initiate or stop an interval press the large [INTERVAL] button on the front of the Joule.

When viewing dashboard metrics, the Joule GPS allows 2 types of views: Ride View and Interval View. Ride View displays metric values related to the entire ride from the start to the current point in time. Interval View displays metric values related to the current interval. Holding the [INTERVAL] button down for 2 seconds toggles between the 2 views.

RIDE VIEW



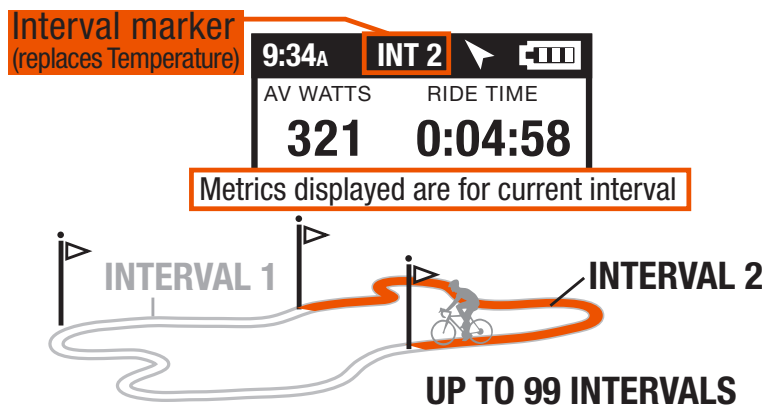
[INTERVAL]



Press & Hold 2 sec. to go to Interval View

Press & Hold 2 sec. to go back to Ride View

INTERVAL VIEW

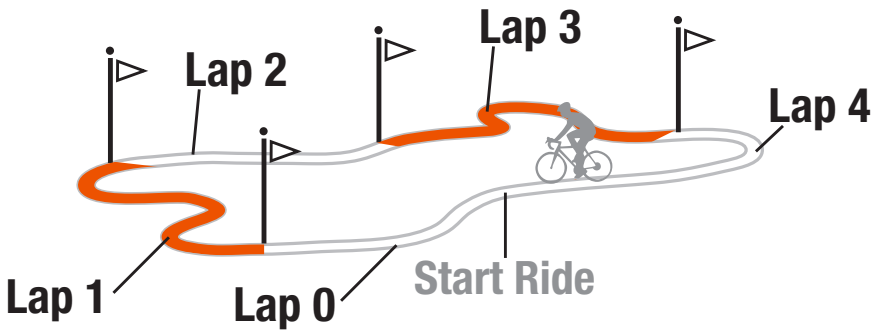


INTERVALS continued

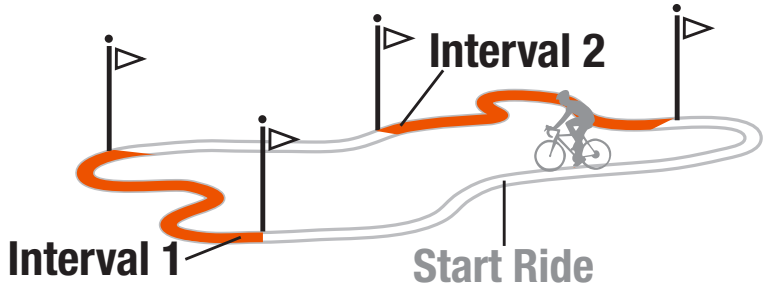
When using intervals, the Joule GPS can operate in one of two modes: Lap Mode or Interval Mode. These modes refer to the action taken when the [INTERVAL] button is pressed. The default is Lap Mode. The mode can be changed in the Record Control section of the Device menu (see chapter 8).

- **Lap Mode** refers to the traditional way the interval button has operated on all computers from PowerTap: Pressing the [INTERVAL] button completes one interval (or Lap) and begins the next interval (Lap). Interval 0 (zero), or Lap 0, is the time recorded from the start of the ride to the first [INTERVAL] button press. The next button press completes Lap 1 and begins Lap 2. The next button press completes Lap 2 and begins Lap 3, and so on...
- **Interval Mode** refers to tracking a rider's intervals as opposed to laps. When the Joule GPS is set to record in Interval Mode, the first press of the [INTERVAL] button begins interval 1. The next press of the button ends interval one. The next press of the button begins interval 2. The next press of the button ends interval 2, and so on... The period between intervals is referred to as the "rest" period in the Joule title bar but the rest/recovery period is not listed on the Interval dashboard. Only intervals are listed on the Interval dashboard.

Below, the  represents when the [INTERVAL] button is pushed.



LAP MODE



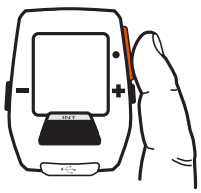
INTERVAL MODE

CHAPTER 3: DASHBOARDS

NAVIGATION DASHBOARD

The Navigation dashboard displays the path ridden from the start of the ride to your current position. Additionally, the screen displays two configurable metric windows, interval markers (□), waypoints (▲), and a pacing icon (△), depending upon which navigation feature is being used. This Dashboard is also used when navigating to a Waypoint or following a route.

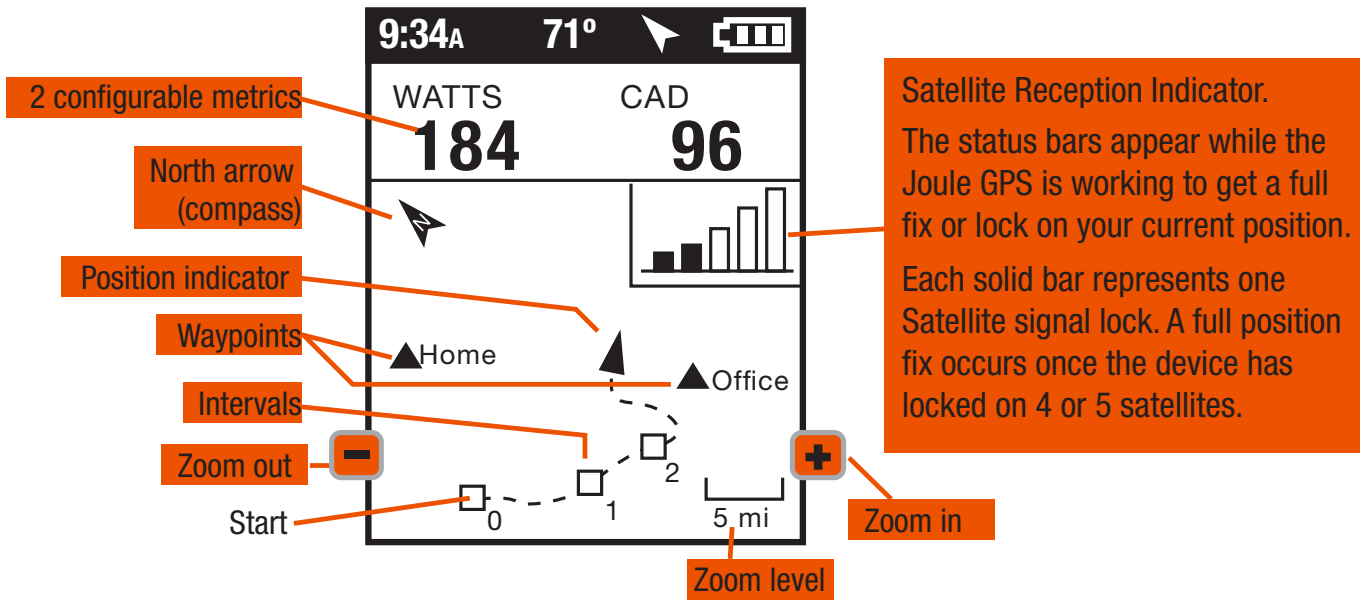
- Zoom the map in/out by pressing the PLUS (+) and MINUS (-) buttons.
- Zoom levels range from 75 meters to 80 kilometers (250 ft to 50 miles).
- When following a route, information related to total route distance or distance to the next turn appears above the metrics. The route name will appear briefly in this area.



•[ENTER]

Press • [ENTER] to advance through Dashboards to the Map screen.

Navigation Dashboard



TIP: The GPS signal locking process can take anywhere from less than a minute to several minutes, depending on weather, environmental conditions and/or when the last time the device was powered up.

See Appendix D for detailed information on GPS signals.

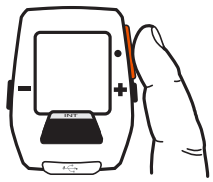
CHAPTER 4: SENSORS

SENSOR OVERVIEW

The Sensor section of the Main Menu is the gateway to all bicycle and sensor associations. In this area you can:

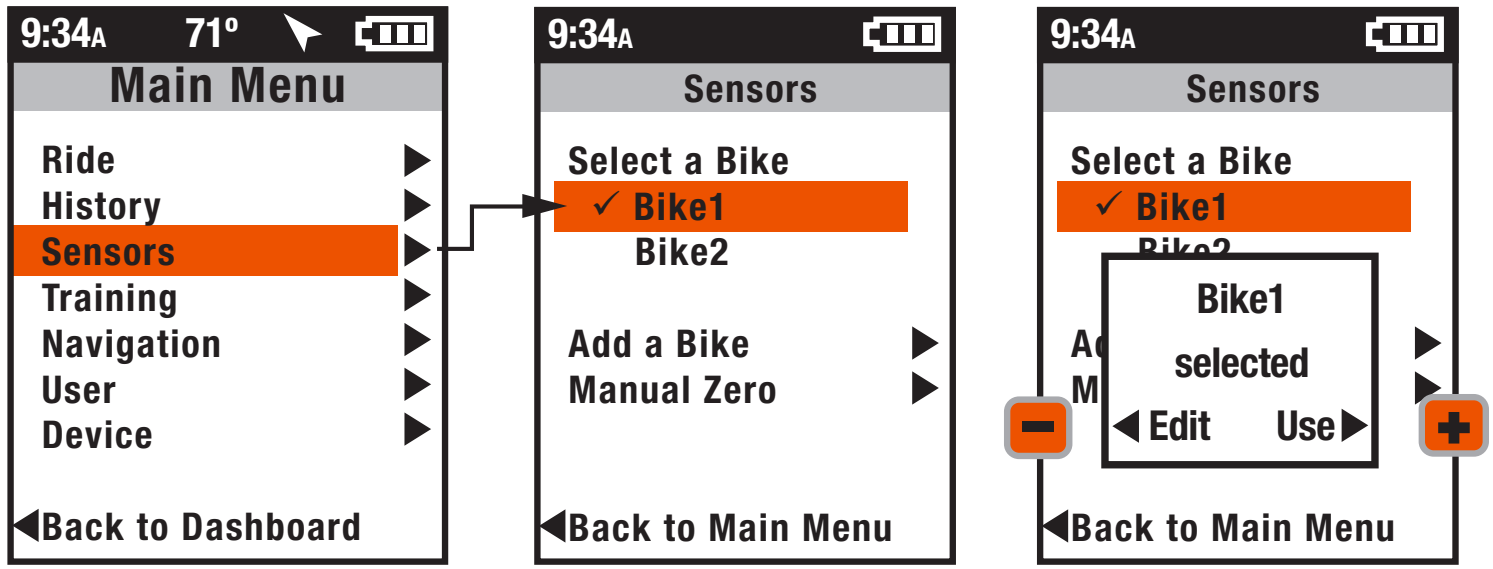
- Define and pair various sensors (e.g. power meter, heart rate strap, speed, cadence, PowerCal, PowerBeam, etc.).
- Create a "bike" description by associating a specific group of sensors.
- Or, if you have already created a bike or two, you can select which bike description you are about to ride or "use," or which bike description to "edit."
- Here, you can also access utilities related to calibration, such as calibrating the torque of a particular power meter or calibrating the Resistance Unit (RU) of a PowerBeam indoor trainer.

FROM DASHBOARD



•[ENTER]

Press & Hold 2 sec. to enter Menus. Scroll to Sensors; Press •[ENTER]; Select a bike Press •[ENTER]; Press +[PLUS] for Use, -[MINUS] for Edit.

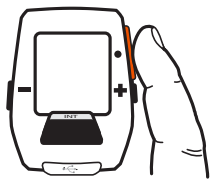


CHAPTER 4: SENSORS

DEFINING A BIKE

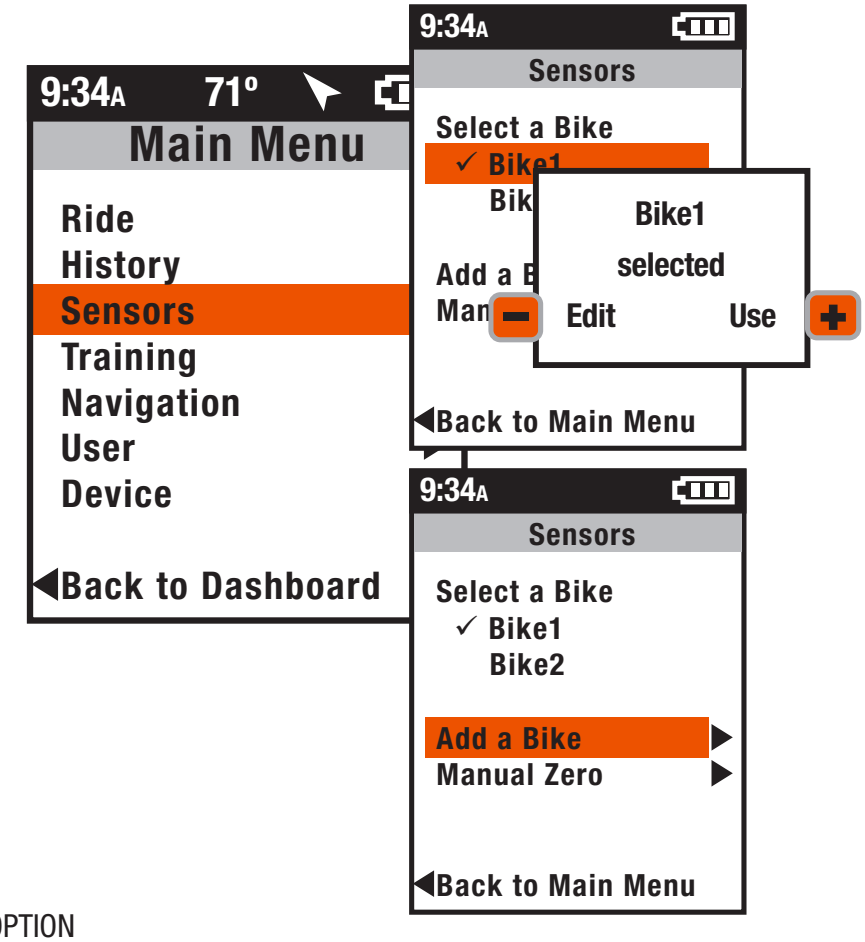
Display the bike definition screen by selecting an existing bike to “edit” or by adding a “new Bike.” The definition contains the bike name, weight of the bike, and links to any associated sensors. Also, the bike definition can be deleted here.

FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Sensors; Press •[ENTER]; Scroll to either an existing bike to edit or to “Add a Bike” to create a new bike. Press •[ENTER]



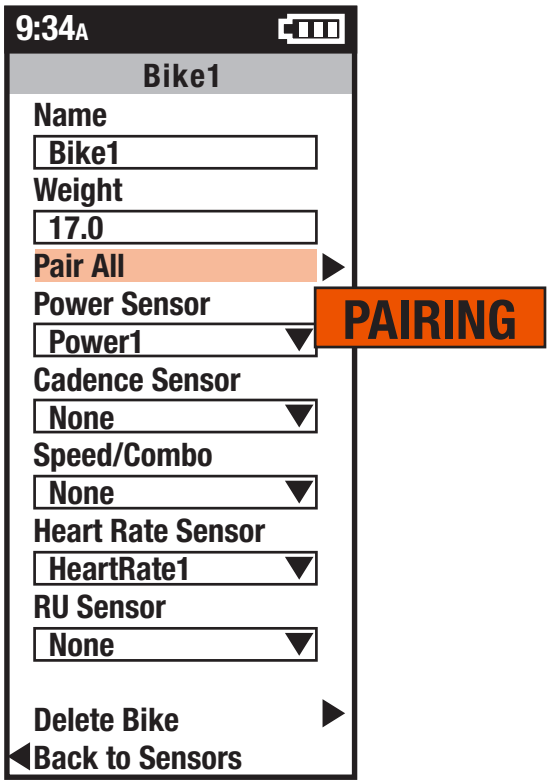
ACTION	OPTION
Define a New Bike	Select “Add a Bike.” Edit the default name and weight of " NEW BIKE1." Pair the sensors individually or by selecting "Pair All."
Activate Existing Bike	Select the bike name, choose Use (press the +[PLUS] button), and the bike will be activated (checkmark appears near bike name).
Edit an Existing Bike	Select the bike name, choose Edit (press the -[MINUS] button), and the bike defintion screen will appear.
Manual Zero	A shortcut for power meter calibration. See information later in this chapter.
Return to Dashboard	Return to dashboard by holding the [ENTER] button down for 2 seconds. You can also back out of the menus to the dashboard by pressing the [INTERVAL] button.

CHAPTER 4: SENSORS

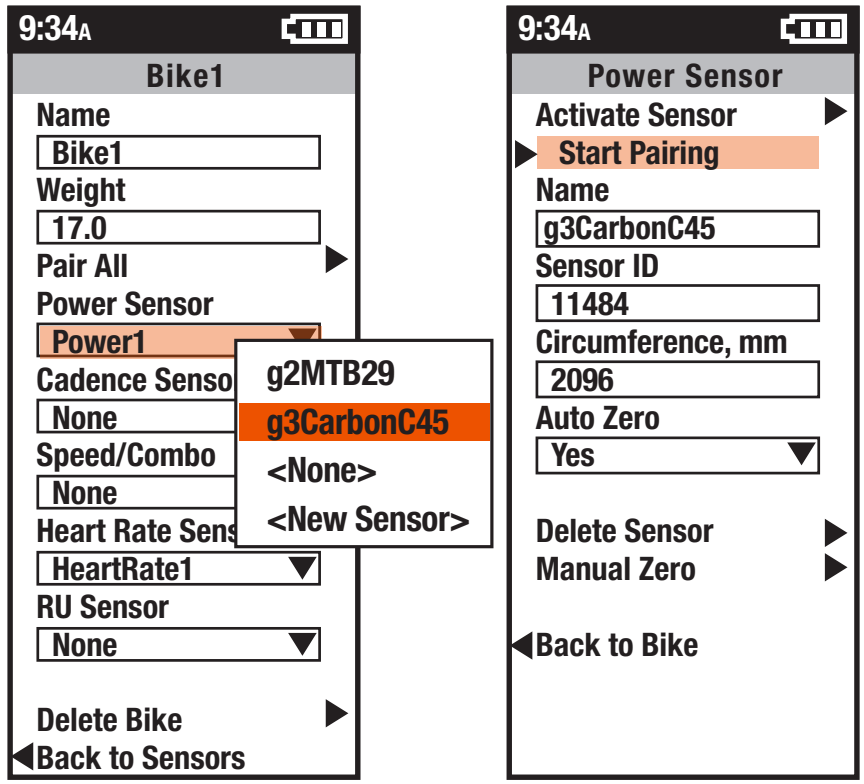
ASSOCIATING SENSORS

For sensor association, there are two options: Pair All or Pair Individually.

PAIR ALL



PAIR INDIVIDUALLY

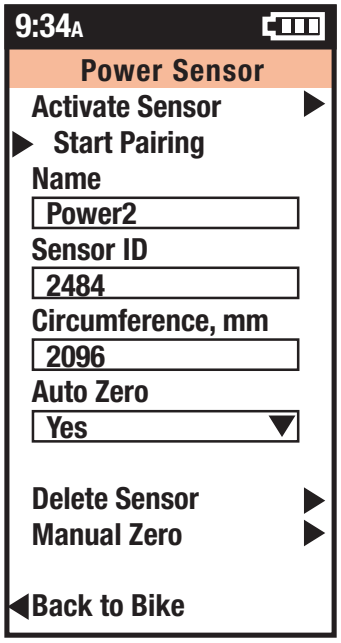


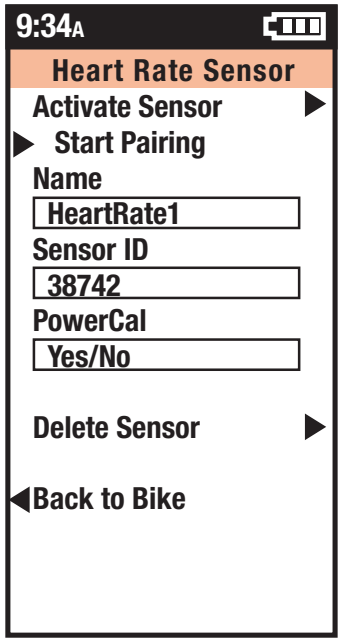
OPTION	DESCRIPTION
Pair All	Select "Pair All" to scan for all sensors awake and in broadcast range. The Joule GPS will display the ID of each sensor found. Selecting Yes, when a sensor's ID is displayed, will link the sensor to the new bike definition (by pressing the +[PLUS] button). Selecting No will instruct the Joule GPS to continue to scan for additional sensors of the same type before searching for sensors of another type (by pressing the -[MINUS] button).
Pair Individually	To pair sensors individually, scroll to and select the sensor. A menu of sensor names will appear. Select "<new sensor>" to scan for an awake and present sensor. When a sensor of same type is found, the ID is displayed. Selecting Yes will link the sensor with the defined bike. Selecting No wil instruct the Joule will continue to scan for another sensor of the same type. The name "<none>" indicates no sensor has been linked to the defined bike.
Link Named Sensor	Scroll to and select the sensor name. A menu of sensor names will appear. Scroll to the preferred predefined sensor; select it. You will be asked to Use it or Edit it. Selecting "Use" will link the sensor to the bike definition.

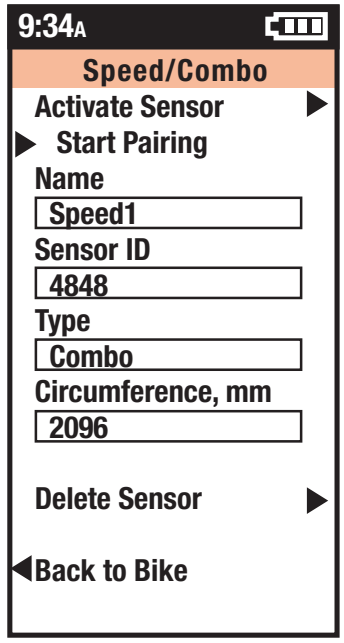
CHAPTER 4: SENSORS

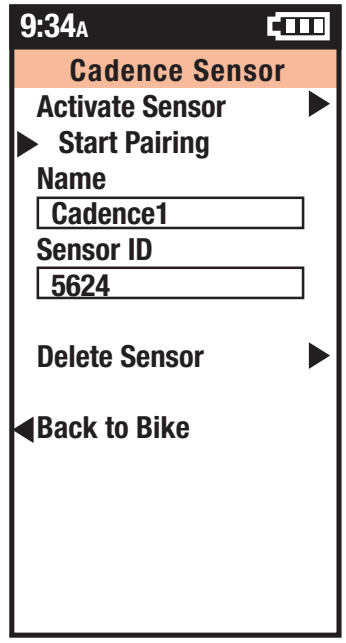
SENSOR TYPE DETAILS

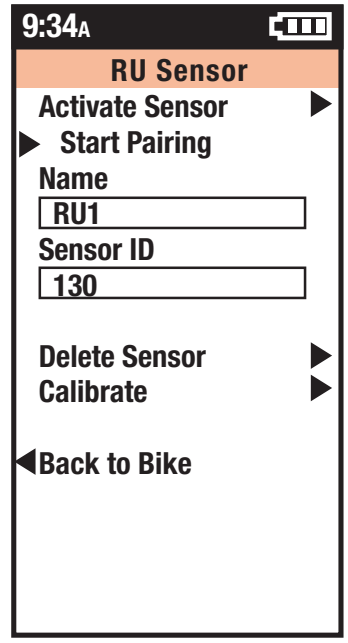
For each type of sensor the detail screen displays items common to all sensors, including activation and pairing functions, an editable name and an editiable ID. The “Start Pairing” option will automatically fill in the ID when pairing completes. If you know the ID of a particular sensor you can manually enter it into the field.







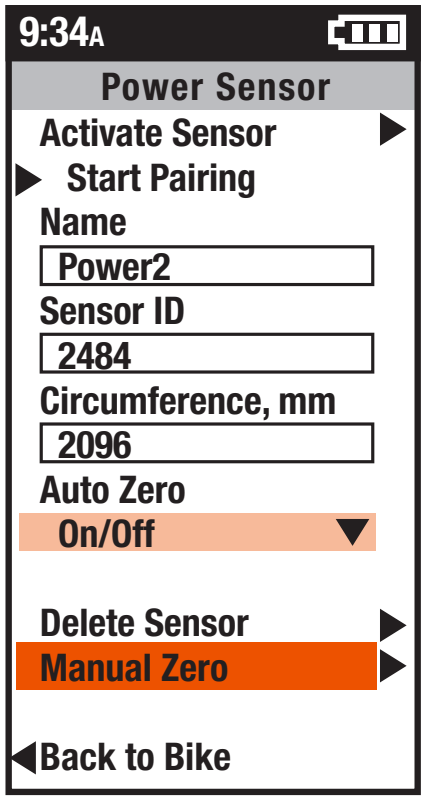


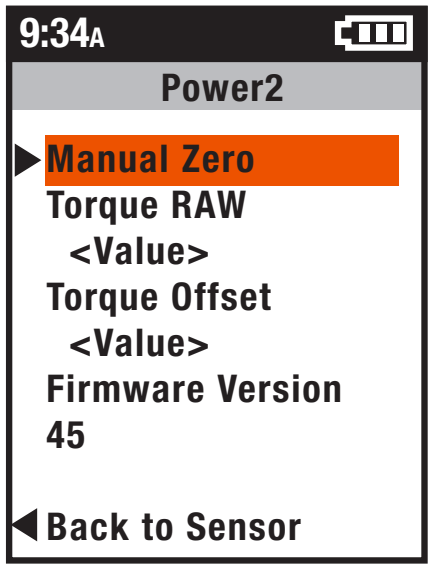


SENSOR	ADDITIONAL OPTIONS DESCRIBED
Power	If your power meter is a hub-based power meter, like a PowerTap, the wheel circumference can be entered here. The default wheel size of 2096mm represents a 700x23 wheel. Ignore circumference if your power meter is not hub-based. Auto Zero and Manual Zero options refer to calibration and are discussed in the following pages.
Heart Rate	The PowerCal option is set automatically, during the paring process, when the Joule GPS determines that the present HR strap is a Powercal.
Speed/Combo	The type of speed sensor is determined automatically during the pairing process (either a combination speed and cadence or a speed-only sensor). Enter the circumference of your wheel. The default wheel size is 2096 mm (700x23).
Cadence	No additional options.
RU	Resistance Unit or RU is associated with CycleOps PowerBeam trainers and indoor cycles.

CALIBRATION, AUTO and MANUAL ZERO

There are many environmental factors that can affect the accuracy of a power meter. Temperature, humidity, and circuit resistance are part of the measurement, but none of them remains constant while riding. The continued accuracy of a power meter depends on its ability to take these changes into account. Auto-zero recalibrates the power meter over and over during a ride to keep the measurements from drifting. Use the Auto or Manual Zero options in the Power Sensor screen to calibrate your power meter, assuring you are getting the most accurate power data at all times.



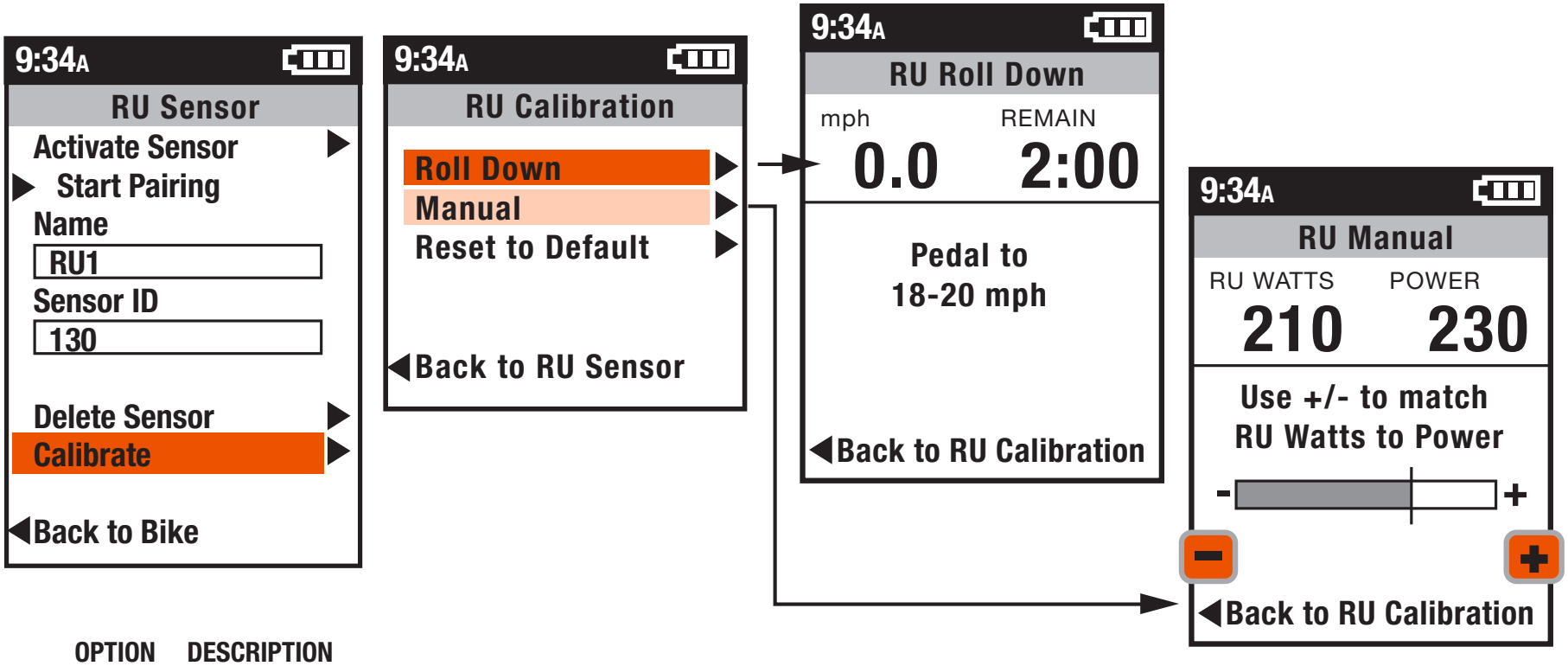


Auto Zero	On or Off. Typically, always On. The Auto Zero function follows the same steps outlined for Manual Zero but does it continually during the ride, whenever the bike is coasting for 4 or more seconds. If your bike is a fixed-geared or track bicycle you may consider turning Auto Zero off.
Manual Zero	Calibrating or "zeroing the torque" refers to the process of resetting the Torque Offset value of the physical torque tube (where the internal strain guages actually measure wheel torque). 1) Make sure the power meter is awake and communicating with the Joule GPS. Make sure the bike is still, with absolutely no pressure on the pedals or tension in the chain. 2) Select Manual Zero on Power Sensor screen. The Calbration screen will appear. Torque RAW should be 0. The last saved Torque Offset is displayed. The value is typically 500-524 in-lbs. 3) Select Manual Zero on Calibration Screen. The Torque Offset value will update with the torque tube calibration value, given the current environmental conditions.

TIP: The accuracy of any power meter is dependent on many variables, especially temperature. Fluctuations in temperature affect the internal strain gauges, which can alter the reported torque value. This is significant as power is calculated from torque. The PowerTap Auto Zero feature continually adjusts the calibration of your device, compensating, in real time, for environmental factors like temperature, assuring that you have the most accurate power data throughout your ride.

CALIBRATION, PowerBeam

Once you are paired with the PowerBeam Resistance Unit (RU) there are two options available to calibrate the device: Rolldown calibration or Manual calibration. There is also an option to reset the most recent calibration back to the factory default values.



OPTION	DESCRIPTION
Roll Down	The RU Roll Down calibration screen will flash the "Pedal to..." message until the wheel speed is in the specified range. Once in range, the clock will begin to count down. Continue pedaling, keeping the speed in range for the entire countdown. This will allow the tire temperature and pressure to stabilize. Once the timer reaches zero, stop pedaling and allow the wheel to spin down.
Manual	Select Manual calibration when another power meter is present on the bike and paired to the Joule GPS. Begin pedaling to see power values from both the RU and the power meter. Once the RU has been clamped against the tire, it is advisable to spend about 2 minutes pedaling to warm up the tire to stabilize the pressures . The vertical bar on the graphic will show the current calibration within the acceptable range. Use the [PLUS] and [MINUS] buttons to increase/decrease the value until the RU Watts and Power Watts are matching. While calibrating, pedal at a consistent power and be sure to give the RU time to adjust with each increase/decrease.
Reset	Reset to Default will reset all values to the factory default calibration.

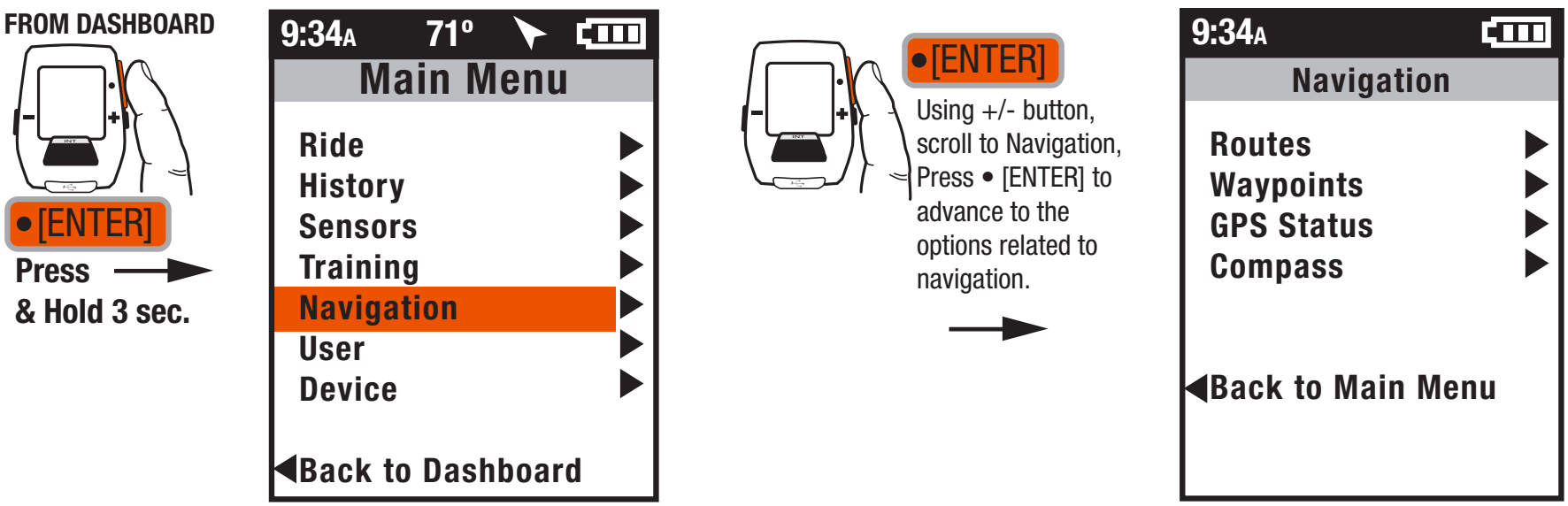
CHAPTER 5: NAVIGATION

NAVIGATION OVERVIEW

The Navigation section of the Joule GPS menu allows you to work with a variety of features including Routes, Waypoints, Compass calibration and the status of the GPS (Global Positioning System).

- **Routes** allow you to follow a particular predefined path. Routes can be created from previous rides in PowerAgent and uploaded to the Joule. Routes can also be created on one of the many mapping sites on the Internet, imported into PowerAgent and uploaded to the Joule.
- **Waypoints** assist with remembering and navigating to a particular location. Waypoints can be created directly on the Joule GPS and stored on the Joule or in the PowerTap PowerAgent software application (available on both Mac and PC).
- **GPS Status** allows you to check on the GPS signal, activate/deactivate the GPS, check current location, estimated accuracy andthe current altitude.
- **Compass**: The Joule GPS also has a magnetic compass, which operates whether the GPS signal is available or not.

See Appendix D for more detailed information on the GPS .



CHAPTER 5: NAVIGATION

ROUTES OVERVIEW

Routes allow you to navigate an unfamiliar path. Routes can also be used for training. By following a previously ridden route, you can compare your current pace against the pace associated with the route.

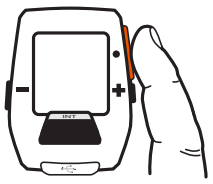
Creating Routes: Routes can be created from various sources:

- From previous rides on the Joule GPS.
- From previous rides (activities) stored in the PowerTap PowerAgent software.
- Via your favorite mapping website, exported, and uploaded to the Joule GPS.

Turn-by-turn Navigation: For those routes that contain turn-by-turn navigation data, the Joule GPS will display upcoming turn information in message notices that appear briefly over the dashboard as each turn approaches. Accurate turn-by-turn data is dependent on how the route was created and exported via the mapping site used.

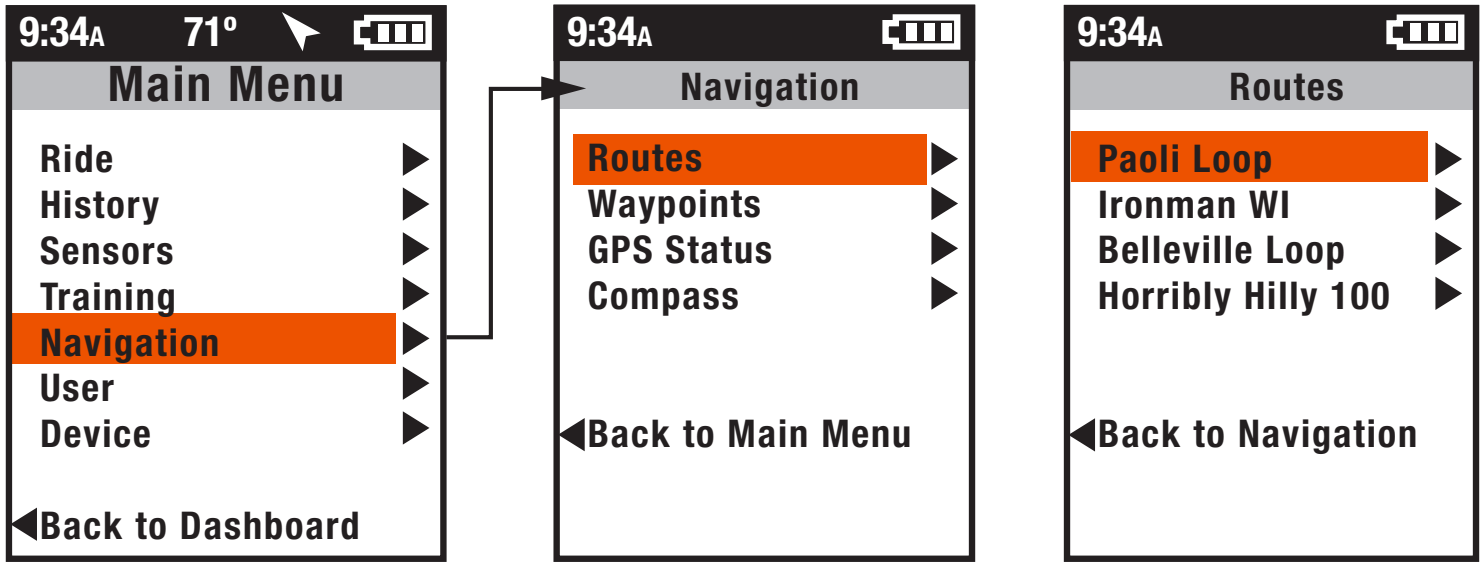
Route Pacing: Routes created from a previous ride will have associated pacing data. As you follow a route with pacing data, a small icon (△), "the Ride Partner" or "Pacer," will appear along the route. This icon represents the pace of the ride from which the route was created. Pacing data associated with a route can also be altered either by changing the average speed, or the total time to complete the route. The direction traveled on the route can also be reversed.

FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Navigation; Press •[ENTER] ; Select Routes, Press •[ENTER] Scroll to a route, Press •[ENTER]



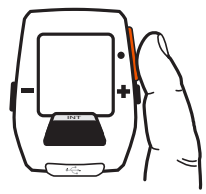
ROUTES, continued

To ride a route:

1) Select the route name from your list of routes.The Route Details display includes route name, length and location of the route.
2) Select Ride Route. The Route Attributes display includes the pacing information associated with the route.
3) Select Start. Confirm the Start. The Navigation dashboard will appear, displaying the route, your position, and the position of the Ride Partner (RP appears if pacing information is available for your selected route).

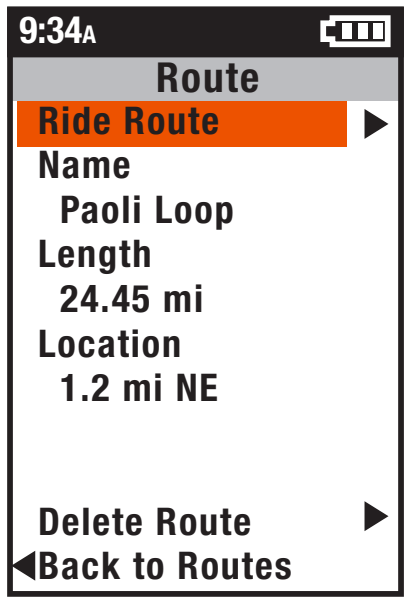
Optional: prior to selecting "Start," you can choose to alter the pacing and/or direction of travel for the route. Changing the Planned Time will automatically update the Planned Average speed. Likewise, changing the Average Speed will automatically update the Planned Time. In terms of Route Direction, select Forward or Reverse.

Use the Route Detail display to Delete or Rename a route.

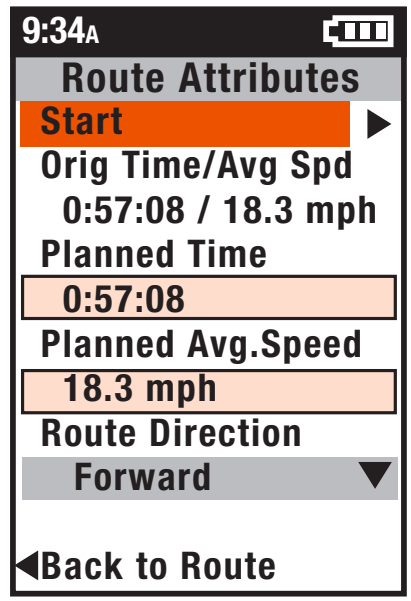


•[ENTER]

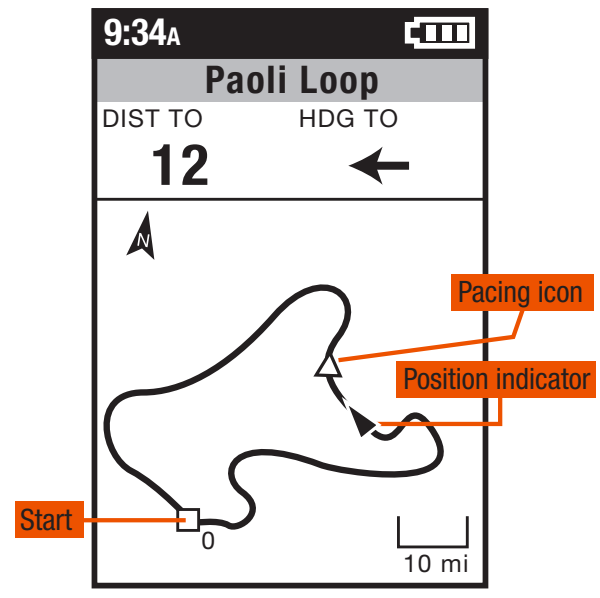
Scroll in the Route list to select the route to ride. Press • [ENTER] to display the route detail page. Select Ride Route. Press • [ENTER] to display Route Attribute page. Select Start. Press • [ENTER] to display the Route on the Navigation Dashboard.



Route Details



Route Attributes



Navigation Dashboard

ROUTES, continued

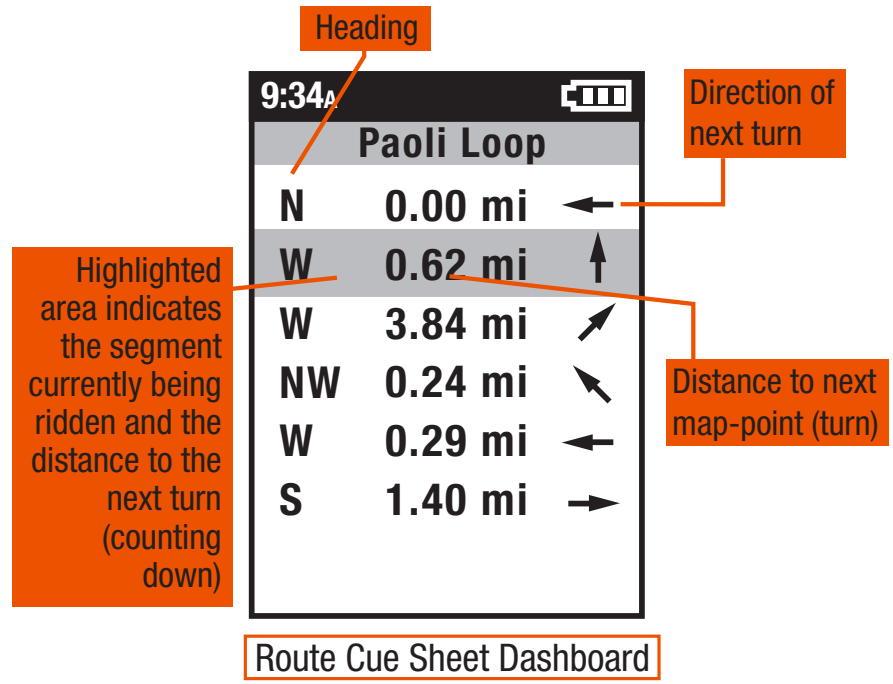
Transferring routes to the Joule GPS:

- Create a ride route using your favorite mapping site on the World Wide Web (e.g. ridewithgps.com, mapmyride.com, strava.com, etc.).
- Save the route and export it from the mapping site as a GPX or TCX file (see TIP below).
- Open PowerAgent and import the route file. Select "Show Routes" from the Window menu to verify that the newly imported route is in the list.
- With your Joule GPS "on" and plugged into the computer, from PowerAgent, select "Configure Device" from the Tools menu.
- From the configuration window, select the "Routes" tab.
- Select or Check the route(s) you want to transfer to the Joule GPS and click the "Save."

More Turn-by-turn details:

When the route selected contains associated Turn-by-turn directions, a Route Cue Sheet dashboard will appear in your list of dashboards. The Route dashboard will display the heading, the distance, and direction to the next route point (a turn or point of interest). The route is also displayed on the Map dashboard. When you are within about 200m (600 ft) to your next turn a popup message notice will appear indicating the direction to turn and counting down your progress to the upcoming turn.

For a route to have Turn-by-turn directions you must create it using a mapping website which has the capability to produce a route file containing turn-by-turn information. Not all mapping sites have this capability.



Route Cue Sheet Dashboard

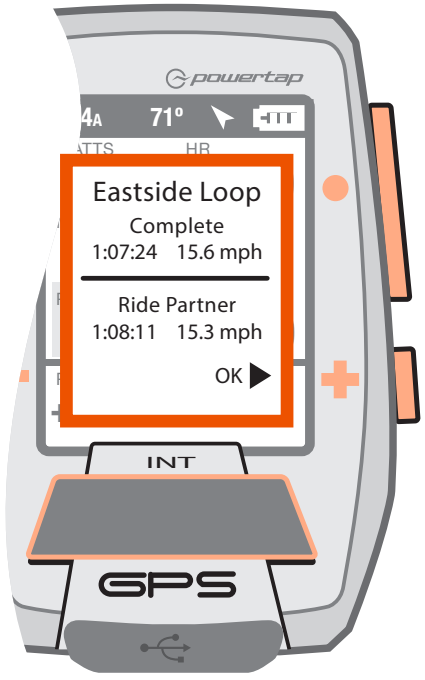
TIP: The Joule GPS only allows a route name to display 15-16 characters. Keep this in mind when naming imported routes.
NOTE: ridewithgps.com is one of the few websites which exports Turn-by-turn directions in their route files, but only in the TCX format and only if you create the route in ridewithgps.com. They do not provide turn-by-turn in their GPX format files.

ROUTES, continued

More Pacing details:
As mentioned earlier, routes created from a previous ride will have associated "pacing data." The Joule GPS will use this data—the average speed and total time taken to complete the ride route—to "set" the pace of the Ride Partner. You can choose to alter the associated pacing data using the the Route Attribute page (see pg. 25).

Once the route is activated and you reach the beginning of the selected route, the Ride Partner will begin moving at the specified pace. You can monitor your progress against the Ride Partner by checking the map dashboard (Ride Partner appearing as the △ icon) or checking the Pacing metric, configured on one of the metric dashboards (see Chapter 2).

When you have completed the route a notice will appear on the Joule GPS screen containing summary information highlighting the average speed and total time to complete the route for both you and the Ride Partner.



Route Completion Summary

Ride Partner Metric

The Ride Partner metric can be added to your dashboard to assist in monitoring your pace verses the Ride Partner. The metric is updated in real time during the ride.

This metric contains 3 values:

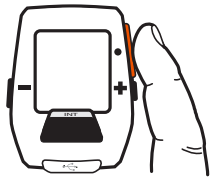
- PACER MI: The distance between you and the Ride Partner (RP), "+" if the RP is ahead, "-" if the RP is behind you.
- PACER TM: The amount of time the Ride Partner is ahead(+) or behind(-) you.
- ESCAPE or CLOSURE RT: The Escape or Closure rate. This is the average speed you will need to maintain to finish the route just ahead of the Ride Partner. The label will list as "Escape RT" when you are ahead of the RP,

CHAPTER 5: NAVIGATION

WAYPOINTS

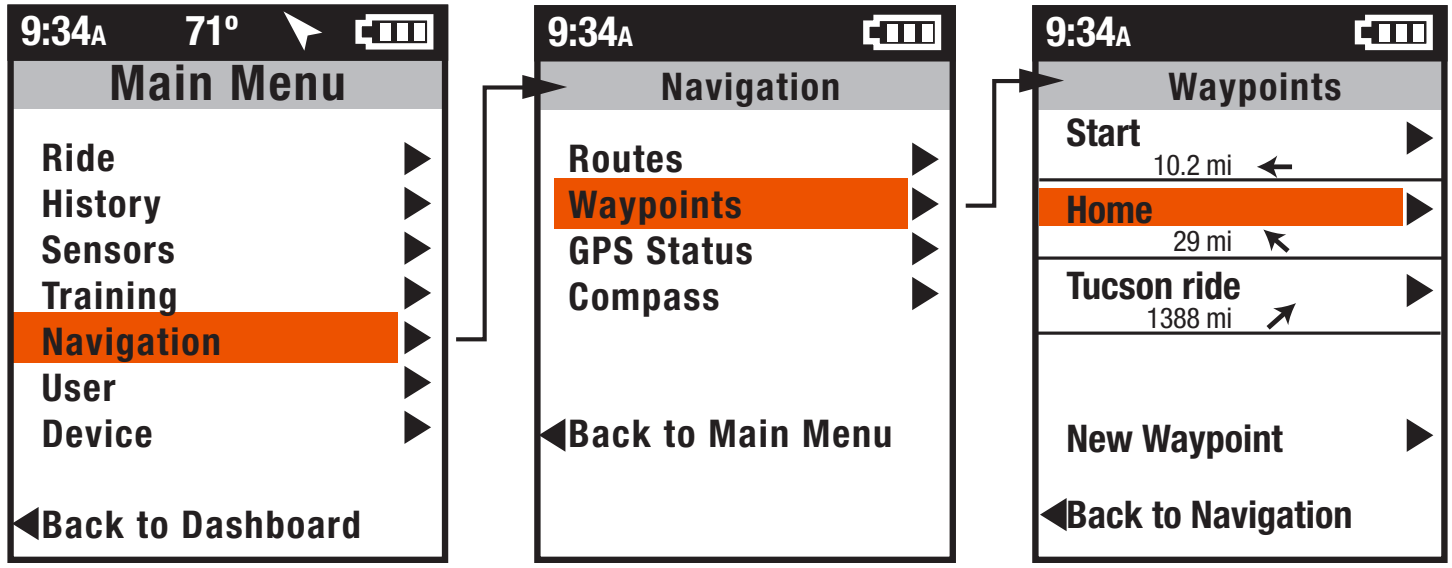
For the purposes of the Joule GPS, waypoints are single specific locations on Earth. Your home, favorite trail head, or cafe can be a waypoint. The Joule GPS can create, delete, select, and store waypoints. Each waypoint you create is stored on the device. Each waypoint is listed by its name, a distance and direction (heading) from your current location. A waypoint labeled “Start” is always in the list and represents the starting point of your current ride. You can select a waypoint in your list to navigate to or create a waypoint representing your current location by selecting “New Waypoint.”

FROM DASHBOARD



•[ENTER]

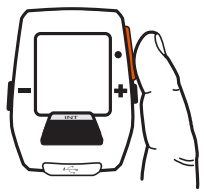
Press & Hold
3 sec. to enter
Menus. Scroll
to Navigation;
Press •[ENTER] ;
Select Waypoints,
Press •[ENTER]
Scroll to a Waypoint
Press •[ENTER]



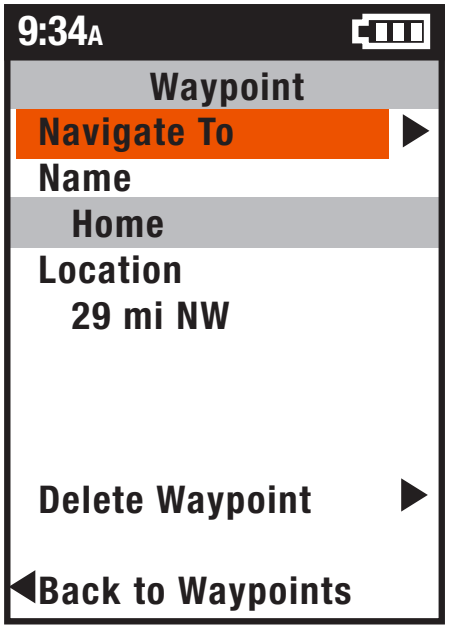
TIP: The heading arrow is accurate as long as the compass has been calibrated. The calibration typically only has to be done once, when you first receive the unit.
For more information, refer to the Compass Calibration section at the end of this chapter.

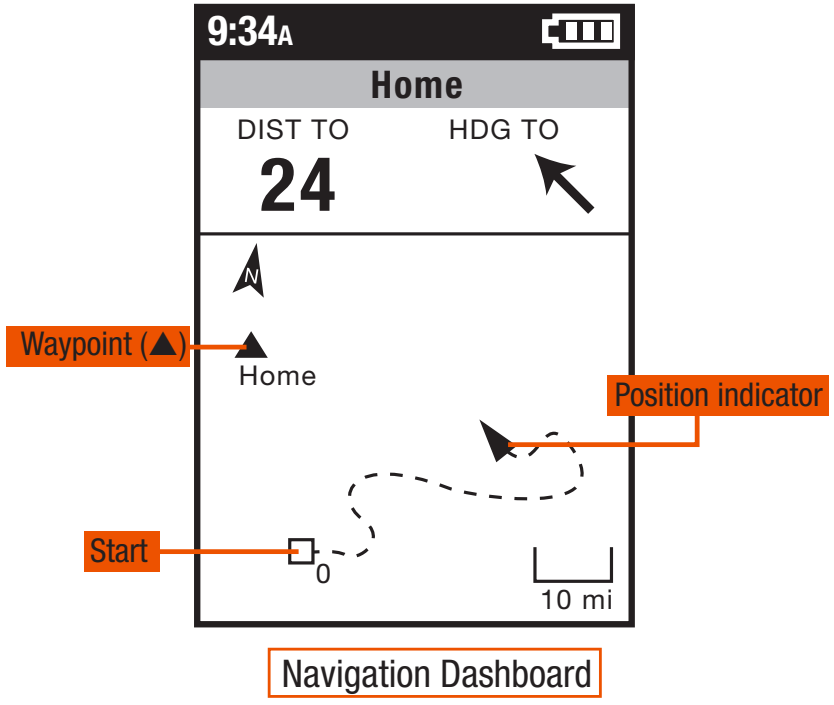
WAYPOINTS, continued

To navigate to a particular waypoint, select it from the list. At this point you can navigate to it, rename it or delete it. Selecting the Navigate To option will take you to the Navigation Dashboard. The name of the waypoint will be listed at the top of the screen along with the distance to the waypoint, from your current position, along a straight line, in the direction indicated by the heading arrow.



Press • [ENTER] to advance through the Menus. Once Waypoint is selected the Distance To and the Heading To the waypoint is displayed on the Navigation Dashboard.



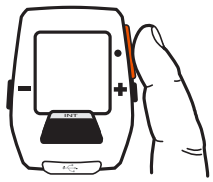


CHAPTER 5: NAVIGATION

GPS STATUS

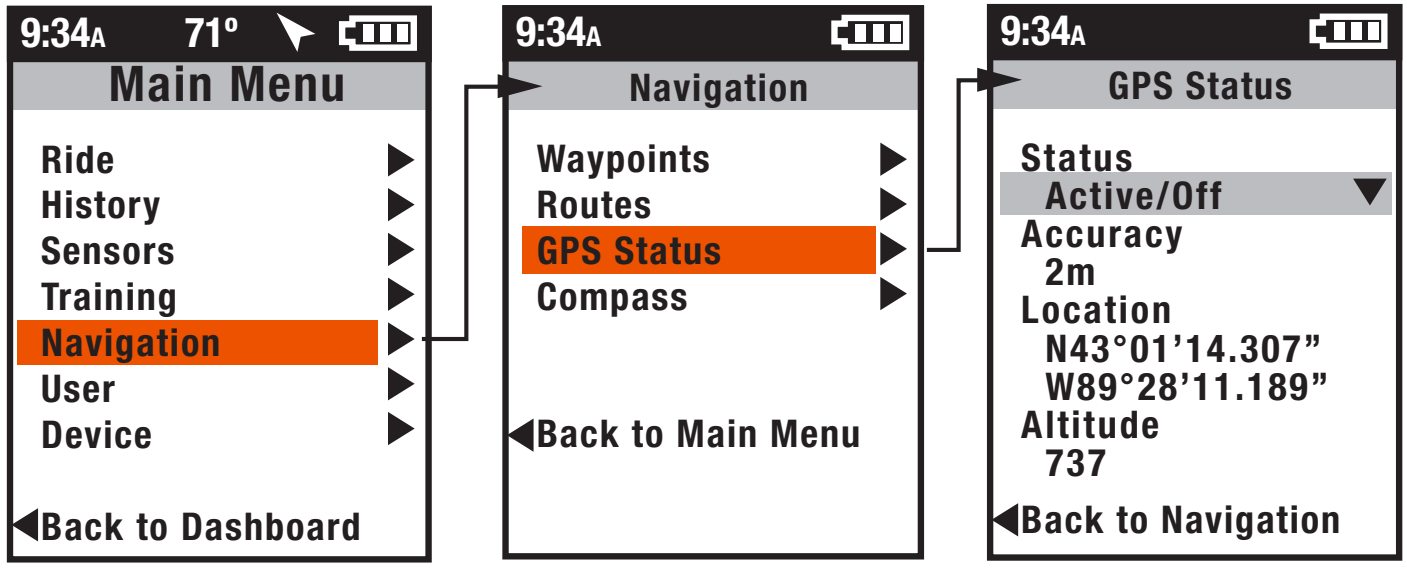
Information related to your GPS signal can be checked in the GPS Status area. Your GPS signal can be set to Active or Off. The current accuracy of your position is estimated in meters. The GPS must be locked onto a minimum of 4 satellites for full operation. Accuracy improves as the device locks onto additional satellites. Also displayed is the exact location of your position in Latitude and Longitude notation (i.e. degrees, minutes, seconds) and the current altitude, as calculated by the Joule GPS barometer.

FROM DASHBOARD



•[ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Navigation; Press •[ENTER] ; Select GPS Status



TIP: Your current location is listed as a latitude and longitude pair. The numbers making up the pair are in degrees, minutes, and seconds. The letter associated with the number is a compass point, North, South, East, West. When viewing a map, latitude lines run horizontally; longitude lines run vertically, converging at each pole, widest at the equator.

Lines of Latitude are numbered from zero degrees to 90°, north and south. These numbers can be subdivided into minutes and seconds for greater granularity. 0° Latitude is the Equator, the imaginary line that divides the earth into north and south hemispheres.

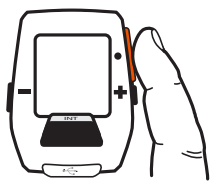
Lines of Longitude, also numbered in degrees, subdivided in minutes and seconds. 0° Longitude is the Prime Meridian, established 1884, an imaginary line that runs through Greenwich, England. From the Prime Meridian, the lines of Longitude run 180° east and 180° west until they meet in the Pacific Ocean, making up the imaginary line known as the International Date Line.

Using the Latitude/Longitude numbered pair you can describe any location on Earth. In fact, the example in the menu above is the location of Saris Cycling Group, near Madison, Wisconsin.

COMPASS

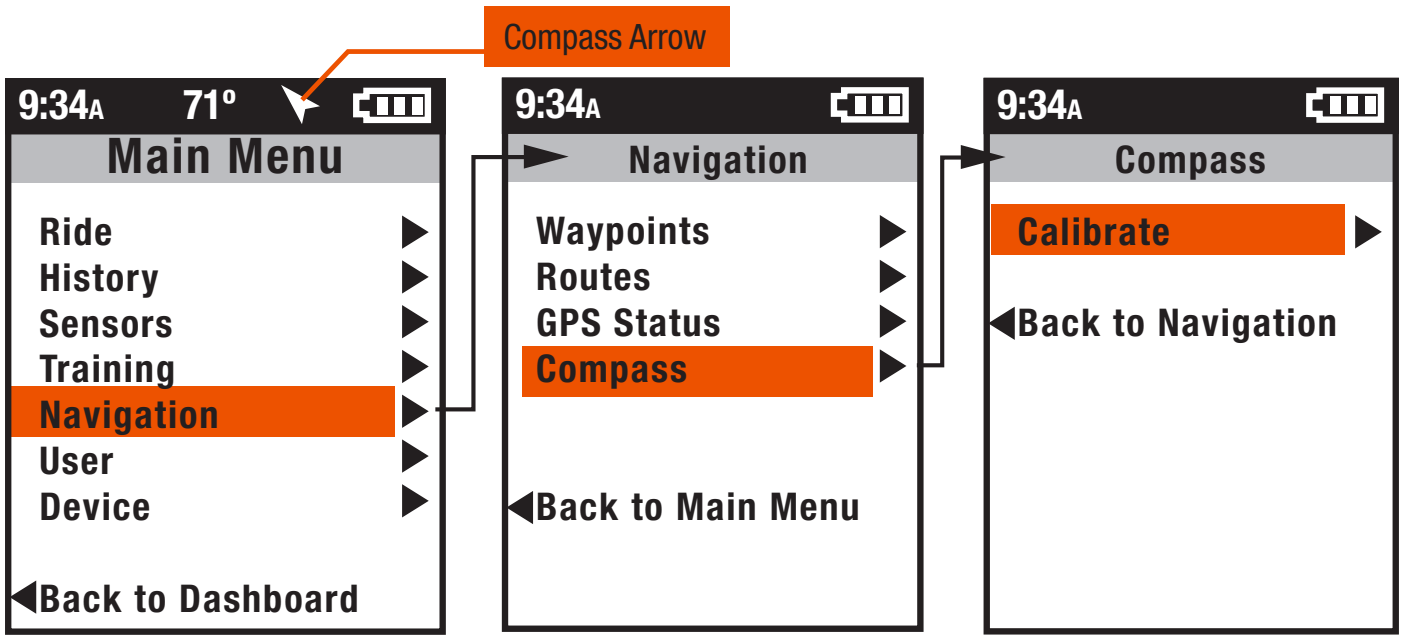
The Joule GPS contains a magnetic compass. The arrow near the right side of the Title bar on the dashboard points North, regardless of your direction of travel. It is good practice to calibrate the compass upon receipt of the device as well as after each firmware upgrade.

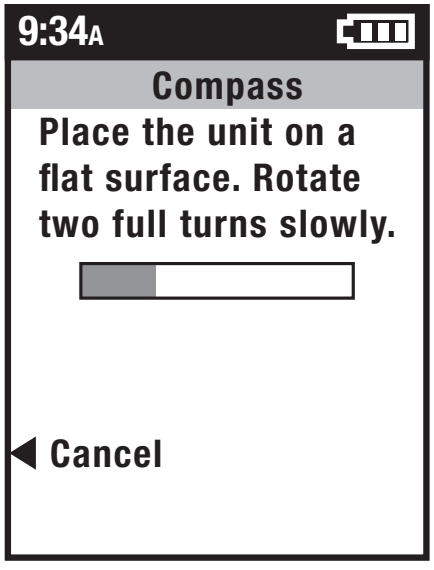
FROM DASHBOARD

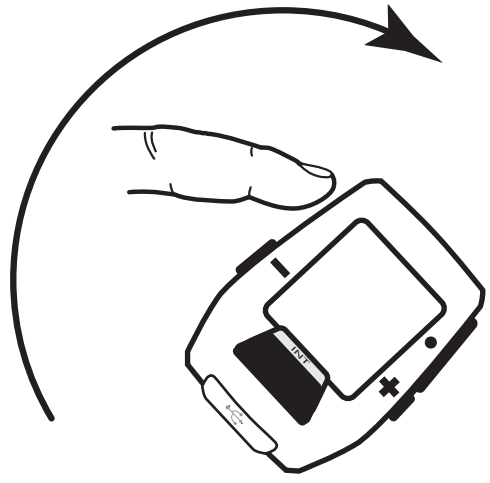


• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Navigation; Press •[ENTER] ; Select Compass, Press •[ENTER] Select Calibrate, Press •[ENTER]





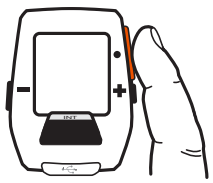


CHAPTER 6: RIDE HISTORY

HISTORY OVERVIEW

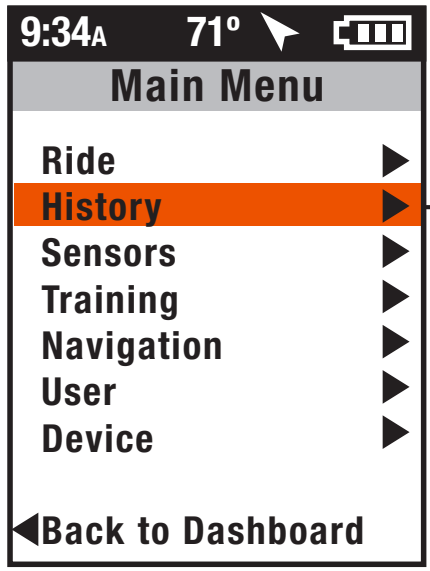
The Ride History area allows access to previous rides and ride summaries stored on the Joule GPS. You can select a full ride, a ride summary, or display a report. Reports compare current ride metrics against averages over a specific time frame (e.g. 1 week, 2 week, 1 month, etc.). A full ride can be converted to a route or a workout. When a full ride is deleted from the device, the ride summary info always remains so that the weekly and monthly history reports can be calculated.

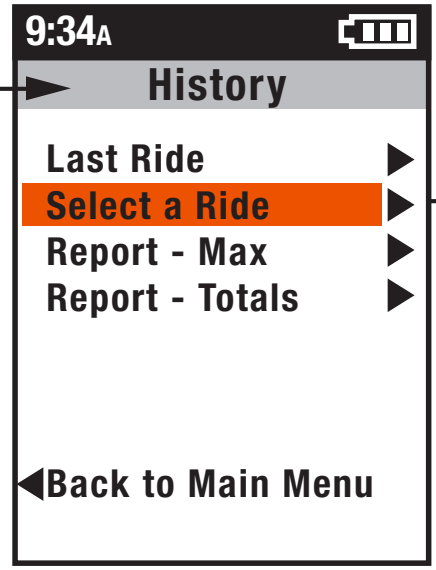
FROM DASHBOARD

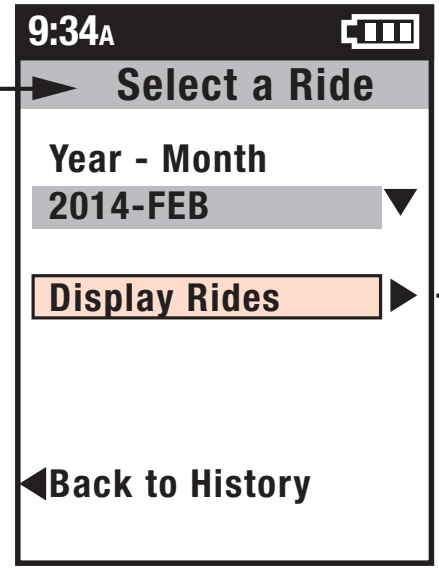


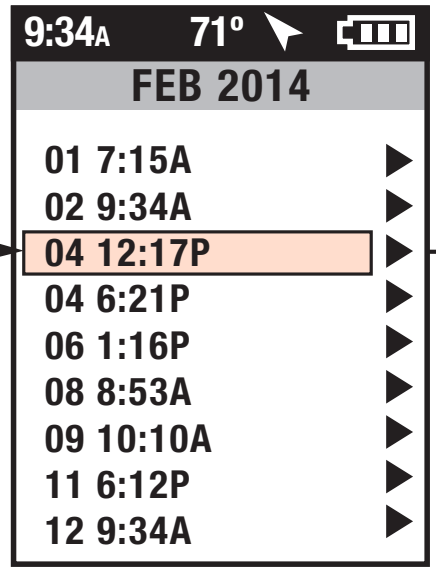
• [ENTER]

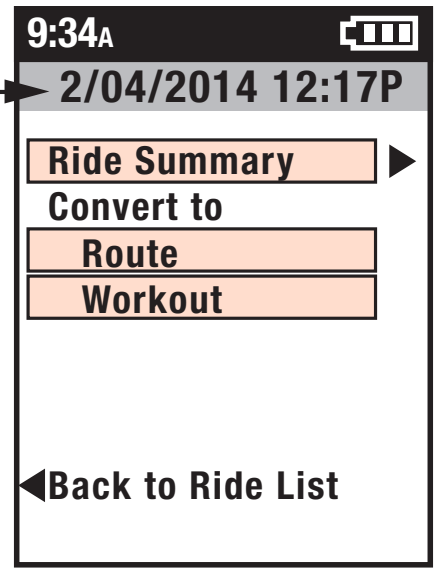
Press & Hold 3 sec. to enter Menus. Scroll to History; Press •[ENTER] ; Select a ride or report.











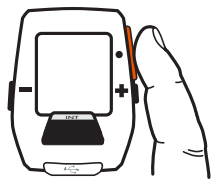
TIP: When navigating pages in the Menu system the [INTERVAL] button acts as the "back" button.

CHAPTER 6: RIDE HISTORY

SUMMARY REPORTS

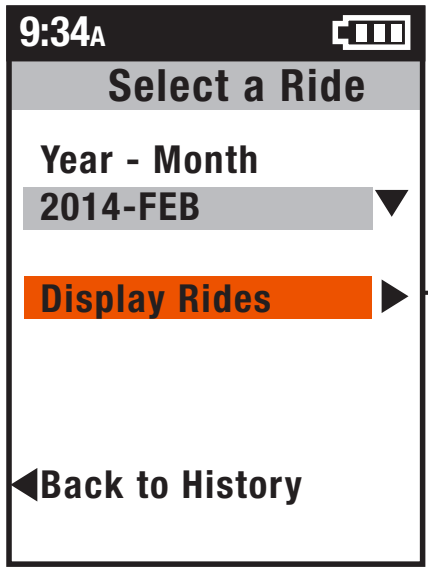
The Joule GPS can create summary reports comparing one of your rides to ride averages over a previous time frame. Report types include summaries of ride data related to Peak Power, Work, Climbing, Time in Zones, and more. Once a ride is selected, the ride data is compiled into a report. The report compares metrics from the selected ride to averages over the previous week, or 2 weeks, or 4 weeks, up to 12 months prior. The data is either averaged by Date or by Ride (see explanation below). Note: the historic averages do not include the selected ride.

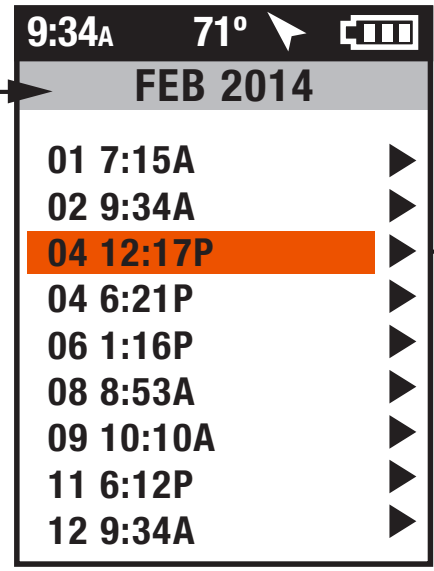
FROM DASHBOARD

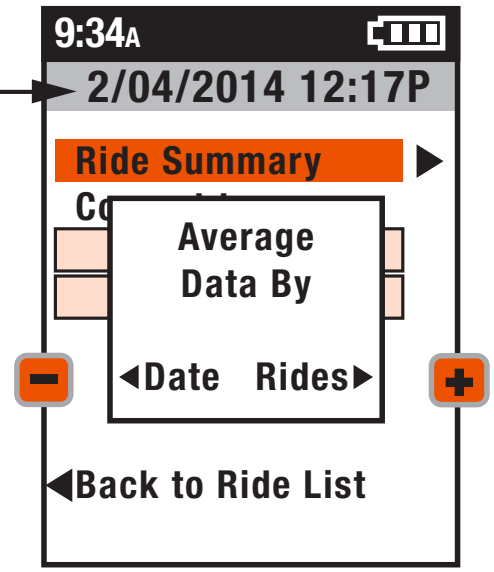


•[ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to History; Press •[ENTER] ; Select a report, Press •[ENTER]

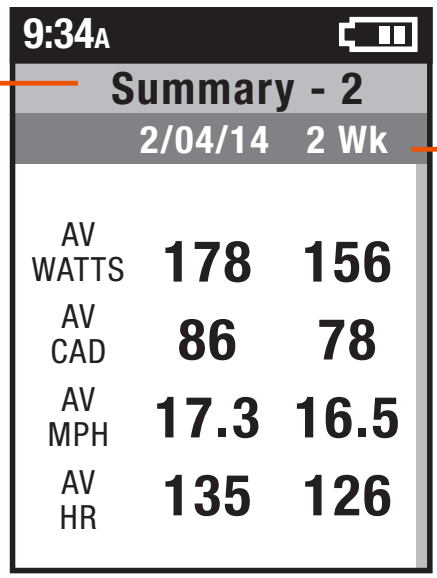






Press •[ENTER] to scroll to each report:
- **Summary 1 & 2**
- **Pwr Detail 1 & 2**
- **Work**
- **Peak Pwr 1 & 2**
- **Time in Zones**
- **Climbing**
- **Surges**

Press [INTERVAL] to view previous report.



Press +[PLUS] to scroll to the next time frame. Press -[MINUS] to return to previous time frame.

Average by Date gives the average for the whole time period. Every non-riding day during the given period of time will be calculated as zero.

Averages by Ride gives the average by the total number of rides for the given time period. If only 3 rides were completed during a 2 week period the average will be given for 3 rides.

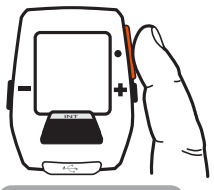
REPORTS, Continued

There are two additional types of ride history reports:

- **Maximums**: Compare maximums from all rides stored on Joule with averages over the selected time frame.
- **Totals**: Compare ride data totals over the selected time period with averages over the same time frame.

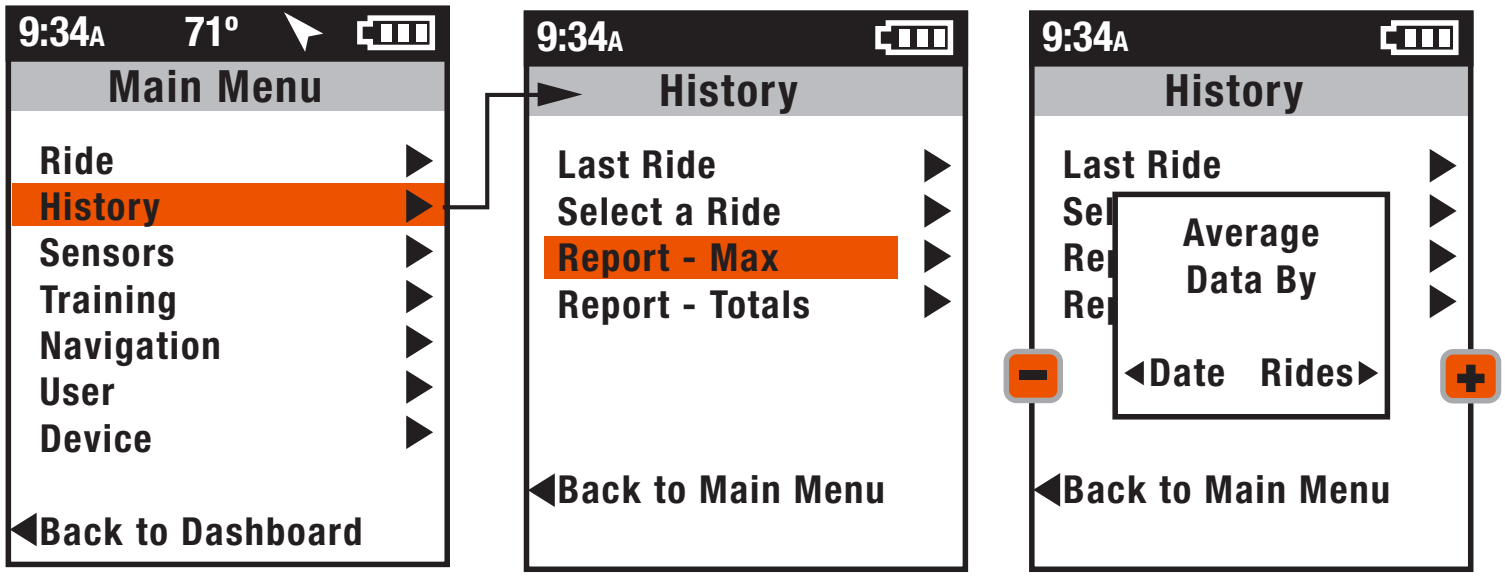
For more information on the details of the report, see appendix A.

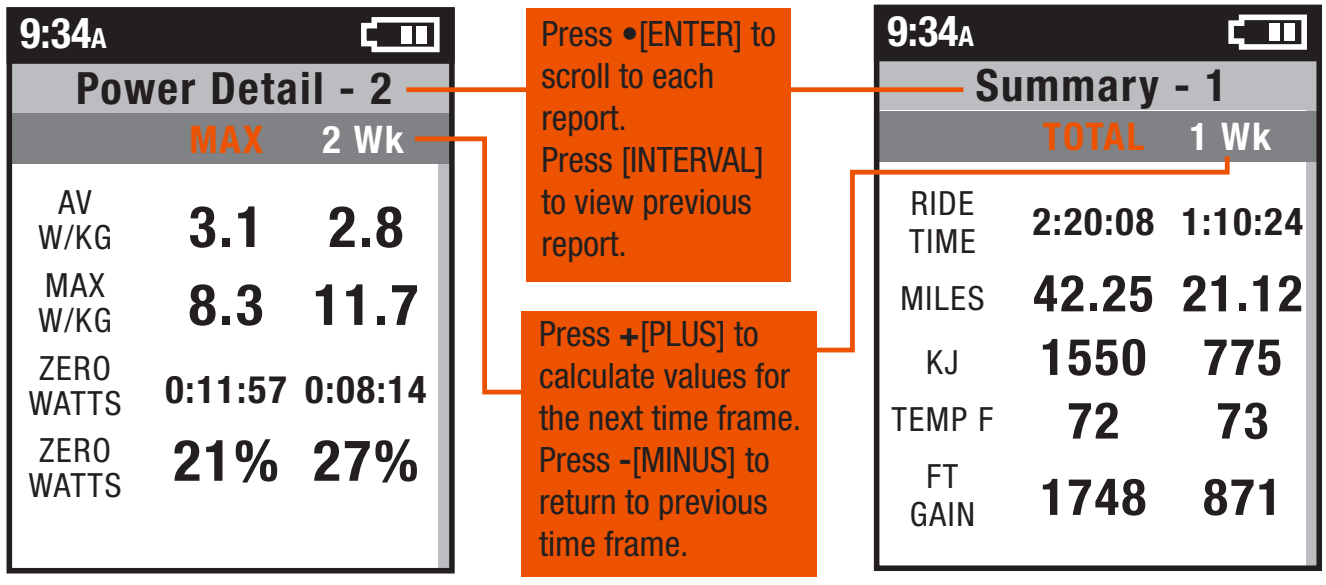
FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to History; Press •[ENTER] ; Select a report.





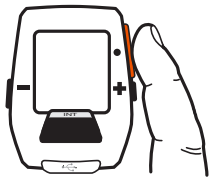
CONVERT RIDES

Rides stored on the Joule GPS can be converted into routes or workouts. The conversion must be done from a full ride file stored on the Joule. There are two types of ride files stored on your Joule GPS:

- Full Ride files contains all ride data, including GPS and elevation data necessary for conversion to Route or Workout.
- Ride summary files contain only a small amount of data used by reports. The summary files are the smaller files that remain after a ride is cleared.

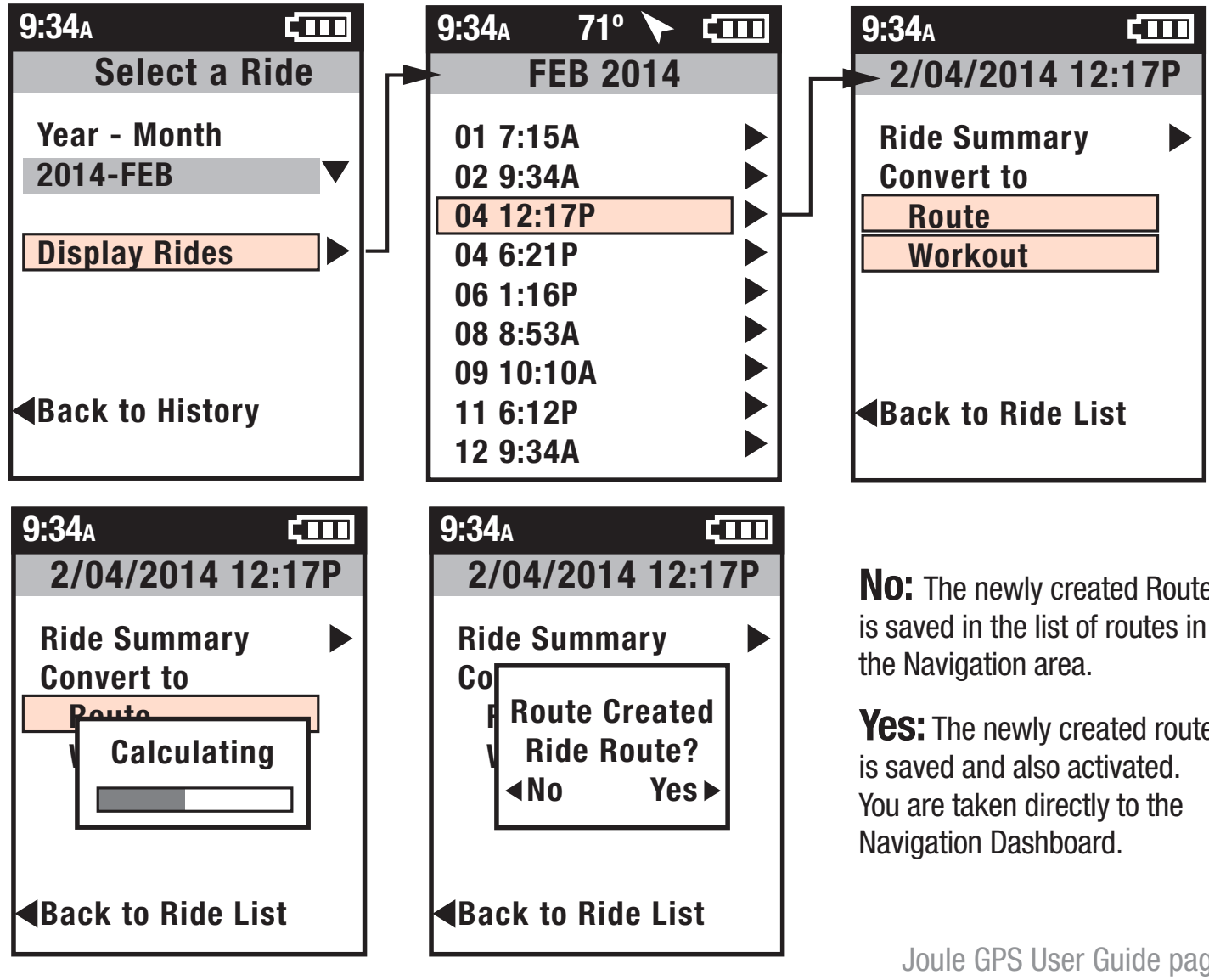
Ride files can be managed using PowerTap PowerAgent software.

FROM DASHBOARD



•[ENTER]

Press & Hold
3 sec. to enter
Menus.
Scroll to History;
Press •[ENTER] ;
Scroll to Select a Ride;
Press •[ENTER] ;



No: The newly created Route is saved in the list of routes in the Navigation area.

Yes: The newly created route is saved and also activated. You are taken directly to the Navigation Dashboard.

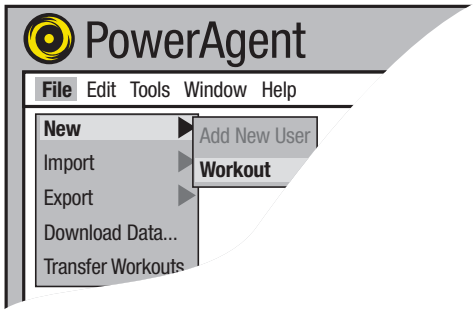
TRAINING using WORKOUTS

The Joule GPS has a robust set of features that assist in training. These features include the cability to:

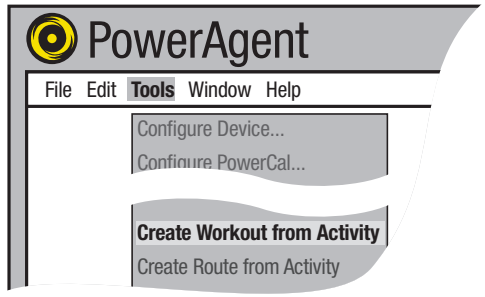
- Create, manage and follow a Workout, either outdoor or indoor using the CycleOps PowerBeam Pro Trainer;
- Set up Auto Laps based on time, distance or GPS position;
- Set a Countdown reminder using time, distance or quantity of work.

Create and manage the workout scripts using the PowerTap PowerAgent application software.

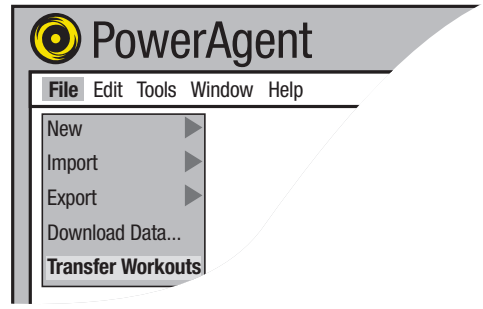
Within PowerAgent, the workout can be created manually...



...or converted from a previous ride activity.

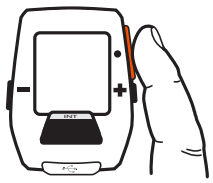


then transferred to the Joule GPS.



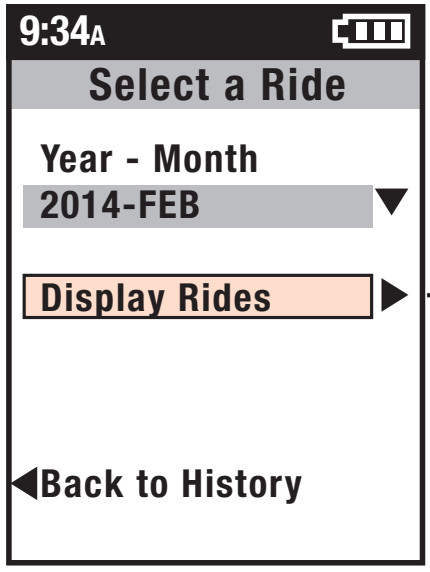
You can also convert a ride to a workout directly on the Joule GPS.

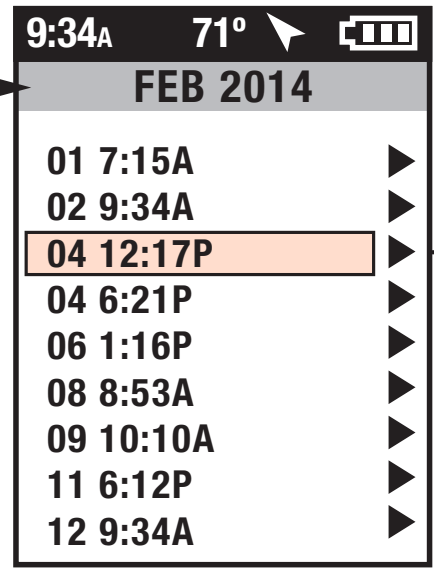
FROM DASHBOARD

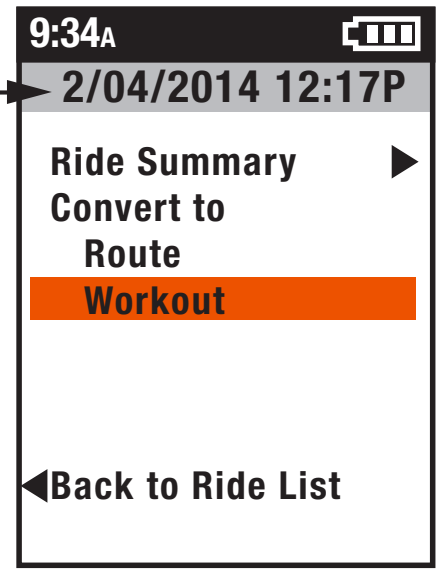


• [ENTER]

Press & Hold
3 sec. to enter
Menus.
Scroll to History;
Press •[ENTER] ;
Scroll to Select a Ride;
Press •[ENTER] ;





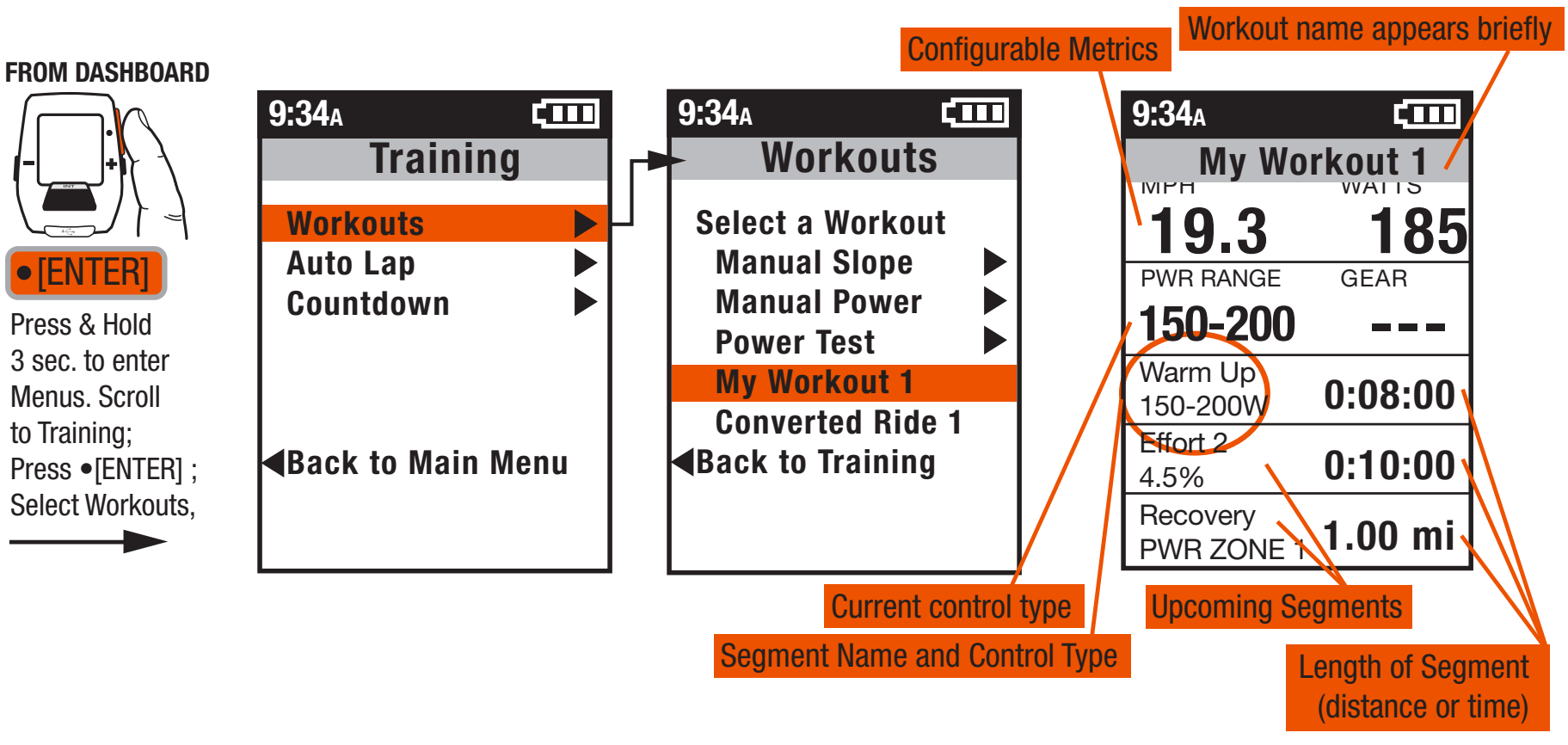


TRAINING with PowerBeam PRO using Scripted WORKOUTS

When creating a“scripted” workout, resistance can be based on:

- Target Slope - mimicking the resistance of a specific grade or incline.
- Target Power - a specific resistance value in terms of watts.
- Power Range - resistance within a range of wattage values.
- Power Zone - a number representing a range of power values.

The length of each segment can be based on distance or time. To initiate a scripted workout, select it from the list of workouts. To skip completion of individual workout segements press the [INTERVAL] button.



NOTE: The “Gear” window is only active and relevant when the Joule GPS is paired to a CycleOps i400 series indoor cycle. Manual Slope and Manual Power **are only displayed** in the Workouts menu if the Joule GPS is paired to a PowerBeam Pro. You can also ride a power-based workout outdoors as well as with any trainer.

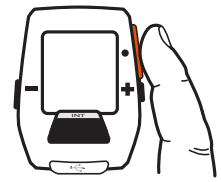
TRAINING with PowerBeam PRO using Manual WORKOUTS

Manual or “unscripted” workouts are exclusively available when using the CycleOps PowerBeam Pro trainer or i400 Series indoor cycles. When paired to one of these units, two additional choices appear in the Workouts menu:

- Manual Slope: Target Slope Mode - set the resistance to mimic a specific grade or incline percentage.
- Manual Power: Target Power Mode - set the resistance to a specific power value.

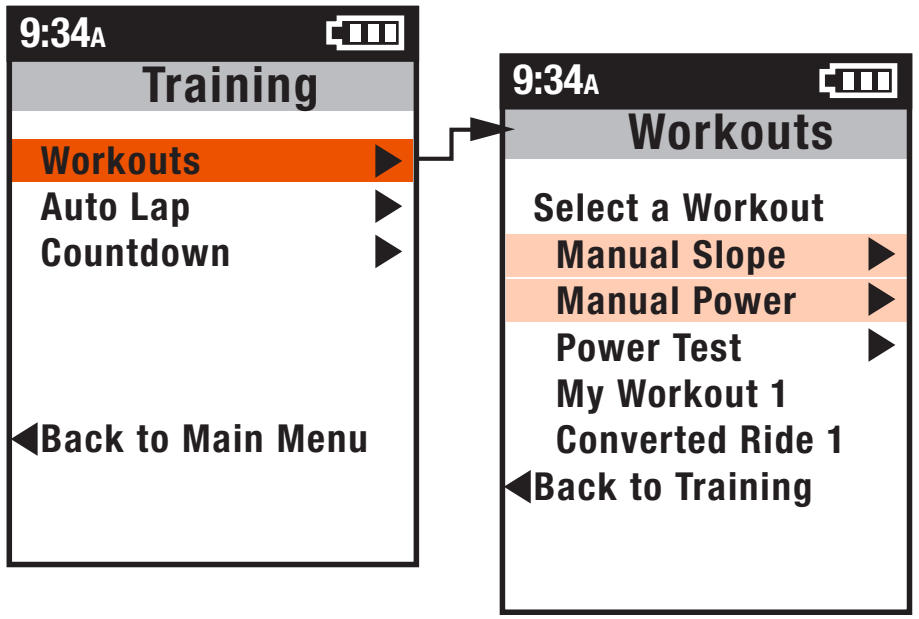
No workout script is necessary. The user can manually increment or decrement the slope or power resistance value during the workout using the +[PLUS] and -[MINUS] buttons. To end a Manual workout early, press and hold the -[MINUS] button.

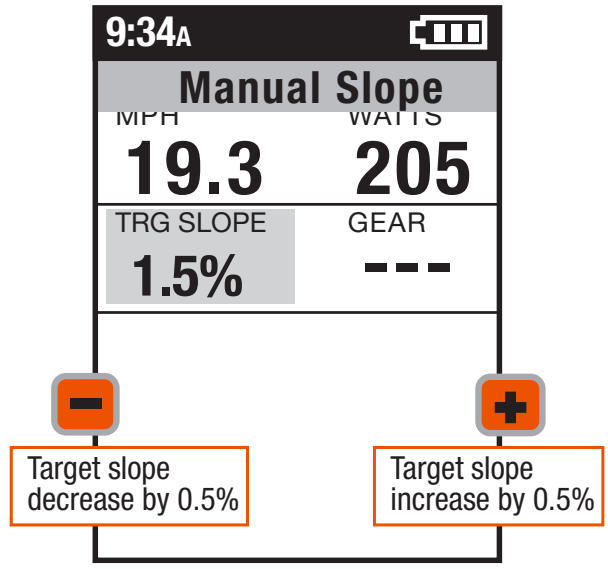
FROM DASHBOARD

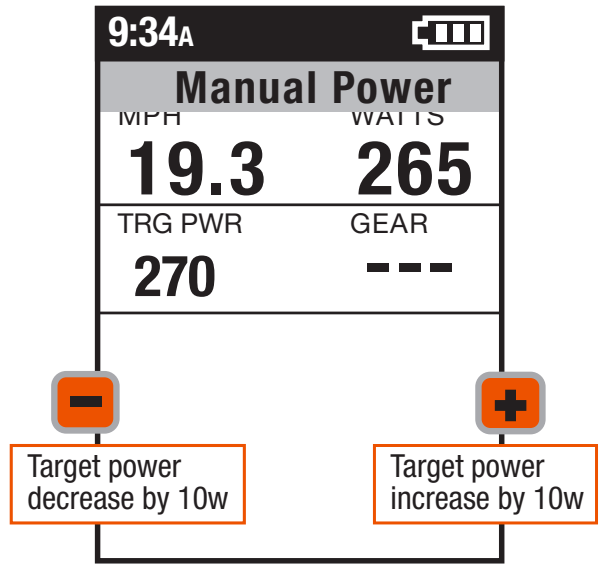


• [ENTER]

Press & Hold 2 sec. to enter Menus. Scroll to Training; Press •[ENTER] ; Select Workouts,





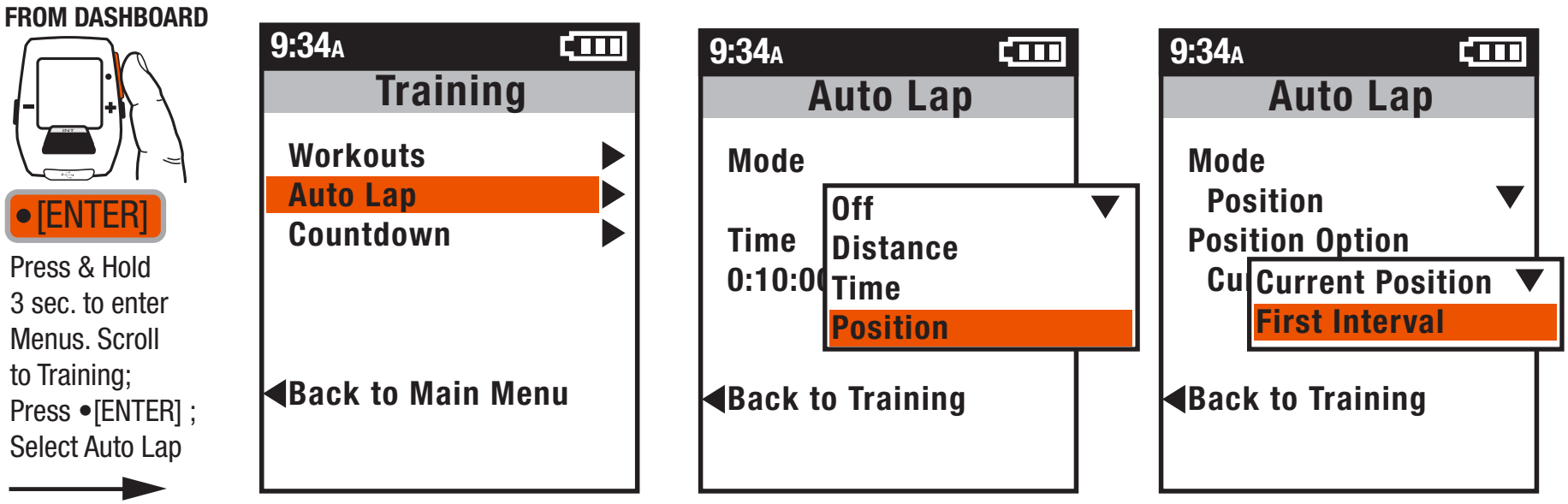


NOTE: The “Gear” window only applies to an i400 Series indoor cycle when a slope-based segment or Manual Slope Mode is active. The bike can be “shifted” when the Gear window is highlighted. The +[PLUS] and -[MINUS] buttons apply to what is highlighted, Target Slope or Gear increment/decrement. To move the highlight hold down the +[PLUS] button briefly.

Also, Manual Slope and Manual Power **are only displayed** in the Workouts menu if the Device is paired to and communicating with a PowerBeam Pro or i400 Series Indoor Cycle.

TRAINING using AUTO LAP

Auto Lap allows you to set the Joule GPS to record laps automatically during your ride based on either time , distance traveled, or passing a specific GPS position point. The lap is automatically marked and will appear on the Interval dashboard. Select Off to turn Auto Lap off. NOTE: Auto Lap only functions when the Joule is set to “Lap Mode” (see Device, chapter 8)



MODE	AUTO LAP MENU OPTION
Distance	Select Distance, scroll to and enter the amount of distance you want to travel before the interval is marked.
Time	Select Time, scroll to and enter the amount of time that you want to pass before the interval is marked.
Position	Select Position, scroll to Position Option, press •[ENTER]. Choose either Current Position or First Interval to set the GPS position of where the interval will be marked. Current Position indicates that each time you pass your current position on earth an interval will be marked. Choosing First Interval indicates that the position marker will be set when you press the interval button the first time. Each time you pass that point on earth an interval will be marked.

TIP: Use Auto Lap in Position Mode when participating in a criterium or cyclocross event to automatically count each lap. Set the Position Option to “First Interval” prior to warmup. When you get to the start line press the interval button, indicating a lap will be marked each time you pass this point (within 20-30 meters of the waypoint).

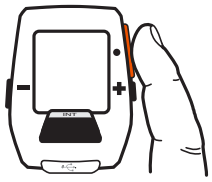
TRAINING using COUNTDOWN

Countdown allows you to set the Joule GPS to notify you when a specific:

- Distance has been traveled;
- Amount of time has passed;
- Amount of work has been completed (measured in kilojoules).

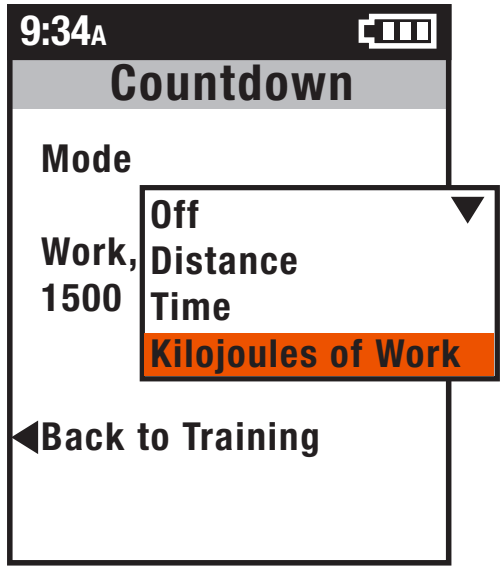
In order to use the Countdown feature you must select the Countdown metric for display in one of your Dashboards. See chapters 3 and 8, and Appendix C for more information on setting display metrics.

FROM DASHBOARD



•[ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Training; Press •[ENTER] ; Select Countdown,



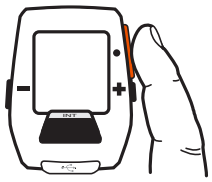
MODE	**COUNTDOWN** MENU OPTION
Distance	Select Distance, scroll to and enter the amount of distance to travel before being notified.
Time	Select Time, scroll to and enter the amount of time that should pass before being notified.
Kilojoules	Select KJs, scroll to and enter the amount of kilojoules of work completed before being notified. Note: Kilojoules Countdown only applies when power measurement is present.

CHAPTER 8: DEVICE MENU

DEVICE Overview, DATE & TIME

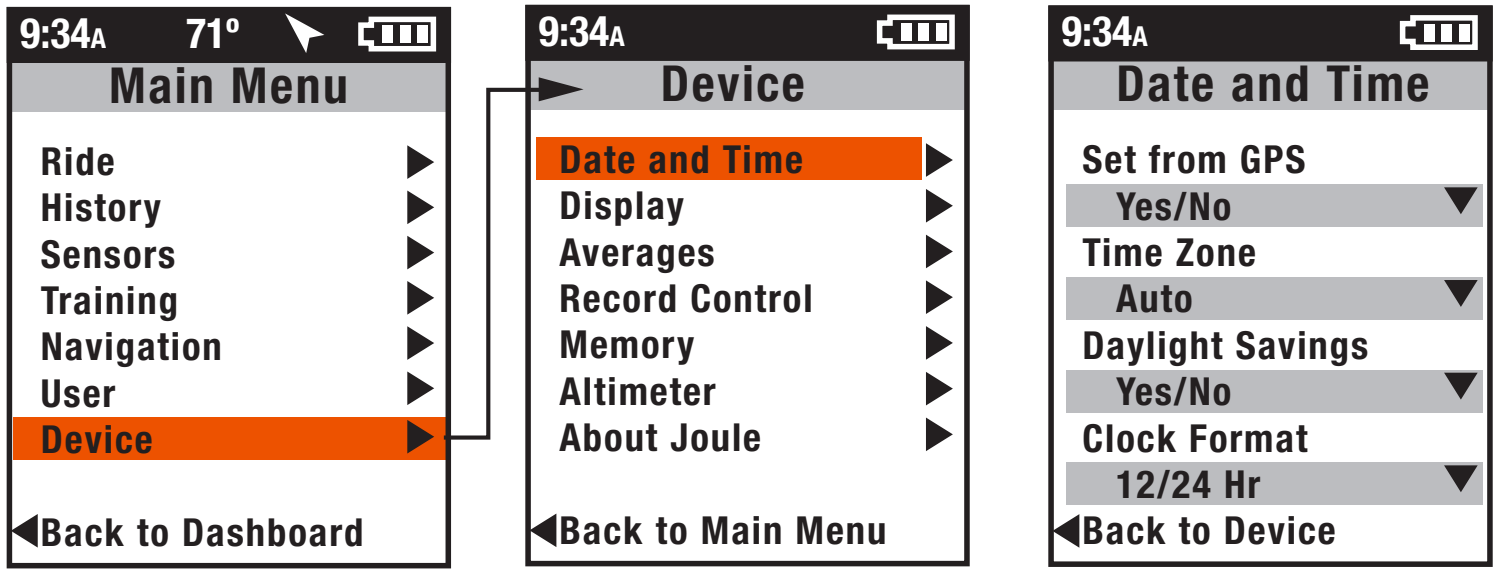
The final choice on the Main Menu has to do with configuring the device itself. This includes time and date settings; display settings (dashboard configuration, lighting, sleep, language and units); device memory management, data recording control, odometer management, display smoothing and averaging, the altimeter offset and information about the Joule GPS itself, such as firmware version numbers.

FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,



DATE & TIME MENU MENU INPUT OPTION

Set from GPS	Yes/No. Yes means the time is set from GPS data. No means the time is set manually.
Time Zone	Auto or UTC time. Select Auto to set the time zone automatically. Select the associated UTC time zone for your area to set the time zone manually. When operating the Joule GPS near the boundary of a Time Zone, the Auto setting may not work well. To avoid inconsistencies, Select the UTC time.
Daylight Savings	Yes/No. Yes means Daylight Savings Time is active in your current location and the clock will be adjusted accordingly. No means Daylight Savings Time is not active.
Clock Format	12/24. Set the clock to display 12 hour or 24 hour format.

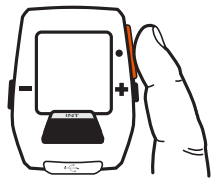
TIP: Coordinated Universal Time (UTC) is basically "world time." UTC time zones begin at Longitude 0 (zero), the Prime Meridian. Example: In the United States, Central Standard Time is 6 hours less than UTC time (UTC minus 6 or UTC-6); Pacific Standard Time is 8 hours less UTC time (UTC-8). When Daylight Savings Time is in effect, subtract 1 hour from U.S. UTC values. In Europe, Central European Time is 2 hours more (UTC+2). In Asia, Hong Kong Time is 8 hours more (UTC+8).

CHAPTER 8: DEVICE MENU

DEVICE DISPLAY

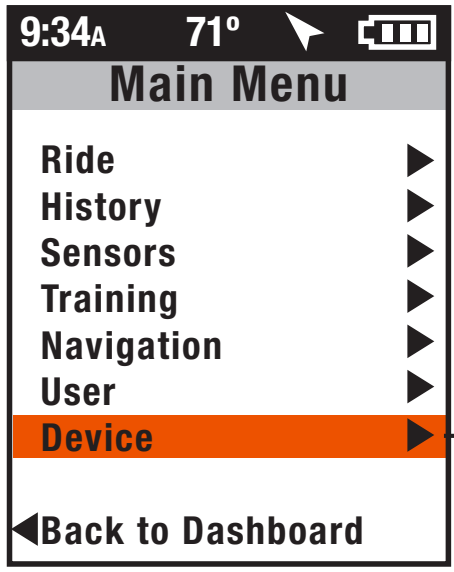
All of the Dashboard configuration, lighting levels, sleep, language, metrics, and units can be set in the Device Display area. You can determine the number of dashboards to display, as well as the number and type of metric associated with each dashboard. See Appendix C for a full list of all metrics.

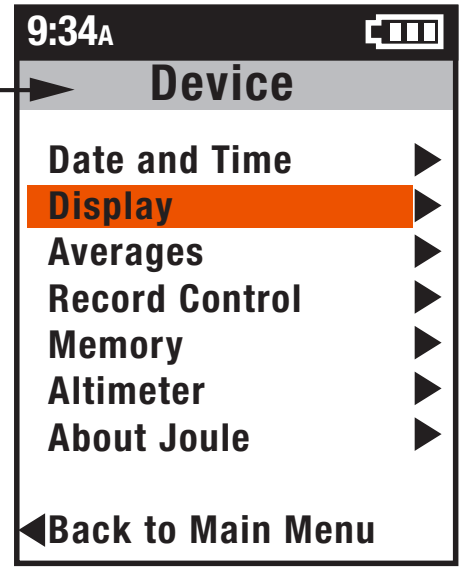
FROM DASHBOARD

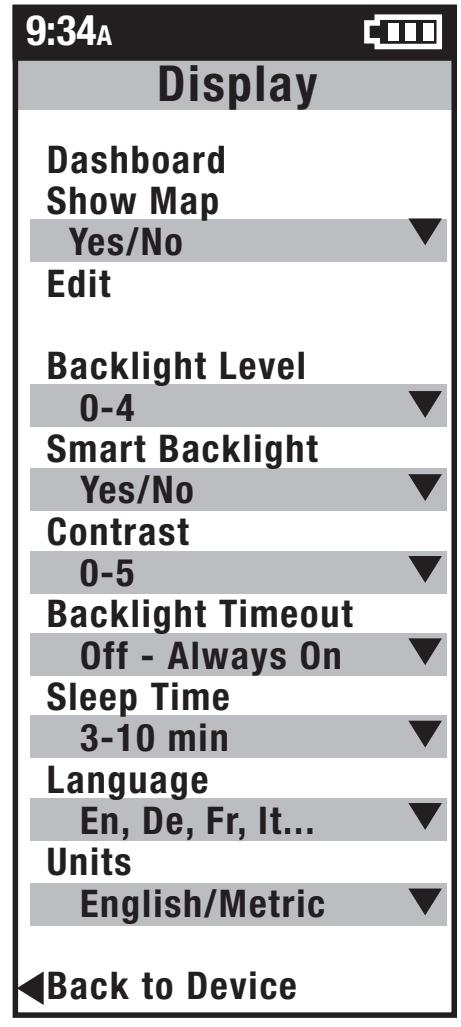


•[ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,







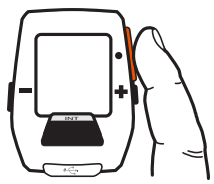
DISPLAY MENU	MENU INPUT OPTION
Dashboard	Change number of metric display windows & individual metrics within each Dashboard
Show Map	Yes/No. Yes to display Map Dashboard. No to not show in list of Dashboards.
Edit	Select metrics to be displayed above map on Map Dashboard.
Backlight Level	0-4. Level of backlight brightness.
Smart Backlight	Yes/No. Yes means, when the Joule GPS is on, the backlight will automatically turn on, 15 minutes before sunset and turn off 15 minutes after sunrise. The GPS location is used to determine when sunrise and sunset occur.
Contrast	0-5. Level of screen contrast.
Backlight Timeout	Never on, 10 sec, 20 sec, 30 sec, 1 min, Always On.
Sleep Time	3, 5, or 10 min. Period of inactivity before device goes into sleep mode.
Language	Display language: English, Deutsch, Français, Italiano, Español, Nederlands.
Units	Display units: English or Metric

DEVICE AVERAGING

The Device Display Averaging page allows you to adjust the way Power and Cadence data is presented during a ride. Select a specific amount of time to average the raw second-by-second data values for power and/or cadence, prior to display. The result is a smoother, steadier value displayed to the rider, over the duration of the ride. The raw data is still written to the ride file.

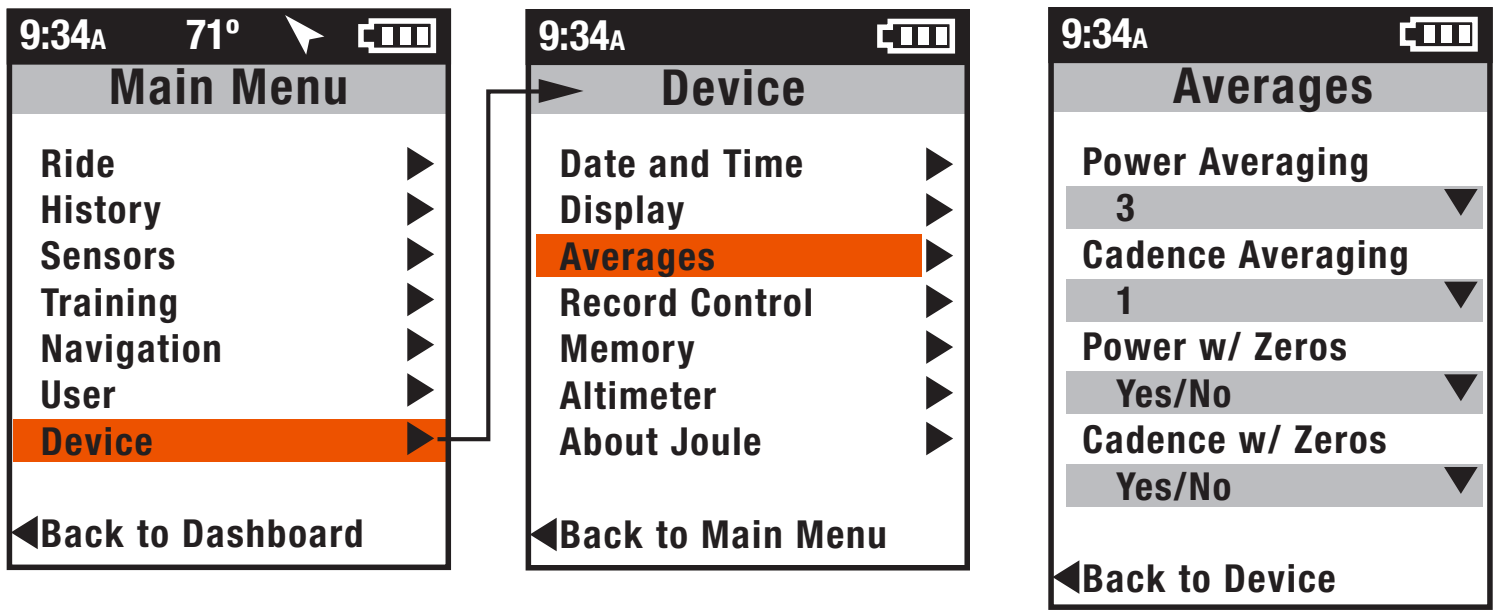
Another setting associated with Device Averaging is calculating and displaying averages with or without values of zero. For example, to view your average cadence while not including time spent coasting. Set "Cadence w/ Zeros" to "No." This will result in not including values of zero when calculating average cadence prior to anytime it is displayed on the device. Again, the raw data written to the ride file will include zeros.

FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,



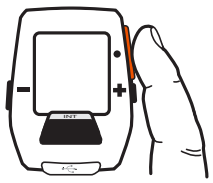
AVERAGES MENU	MENU INPUT OPTION
Power, Cadence Averaging	Selecting 1,3,5,10 or 30 seconds sets the amount of time the raw second-by-second value will be averaged prior to displaying. The greater the time selection, the steadier the value displayed, the slower the response to a change in power or cadence. The default is 1 second, meaning display the data without averaging.
Power, Cadence w/ Zeros	Selecting Yes or No sets the Joule to calculate averages related to power or cadence with or without zeros. The default is Yes, calculate averages with zeros.

DEVICE RECORD CONTROL

The Record Control page allows the user to set:

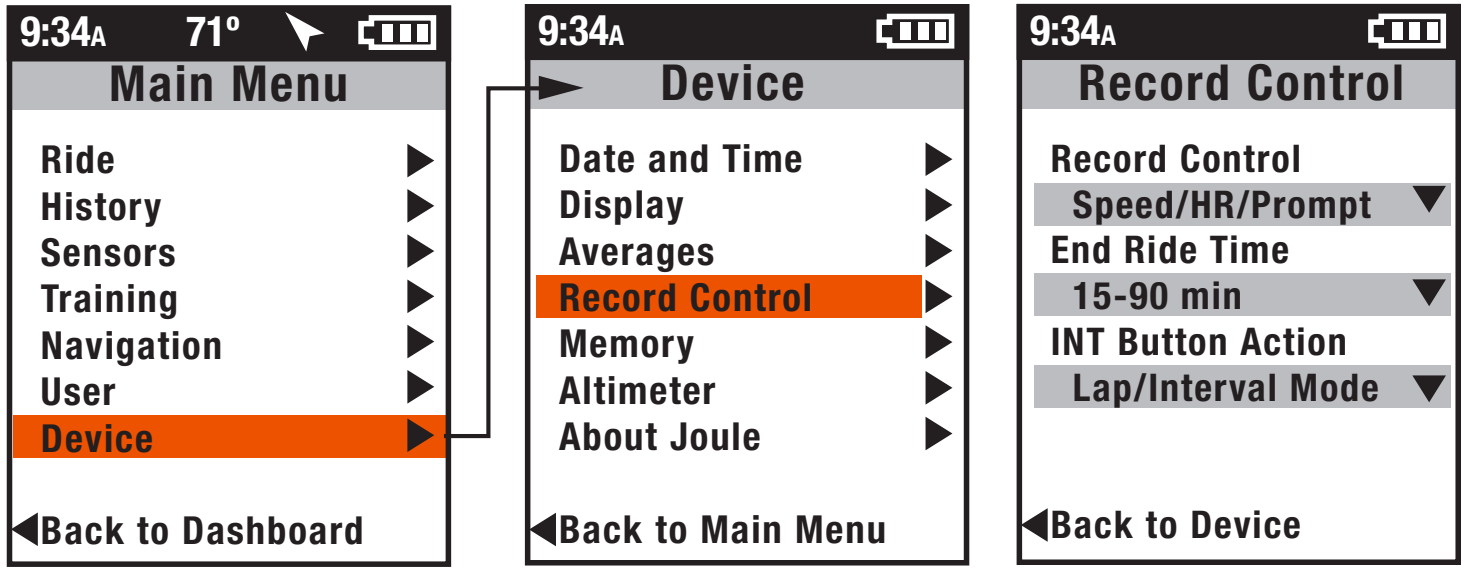
- How the Joule GPS records data during a ride,
- When the ride recording is automatically saved,
- How the [INTERVAL] button works when pressed.

FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,



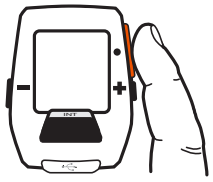
RECORD CONTROL MENU MENU INPUT OPTION

Record Control	Speed, Heart Rate, or Prompt. Sets when ride data will be recorded. -Select **Speed** to record whenever speed is present and greater than 3.6 kph (2.2 mph), via either the hub, a speed sensor or the GPS . -Select **Heart Rate** to record when a heart rate is present. -Select **Prompt** when you want to manually start and stop recording your ride.
End Ride Time	15, 30, 60, 90 minute and Never options for auto saving a ride once it is ended. For example: Selecting the 30 min option would cause the ride to automatically save after 30 minutes of inactivity. “Never” means the user will save manually.
INT Button Action	Lap Mode or Interval Mode. Sets the action of the [INTERVAL] button, when pressed. **Lap Mode:** A traditional lap counter. Each press of the button stops recording the current lap and begins recording a new lap. **Interval Mode:** The first press of the button starts recording an interval. The next press of the button stops recording the interval.

DEVICE MEMORY

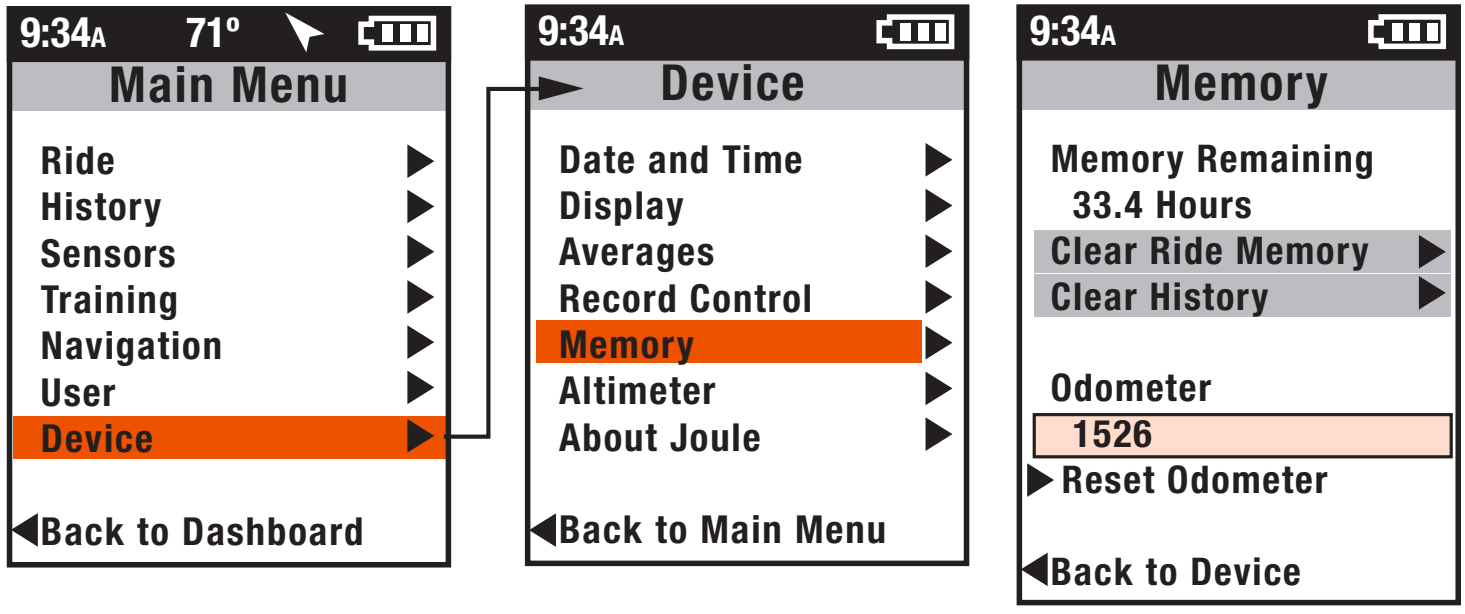
The Memory page allows the user to monitor and manage the space available on the Joule GPS. Also the odometer value can be monitored, updated or reset. Ride summary data, used for history reports (Chapter 6), and complete Ride files can be cleared here.

FROM DASHBOARD



• [ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,



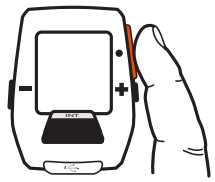
MEMORY MENU	MENU INPUT OPTION
Memory Remaining	The amount of ride storage space available, in terms of ride time.
Clear Ride Memory	Clears all ride files from device. Does not clear ride history data used for reports.
Clear History	Clears all ride history data (no data available for reports).
Odometer	Displays total miles or kilometers accumulated since device was put in service or since last reset. This number is editable by selecting it and pressing [ENTER]; Increase/decrease each digit using +/- buttons; Enter moves to next digit. Press Enter twice at end of field to exit field. Select Reset Odometer to reset ride time, and total Kilojoules of work to zero.

CHAPTER 8: DEVICE MENU

DEVICE ALTIMETER

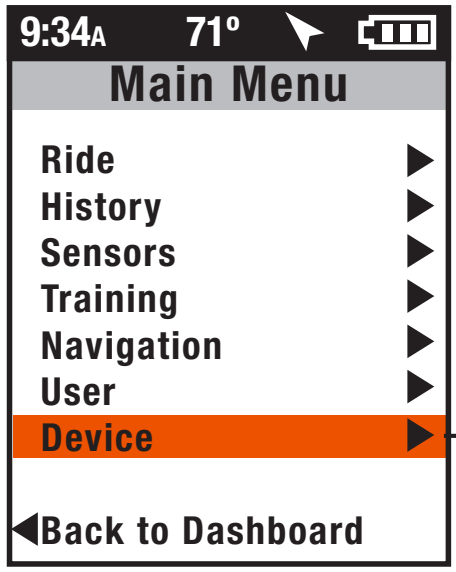
The Joule GPS contains a barometric Altimeter that allows you to monitor your current altitude, also referred to as current elevation. Selecting Altimeter in the Device menu shows the current altitude, as calculated from the barometer. You may set a known value for "home" altitude or the elevation of the starting point of the ride, and adjust the value of the current altitude to this known value.

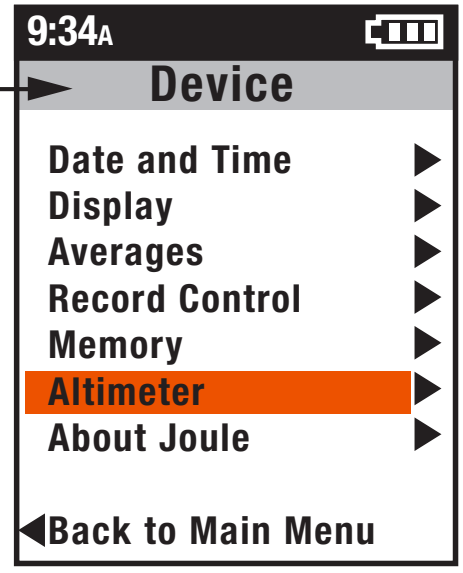
FROM DASHBOARD

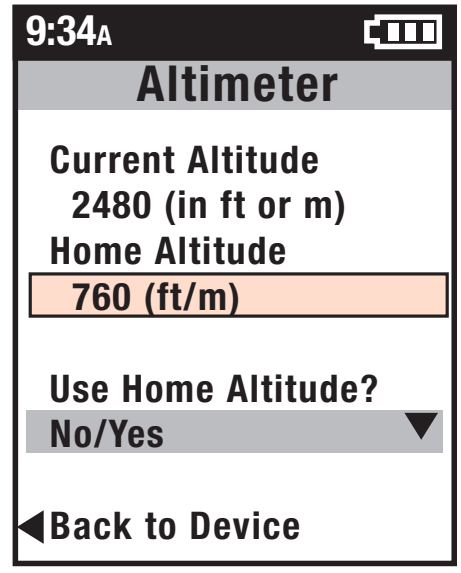


•[ENTER]

Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,







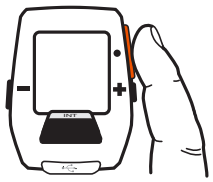
ALTIMETER MENU	MENU INPUT OPTION
Current Altitude	Displays the current altitude above sea level as calculated by the on-board barometric altimeter. This value is displayed in feet or meters, depending the device Units setting.
Home Altitude	Optional. Enter your actual home altitude/elevation here (from a known benchmark or topographic map data). This value will be used to establish an offset for any variances in actual barometer readings, making the displayed elevation value more consistent regardless of weather conditions. If you live below sea level, negative values can be entered as well.
Use Home Altitude?	Yes or No. Selecting Yes will direct the device to use the entered value of your Home Altitude as an offset from which to calculate barometer differentials. Selecting No will direct the device to disguard your Home Altitude offset use the default Sea level pressure of 1013.3mb as the base for all altitude calculations.

NOTE: The barometer in your Joule GPS is very sensitive to barometric pressure. If weather patterns are changing, resulting in a rising or falling barometer, the current elevation value will also change. The less stable the weather the less stable the elevation value. However, even if the weather is not clear and windless, it is the pressure differentials that are used to calculate elevation gains and losses, not the actual elevation change. The resulting calculation, during the relatively short time frame of any particular ride, is accurate.

DEVICE ABOUT JOULE

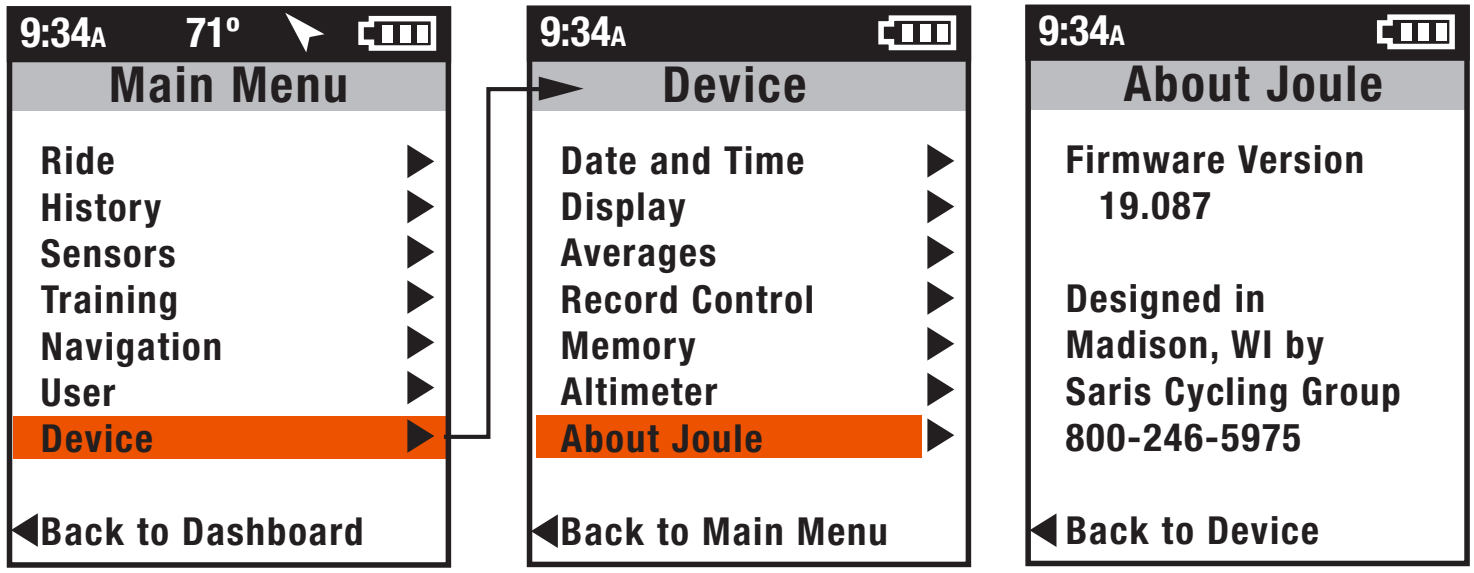
This screen contains information about the Joule GPS, including the version of firmware currently running on the device and the number for Customer Support, typically available Monday through Friday, 8 a.m. to 4:45 p.m., Central Standard Time.

FROM DASHBOARD



•[ENTER]

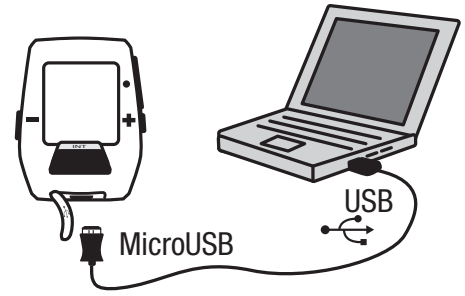
Press & Hold 3 sec. to enter Menus. Scroll to Device; Press •[ENTER] ; Select an option,



CHAPTER 9: DATA & DOWNLOADS

DOWNLOAD

To further configure the Joule GPS and customize the dashboards, install PowerAgent software from www.PowerTap.com/poweragent. PowerAgent also allows you to download and analyze your ride data, configure your Joule settings in a more user-friendly manor, manage route, workout, and waypoints, as well as upload your ride to different social media and social fitness sites.



CHAPTER 10: FAQ & TROUBLESHOOTING

FREQUENTLY ASKED QUESTIONS

For the most current FAQ's and troubleshooting please visit the customer support section of our website, www.PowerTap.com.

CHAPTER 11: IMPORTANT PRECAUTIONS and NOTES

IMPORTANT

- Keep eyes on the road. Do not become overly engaged with display.
- We recommend getting familiar with the computer functions while stationary.
- The computer and chest strap are water resistant, not waterproof. Avoid sustained water contact and do not deliberately place in water or under high-pressure sprays.
- Avoid spraying the unit directly with solvent. Do not use thinner or other solvents to clean parts.
- Failure to adhere to these precautions may cause premature failure or incorrect operation of the unit and may void the warranty.

Other Important Notes:

- Battery Life: The Joule GPS has a rechargeable battery that will last a significant amount of time when fully charged. However, some features of the Joule will use more power then others:
  - Displaying the Navigation dashboard for extended periods of time can impact battery life. A lot of processing power is required to keep the live map display up to date.
  - Setting the backlight to “always on” will impact battery life, although the Joule is still very efficient in terms of power usage when the backlight is in use.
  - Setting the backlight time out to a long period of time (something more then 30 seconds) will impact battery life, depending on how often buttons are pushed, causing the backlight to go on.
  - Setting the Smart Backlight option could impact battery life if a significant amount of time is spent using the device at night.
- GPS signal lock time can vary depending on environmental conditions. See Appendix D for more detailed information on GPS signal locking.

CHAPTER 12: FEATURES AND TECHNICAL SPECIFICATIONS FOR JOULE GPS

JOULE GPS FEATURES

3 Customizable Dashboards
Altitude
Auto Lap marking via time, distance, or position
Battery Level Indicator (sensors, Joule GPS)
Cadence (current, average, maximum)
Countdown timers (Time, Distance, Kilojoules)
Current Heading
Distance Remaining in Workout
Distance to Next Route Point
Distance to Ride Partner
Heading to Next Route Point
Heart Rate (current, average, maximum)
Heart Rate Zone
Intensity Factor (IF)
Intervals Summary Screen
Kilojoules
Kilojoules per Hour
Normalized Power (NP)
Peak Power (5 second, 5 minute, 20 minute)
Pedal Balance (Current, Average)
Percent Grade (Current, Average)
Power (Current, Average, Maximum)
Power Zone (Current, Average)
Recording options of Speed, Heart Rate, and Prompt
Ride Distance
Ride Pacing
Ride Summary Reports
Ride Time
Routing
Speed (Current, Average, Maximum)
Surge Count (w/kg, ranges: 4-6, 6-8, 8+)
Temperature
Time of Day
Time Remaining in Workout
Time to Ride Partner
Total Ascent
Total Kilojoules
Training Stress Score (TSS)
VAM (Vertical Ascent in Meters)
Watts per Kilogram (Current, Average, Maximum)
Workouts, scripted and unscripted

CHAPTER 12: FEATURES AND TECHNICAL SPECIFICATIONS FOR JOULE GPS

JOULE GPS TECHNICAL SPECIFICATIONS

ANT+™ Compatible	Yes
Barometric Altimeter	Yes
Battery	Rechargeable
Battery Life	Approximately 20 hours
Display Size	40L x 30W (mm)
Display Type	Dot matrix (128x160)
Download cable	Micro USB
Interval button	Yes
Mount Type	Stem/Handlebar, Front
Operational Temperature	0-140 F degrees
Ride History	1 year
Ride Memory	Approximately 80 hours
Unit Dimensions	78L x 53W x 26D (mm)
Water Resistant	Yes, IPX 7
Weight	70 grams

CHAPTER 13: Warranty

WARRANTY
In the event that warranty service is required, original sales receipt may be required.

The Joule is warranted to the original retail purchaser to be free from defects in materials and workmanship. Warranty coverage is valid to the original purchaser only and proof of purchase will be required.

- Electronics
  - 1 year
  - 2 years (Europe)

THIS WARRANTY DOES NOT COVER:

- Normal wear and tear.
- Any damage, failure or loss caused by accident, misuse, neglect, abuse, improper assembly, improper maintenance or failure to follow instructions or warnings in User Guide.
- Use of products in a manner or environment for which they were not designed.

LIMITATIONS
The foregoing warranties are in lieu of and exclude all other warranties not expressly set forth herein, whether expressed or implied by operation of law or otherwise, including, but not limited to, warranties of merchantability or fitness for a particular purpose. Saris Cycling Group shall in no event be liable for incidental or consequential losses, damages or expenses in connection with its exercise products. Saris Cycling Group's liability hereunder is expressly limited to the replacement of goods not complying with this warranty or, at Saris Cycling Group election, to the repayment of an amount of the purchase price of the exercise product in question. Some states do not permit the exclusion or limitation of implied warranties or incidental or consequential damages, so the preceding limitations and exclusions may not apply to you.

PROCEDURES
Warranty service will be performed by Saris Cycling Group or an authorized Saris Cycling Group Dealer. The original purchaser must provide proof of purchase. Service calls and/or transportation to and from the Authorized Saris Cycling Group Dealer are the responsibility of the purchaser.

- Saris Cycling Group will have the option to repair or replace any product(s) which requires warranty service.
- Saris Cycling Group will replace any unit that is structurally defective with a new unit or replace the unit with a unit of equal value.
- In the event a product cannot be repaired, Saris Cycling Group will apply a limited credit reimbursement toward another PowerTap product of equal or greater value.

Appendix A: HISTORY REPORTS

Summary Report Definitions

Ride Time
Time of ride defined as any time spent moving. Note: time spent stopped can be included if Joule Mode settings are changed from speed record control to heart rate record control.

MI/KM
The ride length from start to finish measured in miles or kilometers.

KJ
Kilojoule (1000 Joules). A Joule is unit of work equal to the work done by a force of 1 newton to move an object a distance of 1 meter. Kilojoules are a common unit used to express the total volume of work accomplished during a given workout, ride, or exercise bout. Kilojoules are used to express the total training load. One Joule per second equals 1 watt. The average power output in watts multiplied by the time in seconds divided by 1000 equals the total amount of work, during the specified time frame, in kilojoules.

TEMP C/F
The current temperature measured by the Joule's internal sensor.

AV WATTS
1. Average power during a ride. 2. A common unit used to express effort or intensity amongst cyclists. Note: Average calculation may or may not include zeros (time spent coasting or with no power) depending on Joule's set up. By default, zeros are included. For 2 WK, 4 WK rolling averages are time weighted over the selected period.

AV CAD
Average pedal revolutions per minute during a ride. Note: Average calculation may or may not include zeros (time spent coasting or with no power) depending on Joule's set up. By default, zeros are included. For 2 WK, 4 WK rolling averages a time-weighted average over the selectable time period is used.

AV MPH/KPH
Average speed in miles per hour or kilometers per hour during a ride.

AV HR
Average heart rate in beats per minute during a ride. Note: For 2 WK, 4 WK rolling averages, a time weighted average over the selectable time period is used.

Appendix A: HISTORY REPORTS

Power Detail Report

AV WATTS
1. Average power during a ride. 2. A common unit used to express effort or intensity amongst cyclists. Note: Average calculation may or may not include zeros (time spent coasting or with no power) depending on Joule's set up. By default, zeros are included. For 2 WK, 4 WK rolling averages a time weighted average over the selectable time period is used.

MX WATTS
Maximum power in watts during a ride. Note: For 2 WK, 4 WK rolling averages a time weighted average over the selectable time period is used.

ZERO WATTS
Cumulative ride time when Power is zero displayed in absolute minutes or as percentage of total ride time.

NORMALIZED POWER
An estimate of the power that you could have maintained for the same physiological "cost" if your power output had been perfectly constant. The formula for calculating NP was developed by Training Peaks.

AV W/KG
Average power in watts divided by rider weight in kg during a ride.

MX W/KG
Maximum power in watts divided by rider weight in kg during a ride.

Appendix A: HISTORY REPORTS

Work Report and Peak Power Report

KJ
Kilojoule (1000 Joules). A Joule is unit of work equal to the work done by a force of 1 newton to move an object a distance of 1 meter. Kilojoules are a common unit used to express the total volume of work accomplished during a given workout, ride, or exercise bout. Kilojoules are used to express the total training load. One Joule per second equals 1 watt. The average power output in watts multiplied by the time in seconds divided by 1000 equals the total amount of work, during the specified time frame, in kilojoules.

KJ/HR
Average Kilojoules per hour during a ride.

TSS
Training Stress Score estimating the total amount of glycogen burned on a ride.

IF
Ratio of the normalized power to threshold power. Joule uses the mid-point between the threshold zone (zone 3) and the race pace zone (zone 4) as the threshold power value.

Peak Power
The highest average power output that can be held for a given duration. 2. For most individuals a peak sustainable power or peak power output lasting 4 to 8 minutes is equivalent to an intensity that elicits their VO2 max, or maximal capacity to consume oxygen. 3. For most individuals a peak sustainable power output lasting 20 to 40 minutes is equivalent to an intensity that elicits their lactate threshold or a value of blood lactate 2 to 3 mm above their baseline blood lactate. 4. For most individuals a peak sustainable power output lasting 40 minutes to 2 hours is equivalent to an intensity that elicits their lactate threshold, or a value of blood lactate just above to 1 mm above their baseline blood lactate. 5. In cycling, the peak sustainable power for any given duration is analogous to their best performance for a given time. For example, a runner might have a personal best of 5 minutes in a mile run and 35 minutes in a 10 KM run, whereas a cyclist might have a personal best or peak sustainable power of 300 watts for 5 minutes and 240 watts for 35 minutes.

Appendix A: HISTORY REPORTS

Time in Zones Report

Training Zones

1. Discrete bins or intervals specific to a particular energy or physiological system. From short maximal efforts to long maximal efforts these energy systems run along a continuum from anaerobic to aerobic metabolic pathways. Common reference points for this continuum include the power at lactate threshold and power at VO2 max.

Recovery Zone (Zone 1)

1. An easy exercise intensity where there is minimal stress or strain on the body. 2. On a 1 to 10 rating of perceived exertion scale, the recovery zone corresponds to a 1 to 2 or “really easy” to “easy”. 3. On a 6 to 20 rating of perceived exertion scale, the recovery zone corresponds to a 6 to 10 or “very very light” to “very light.” 4. An exercise intensity dependent solely on aerobic metabolism of primarily fat. 5. An exercise intensity that can be held for an indefinite time frame.

Endurance Zone (Zone 2)

1. A moderate exercise intensity where there is some stress or strain on the body 2. On a 1 to 10 RPE scale, an intensity corresponding to 3 to 4 or “moderate” to “sort of hard”. 3. On a 6 to 20 RPE scale, an intensity corresponding to a 10 to 13 or “fairly light” to “somewhat hard.” 4. An exercise intensity depending on the aerobic metabolism of both fat and carbohydrate. 5. An exercise intensity that can be held as long as the athlete were supplied with an influx of carbohydrate (i.e., allowed to eat).

Lactate Threshold (LT) Zone (Zone 3)

1. A hard intensity zone marked by a sudden increase in breathing rate. 2. On a 1 to 10 RPE scale, an intensity corresponding to a 5 to 7 or “hard” to “really hard.” 3. On a 6 to 20 RPE scale, an intensity corresponding to a 13 to 16 or “somewhat hard” to “very hard”. 4. A range of exercise intensity beginning at a slight inflection or rise in the blood lactate over a resting baseline to an intensity corresponding with a blood lactate 2 to 3 mm above a resting baseline. 5. A demarcation between aerobic metabolism to a mix of anaerobic and aerobic metabolism. 6. An all out exercise intensity that can be held between 40 minutes to 2 hours depending on the availability of stored carbohydrate or glycogen within the body.

Appendix A: HISTORY REPORTS

Time in Zones Report...Continued

Race Pace Zone (Zone 4)

1. An extremely hard or all out intensity zone. 2. On a 1 to 10 RPE scale, an intensity corresponding to a 7 to 8 or “really hard” to “really really hard.” 3. On a 6 to 20 RPE sale, an intensity corresponding to a 16 to 18 or “very hard” to “very very hard.” 4. An exercise intensity dependent primarily on the aerobic and anaerobic metabolism of carbohydrate. 5. An all out exercise intensity that can be held between 10 minutes to 30 minutes.

Max Zone (Zone 5)

1. An all out or maximal intensity zone. 2. On a 1 to 10 RPE scale, an intensity corresponding to a 9 to 10 or “really really hard” to “maximal.” 3. On a 6 to 20 RPE scale, an intensity corresponding to an 18 to 20, or “very very hard” to “maximal.” 4. An exercise intensity that elicits the causes the body to reach its maximal capacity to consume oxygen (i.e., an exercise intensity that elicits VO2 max). 5. An all out or maximal effort that can be held between 2 to 8 minutes or an average of 4 minutes.

Appendix A: HISTORY REPORTS

Climbing and Surges Report

M/FT GAIN
The total vertical distance in feet or meters traveled or climbed over a given distance ridden.

AV% GRADE
The rise or vertical increase in elevation divided by the run or horizontal distance traveled multiplied by 100 (rise ÷ run x 100).

M/FT LOST
The total vertical distance in feet or meters descended over a given distance ridden.

VAM
1. The rate of vertical ascent in meters per hour. Note: At an 8% grade, a rate of ascent of 1800 meters per hour requires a power output of 6.3 watts per kg and is considered the upper limit for climbing speed in professional cyclists. To compare that with age group racers and recreational riders, their VAM on the same grade would be around 1064 and 560 m/hr, respectively.

Surges
A surge is a sudden, short acceleration lasting a minimum of 3 seconds within a particular “power to weight” or w/kg zone. The value displayed is the number of surges occuring within a w/kg zone. Once a surge is recorded in a w/kg zone, the rider’s current w/kg power value must drop at least 0.1 w/kg below the minimum of the zone before a new surge can be considered. For this metric to be calculated correctly, the rider’s weight must be accurate, as listed in the User section of the Main Menu on the Joule GPS.

Appendix B: POP-UP WINDOWS

This section describes the various pop-up messages you may see on the device.

Message		Action		Action
MEMORY FULL			OK	Dismisses popup
LOST SIGNAL GPS SENSOR	FIND	Initiates an immediate find	OK	Turns off finding for specified sensor until device goes to sleep
DEVICE LOW BATTERY			OK	Dismisses popup
GPS SIGNAL LOST			OK	Dismisses popup
Workout Complete	RESTART	Restarts the workout	OK	Dismisses popup
SPEED UP			OK	Dismisses popup (popup will dismiss automatically when you reach the minimum speed)
SLOW DOWN			OK	Dismisses popup (popup will dismiss automatically when you reach the maximum speed)
PowerBeam Detected GPS Off			OK	Dismisses popup
Are you riding indoors?	No	Continues searching for GPS	Yes	Turns the GPS off
GPS Off			OK	Dismisses popup
GPS NOT ACQUIRED Turn GPS Off?	No	Continues searching for GPS	Yes	Turns the GPS off
Route Point	Map	Shows the map screen	OK	Dismisses popup
Off Course Warning	Map	Shows the map screen	OK	Dismisses popup
Course Found			OK	Dismisses popup

Appendix B: POP-UP WINDOWS

This section describes the various pop-up messages you may see on the device.

Message		Action		Action
Bike Selected	Edit	Shows the bike screen for the selected bike	Use	Activates the selected bike
Delete Bike	Cancel	Dismisses popup	OK	Deletes the selected bike
Delete Sensor	Cancel	Dismisses popup	OK	Deletes the selected sensor
Rolldown Complete			OK	Dismisses popup
Navigate to	Cancel	Dismisses popup	OK	Begins navigating to the selected waypoint
Delete Waypoint	Cancel	Dismisses popup	OK	Deletes the selected waypoint
Ride	Cancel	Dismisses popup	OK	Begins following the selected route
Delete Route	Cancel	Dismisses popup	OK	Deletes the selected route
Calibration Complete			OK	Dismisses popup
Selected Below	Edit	Shows the user screen for the selected user	Use	Activates the selected user
Power Above	Cancel	Turns off power zone warnings. Warnings are re-activated the next time the unit wakes up.	OK	Dismisses popup
Power Below	Cancel	Turns off power zone warnings. Warnings are re-activated the next time the unit wakes up.	OK	Dismisses popup
Heart Rate Above	Cancel	Turns off heart rate zone warnings. Warnings are re-activated the next time the unit wakes up.	OK	Dismisses popup
Heart Rate	Cancel	Turns off heart rate zone warnings. Warnings are re-activated the next time the unit wakes up.	OK	Dismisses popup

Appendix B: POP-UP WINDOWS

This section describes the various pop-up messages you may see on the device.

Message		Action		Action
Calculate a new HR to Power Calibration. 5 min warm up, then 15 minutes in 5 segments, maintaining steady cadence	Cancel	Dismisses popup	OK	Starts test sequence
Test Complete accuracy = _._ FTP = ___	Back	Re-starts the power test	Save	Saves the test results
Calibration Unsuccessful			OK	Dismisses popup
Sending	Cancel	Cancels sending the parameters to the PowerCal		
Success			OK	Dismisses popup
Failed			OK	Dismisses popup
Clear Memory Are you sure? This will not affect any reports.	No	Dismisses popup	Yes	Clears the memory
Clear History Are you sure? This will delete all ride data and reports.	No	Dismisses popup	Yes	Clears the history

Appendix C: METRIC LIST

Category	Metric 1	Metric 2	Metric 3	Description
Cadence	Current Cadence CAD 250	Average Cadence AV CAD 250	Maximum Cadence MX CAD 250	Current, average, and maximum number of times per minute pedal revolution.
Countdown	Countdown Time RIDE TIME 99:59:59	Distance Countdown MILES 999.9	Kilojoules Countdown KJ 9999	Displays one of 3 types of Countdown (time, distance, or Kilojoules). Initiate from dashboard by highlighting the metric, pressing INT button.
Gain/Loss	Vertical ascent VAM 45.0	Current Altitude (ft or m) ALTITUDE FT 29999	Total Ascent (ft or m) FT GAIN 9999	VAM - Vertical Ascent in Meters, Current altitude (from barometric altimeter), Total amount of Ascent (Gain) during current ride.
Grade	Current grade % GRADE 45.0	Current Altitude (ft or m) ALTITUDE FT 29999	Total Ascent (ft or m) FT GAIN 9999	Current percent grade or slope, Current altitude (from barometric altimeter), Total amount of Ascent (Gain) during current ride.
Heart Rate	Heart rate HR ♥250	Average Heart Rate AV HR ♥250	Maximum Heart Rate MX HR ♥250	Current, average, and maximum number of times per minute your heart beats.
Interval	Interval # INTERVAL 99	Interval Time INT TIME 99:59:59	Interval Avg Power INT AVG PWR 2999	Current interval number, current interval time, and the average power from the start of the interval to the instant the metric is viewed.
Peak Power	5 Sec Peak 5 SEC 2999	5 Min Peak 5 MIN 2999	20 Min Peak 20 MIN 2999	Your best average power over one of the listed time periods, from the start of the ride to the instant the metric is viewed.
Pedal Balance	Balance BALANCE 100%	Average Balance AVG BAL 100%	Cadence CAD 250	
Power	Watts WATTS 2999	Average Watts AV WATTS 2999	Maximum Watts MX WATTS 2999	Current power, average and maximum power from the start of the ride to the instant the metric is viewed.
Ride	Ride Time RIDE TIME 99:59:59	Ride Distance (mi or km) MILES 99.99	Kilojoules of Work KJ 2999	Ride time, distance traveled, and amount of work done (in kilojoules) since the recording of the ride was started.

Appendix C: METRIC LIST

Category	Metric 1	Metric 2	Metric 3	Description
Ride Partner	Pacer Distance (mi or km) PACER MI ±99.9	Pacer Time PACER TM 99:59:59	Escape/Closure Rate ESCAPE RT 99.9	Distance the Ride Partner (Pacer) is ahead (+) or behind (-) your current position; Time the Pacer is ahead/behind; Escape/Closure Rate: The speed to average to beat Pacer to end of route.
Route	Distance To DIST TO 99.99	Heading To HDG TO 99.99	Cur. Heading or Bearing BRG SSE	Distance to the end of the route. Heading to the end of the route. Your current heading or Bearing.
Scores	Training Stress Score TSS 234.7	Normalized Power NORM PWR 2999	Intensity Factor IF 2.000	Various training metrics, not only available at end of ride but also calcualted while moving.
Speed	Current Speed MPH 20.0	Average Speed AV MPH 20.0	Maximum Speed MX MPH 20.0	Current speed, average and maximum speed from the start of the ride to the instant the metric is viewed.
Surges	4-6 w/kg Surge 4-6 W/KG 999	6-8 w/kg Surge 6-8 W/KG 999	+8 w/kg Surge >8 W/KG 999	The number of surges in various power ranges. One surge is 3 or more consecutive seconds in a power range. Metric relys on accurate rider weight.
Watts/kg	Watts Per Kilogram W/KG 20.0	Average Watts/kg AV W/KG 20.0	Maximum Watts/kg MX W/KG 20.0	Current calculated Watts per Kilogram of body weight; average and maximum w/kg from the start of the ride to the instant the metric is viewed.
Weather	Temperature (F or C) TEMP F 199	Sunrise RISE 12:59	Sunset SET 12:59	Weather metric includes current temperature and the time of todays sunrise and sunset.
Workout	# of Segments Remaining REM SEG 999	Time Remaining REM TIME 999	Distance Remaining REM DIST 999	When following a scripted workout, this metric displays the number of workout segments remaining, the time and distance remaining.
Work	Kilojoules Of Work KJ 9999	Kilojoules / Hour KJ/HR 9999	Training Stress Score TSS 234.7	The amount of work (in kJs) from the being of the ride to the instant the metric is viewed; An estimate of the current Work rate in kJ/hr.
Zones	Current Power Zone PWR ZONE 6	Average Power Zone AV PWR ZONE 4.2	Heart Rate Zone HR ZONE ♥ 3	Power and Heart Rate Zones you are currently riding in; Also, an average of the various power zones during the ride.

Appendix D: GPS OVERVIEW

Understanding GPS Signal Acquisition and Signal Strength

Overview:
The Global Positioning System, GPS, originally developed for military purposes, was deployed over the span of years beginning in the 1980s, completing deployment in 1995. Today the GPS system is primarily used for civilian applications. Within the next 5 to 6 years there will be 3 fully independent Global Navigational Satellite Systems in service - the United States will continue to provide and improve GPS, the European Union will complete deployment of their system, GALILEO and Russia will complete deployment of their system GLONASS.

The GPS is a constellation of 32 fully operational satellites orbiting the earth in 6 different orbital planes, with 5 to 6 satellites per orbit. At any one time 24 of the satellites are considered "in service." The others are available in case one of the 24 needs to come offline for maintenance issues. The satellites circle the earth at an attitude of 20,180 kilometers (about 12 miles). Each orbit takes about 12 hours, but due to the earth's rotation, each satellite returns to it's starting point above earth in just under 24 hours. The 6 orbital planes, including the number and spacing of satellites in each plane are designed to ensure that there are a minimum of 4 satellites in view of any location on earth at any time. Typically there are more than 4. The more satellites a receiver locks onto, the more accurate the position data. Receivers positioned in higher latitudes will typically "see" less satellites. The master control station for the entire GPS network is located in Colorado. There are 5 additional monitoring stations around the world.

GPS Signal Strength:
GPS signal strength can be affected by many conditions. These include weather, the environment, receiver movement, and the orbital position of the satellites. This is especially noticeable at the point in time when the receiver is attempting to get a full GPS lock (typically means the reciever is locked onto a minimum of 4 satellites for accurate location data).

- When considering the weather, the signal strength is affected by the density of any clouds. Heavy rain or snow clouds can be a negative when it comes to GPS signal locking. This type of atmosphere tends to slow the locking process. The best conditions are cloudless sunny days or partial high, thin cloud cover.

- Environmental considerations include whether the receiver is in a mountainous or flat area, urban or rural area, under a tree canopy, or some combination of the above. Mountainous topography can include deep valleys or

Understanding GPS, continued

canyons. It can be hard to receive a satellite signal when not much sky is visible. Similarly, in urban areas, tall buildings, sometimes referred to as urban canyons, can cut down on the amount of viewable sky. Also, in rural areas, where the receiver may be under tree-lined roads or trails, the density of the tree canopy could have an effect on the GPS signal. The best environmental conditions for a GPS signal would be flatter terrain, rural areas, with lots of open sky, and light to nonexistent tree cover.

- The global satellite network itself can also affect the GPS signal. As mentioned earlier, the GPS network consists of 24 satellites in 6 different orbits around the earth. There are brief times during the day where a "coverage hole" may temporarily exist, over a particular geographical area, due to the location of each satellite in its orbit, at that particular point in time. In this case, the user of the receiver may need to wait a few minutes for satellite movement to "close the coverage hole" in that geographical area.

- Receiver movement can have an affect on the initial GPS signal lock. Typically, it is better to keep the receiver unit stationary while the unit is trying to complete the lock of the GPS signal. If movement is necessary during the locking process, the process may take more time to complete. This occurs because, as part of the locking process, distances to each satellite are being calculated. Any significant movement would cause the distance to change and thus a recalculation.

- The GPS signal is a radio frequency (RF) signal. Anything that affects RF can have an impact on GPS signal reception. Indoors, this can mean the thickness of the walls around the reciever, the roof over the reciever, or the type of material the roof or walls are constructed from. Outdoors, this can mean paying attention to events that can affect electro-magnetic radiation (EMR), like solar flares from the Sun. Solar activity, like the weather, is tracked and predicted, by various organizations. On days when a major solar flare produces a huge EMR blast toward the earth, your GPS signal will be affected.

Technical Details, Cell Phones:
As mentioned above, the GPS network was designed prior to the 1980s. The transmission rate from satellite to a receiver on the ground is only 50 bits per second. In perfect weather conditions, once a communication is established with the first satellite, it takes a minimum of 30 seconds to receive the initial information, a 1500 bit message block.

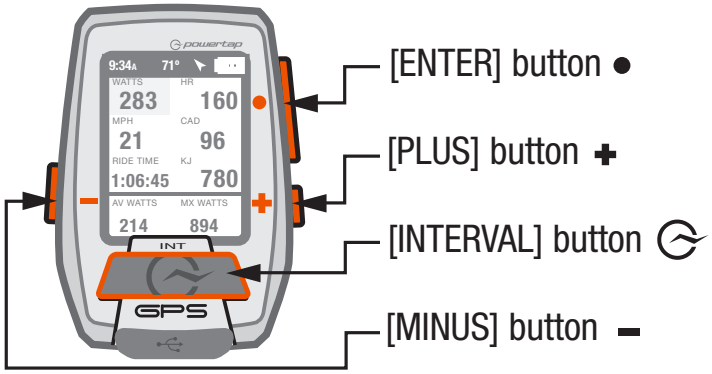
Understanding GPS, continued

A receiver will need to lock on a minimum of 4 satellites to get an initial good position location. In order to find other satellites the receiver will reference a copy of a data file, containing position data of all other satellites in the system. This file is commonly referred to as the almanac file. Each satellite is in constant communication with the other satellites in the system. Each satellite continually gathers up-to-date position data of the other satellites. This information becomes the bulk of the almanac file. Receivers typically keep their copy of the almanac file updated without notice to the user.

However, receiver almanac files can become out of date by moving great distances between powering up the device or not powering it up for a long time. If this is the case, downloading a completely new copy of the almanac will take approximately 12.5 minutes under good sky conditions (the almanac file is approximately 25 message blocks in size, downloading at 50 bits/sec). Once the first satellite is locked, the almanac file is determined to either already be up-to-date or a new one is downloaded, the receiver begins to look for and lock other satellites. The complete lock process is accelerated at this point because finding additional satellites is much quicker once the receiver knows where to look for them via position info from the now up-to-date almanac data.

Cell phones acquire a GPS lock faster then other receivers. Most of the newer phones use what is called A-GPS,or Assisted GPS technology. This is in essence a hybrid communication technology that allows the receiving cell phone to acquire a GPS signal lock quickly using assistance from other technologies. Assisting technologies include cell tower triangulation, the high speed data transmission link between the phone and the tower, and the fact that the tower, in a fixed position, is always locked onto and monitoring the GPS satellite constellation, 24 hours per day, 7 days per week. Leveraging these technologies, the cell phone can acquire a GPS signal lock quickly compared with other receivers communicating directly with the satellites at 50 bits per second.

Appendix E: BUTTON COMBINATIONS, SHORT CUTS and QUICK LINKS



Function	Button Combination, Short Cut, Or Quick Link
Dashboard to Menus	Press and hold the ENTER button for 3 seconds
Back to Previous Screen	When in Menus, click the INTERVAL button to move back to the previous screen. When in an edit field click INTERVAL to move back one character; exits field when at first character.
Menus to Dashboard	Press and hold the ENTER button for 3 seconds, or click the Back button.
Find Sensors	Press and hold the PLUS and MINUS buttons at simultaneously for 2 seconds.
Interval/Ride Mode toggle	Press and hold the INTERVAL button for 2 seconds to toggle between metric data related to the whole ride and metric data related to the current interval/lap.
Sleep	Press and hold the PLUS and INTERVAL buttons at simultaneously for 3 seconds.
Ride Menu Quick Display	Press and hold the MINUS button for 2 seconds
Metric Rotation	Press and hold the PLUS button for 2 seconds, continue hold while highlighted metric rotates. Release when desired is in main window.
Quick Backlight	Click the MINUS and INTERVAL buttons simultaneously to turn backlight “On” temporarily, until next sleep; additional clicks scroll through brightness settings.
Shifting, Target Slope	When paired to an i400 series indoor cycle, use the PLUS and MINUS buttons to increase/decrease the Target Power, Target Slope, or Gear, , when the associated window is highlighted on Workout dashboard. Press and hold the PLUS button to move the Highlight.
Manual Zero	A link to the Manual Zero screen of the active bike is on the Sensors menu.
PowerBeam Calibration	A link to the PowerBeam Calibration screen appears on the Sensors menu when the active bike definition includes an RU sensor.
Active Bike	The Active bike is pre-selected when entering the Sensors menu.
Ride Partner (Pacer) Reset	Choice appears on the Ride menu when a route with pacing data is active. Selecting this choice forces the Ride Partner to be “virtually” moved to the current location of the rider.