LeafSpy Pro Help Version 1.0.5 (iOS)

Note: This **Help** is available as a **PDF** file by sending an email with a subject of "**iOS PDF Help**" to WattsLeft.meter@gmail.com. If you find any errors or have suggests for improvements please send them to the same email address but with subject "**iOS Help file**".

OVERVIEW

LeafSpy Pro extracts and displays information from the Leaf through an **LELink** Bluetooth 4.0 LE OBDII Adapter (recommended) or a WiFi connection to a WiFi OBDII adapter plugged into the Leaf's OBDII connector located under the Leaf's dash. The **LELink** Low Energy Bluetooth 4.0 adapter is the recommended adapter as it is low power and requires no setup to use. A WiFi OBDII requires special settings and will need to be selected manually each time LeafSpy is started if the current network is not the OBDII adapter. If you have a home network then most likely it will be auto selected each time you enter your house.

LeafSpy Pro consists of 4 main information screens plus one Service screen that can be enabled on the **Settings/Service** panel. By default the Service screen is disabled each time **LeafSpy Pro** is started to prevent accidentally making changes to the Leaf.

Located in the lower left corner of each screen is an indicator that shows how many screens are available (4 or 5) and which screen is currently displayed. Swipe left or right to change to next or previous screen. First and last screens do not wrap.

Tap the blue asterisk * in the upper right corner of a screen to display an overlay of "hot" areas on the screen that can be tapped and their assigned function.

The 12 volt battery voltage is displayed in the lower left area of the first four screens. Battery current will also be displayed for model years 2011/2012. Depending on screen size you may need to be in landscape mode to see the 12 volt battery's current reading.

Screen 1 is the Battery Status screen. The top of the screen shows battery AHr rating when fully charged, State of Health (SOH), battery voltage and current, VIN, Hx (% of new battery conductance), odometer, Quick Charge cycles and L1/L2 charge cycles/connections.

The center of the screen shows a bar chart of the voltage of each of the 96 cell pairs making up the High Voltage battery pack. Tap the top of the chart to zoom out and bottom to zoom in. A Red colored bar indicates a small bleeder load is being applied to that cell in order to drain energy from it to better balance it with the other cells.

The bottom area below the x axis lists the minimum, average, maximum cell voltages and delta between the minimum and maximum cell voltages as well as the temperature readings from the 3 or 4 sensors monitoring the battery pack. The delta between lowest to highest temperature sensor is also displayed.

Along the left edge is the current mV scale with 50 mV being the smallest. Zooming In and Out changes this scale.

Screen 2 displays one of four graphs. Tapping the center of the screen selects the next graph and a long tap selects the previous graph. The number of the current graph is displayed on the bottom left of the screen.

Graph 1 is a battery cell Histogram that displays the variation in cell voltages. Less variation between cells is a sign of a better balanced pack that can hold moreusable energy.

Graph 2 displays the battery pack temperature sensors.

Graph 3 displays the last charge cycle monitored by LeafSpy Pro. The graph plots the SOC, Gids and charge power as the battery is being charged. During a Quick Charge the battery pack temperature is also graphed. The graph is automatically saved at the end of a charge for later review.

Graph 4 records the elevation and speed during a drive and auto resets at the start of each drive. The graph can be saved for later review. **Note:** The iOS device must have GPS for this function to work.

Screen 3 is a table showing State of Charge, available battery energy in kWh, current battery Ah, battery voltage, a Wh counter that shows energy used during a drive, battery temperature, estimated distance remaining and Gids. Displays Climate Control state including HVAC mode, power used, fan speed, air flow direction and set temperature.

Screen 4 is the Summary screen. It displays battery and energy usage information, power used per function (motor, accessories, heater, A/C), tire pressures, delta between tires, estimated trip distance and outside temperature.

Screen 5 when enabled, adds a Service screen that allows viewing and changing service information normally only available to the dealer such as reading/clearing Diagnostic Trouble Codes (DTC) and changing the auto door lock/unlock conditions.

OBDII Hardware

In order for **LeafSpy Pro** to communicate with a Leaf an OBDII adapter must first be installed in the Leaf's OBDII socket located under the dash above the driver's left knee and the Leaf must be turned on (not ACC mode). **LeafSpy Pro** for iOS requires an **LELink** Low Power Bluetooth 4.0 or WiFi OBDII adapter. Standard Bluetooth OBDII adapters are not supported.

iOS WiFi Device Setup

Use the following WiFi setup to prevent your iOS device from trying to connect to the Internet through the WiFi adapter plugged into the Leaf. Once setup correctly your iOS device will instead use your phone's data plan to make an Internet connection. By using the **LELink** Low Energy Bluetooth 4.0 adapter instead of a WiFi adapter you can avoid this complicated setup.

This setup requires the OBDII-WiFi adapter be plugged into your Leaf and powered on. The Leaf does not need to be on during this setup stage but if the adapter has a power switch you may need to press it to power on the OBDII adapter. Check that the adapter's power LED is lit. Some adapters require around 30 seconds after being plugged in before they become visible on your iOS device's WiFi networks list.

- 1) On your iOS device go to **Settings**
- 2) Then select **Wi-Fi**
- 3) Under **Choose a Network...** look for the WiFi OBDII adapter's name. Typical names are **CLKDevies**, **WiFi ELM327**, **WiFi_OBDII**, and **WiFiOBD**
- 4) Touch the Blue "**i**" to configure the network connection
- 5) Choose **Static**
- 6) Set IP address to 192.168.0.xxx where xxx is any number other than **10**. **Example 192.168.0.123**
- 7) Set Subnet Mask to **255.255.255.0**
- 8) Leave the Router and DNS fields blank. The router field must be blank to allow a cellular data connection. Otherwise your iPhone will try to connect to the Internet through the OBDII-WiFi adapter which of course will not work.

Once the WiFi OBDII adapter is connected to the iOS device start **LeafSpy Pro** and go to the **Settings/System** panel and register the current SSID as the SSID of the OBDII Adapter. Only when **LeafSpy Pro** detects the registered SSID does it try to communicate with the Leaf.

Recent Changes

Added two new options on the **Settings/Options** panel. One to disable the automatic selection of the energy usage graph on screen 4 if the PTC heater is active. The other to disable all sound.

The weak cell test on screen 1 will only be run if the difference between the maximum and minimum cell pair voltages is at least 200 mV.

Support for the **LELink** and **Viecar** Bluetooth 4.0 Low Energy (LE) OBDII adapters. The **LELink** is about 20% faster than the **Viecar** adapter when communicating with the Leaf. These adapters require no setup or pairing but only that Bluetooth be enabled. They are recommended over the previous WiFi OBDII adapters because of their ease of use and low power from both the iOS device and the Leaf.

Enabled support for the new larger 30kWh battery.

Reenabled reading the SSID on iOS 9 since Apple decided at the last moment to allow this function on the released version of iOS 9. This function had been removed from beta versions of iOS 9 but is now back. If you installed LeafSpy Pro after you upgraded to iOS 9 you will need to register the OBDII SSID by going to the LeafSpy **Settings/System** panel after previously selecting the WiFi OBDII adapter from the iOS settings menu. If you switch to the new LELink Bluetooth 4.0 Low Energy OBDII adapter you will not need to worry about registering an SSID.

Added a user resettable energy counter as a fourth option on Screen 4. Go to the **Settings/Battery** panel and open the **Config Wh Counter** pulldown to select it.

Increased ambient temperature adjustment range from -5 to +5 to -10 to +10 degrees.

Added an option to **Settings/Options** panel to add an offset to the outside temperature value displayed on screen 4. The offset range is -5 to +5 degrees. Only make this adjustment after the Leaf has been at the same temperature for an hour to give time for the Leaf dash display to stabilize.

Added climate control state information to screen 3.

Background Operation To allow **LeafSpy Pro** to continue to run in the background go to **Settings/Logging** and enable **Always keep GPS active**. Once connected to the Leaf **LeafSpy Pro** will continue to run as long as the WiFi link to the Leaf stays active.

While running in the background a badge number will appear on the **LeafSpy Pro** icon. The units digit will cycle between 1 and 9 to indicate the app is still running. The other left side digits are the link status. A value of **6x** means the app is connected to the Leaf. While a value of **5x** or **7x** means the connection is being retried.

Keep in mind that additional power will be used while running in the background since the WiFi link is kept active.

Dropbox Synchronization Added support for syncing selected file types with your Dropbox. The Dropbox app does not need to be installed to use this feature. A sync interval of 1, 2, 5, 10 or 15 minutes can be specified. By default the **Trip/Charge log** is always synchronized. The other types of files that can be synchronized are:

- Log Files
- Charge & Elevation Files
- Trace & Error Files

A new folder structure is created in your Dropbox to hold the uploaded files. The new folders are:

- **Apps/LeafSpyPro/** - for Trip/Charge log
- **Apps/LeafSpyPro/Log Files** - for Log Files
- **Apps/LeafSpyPro/Charge & Elevation Log** - for Charge and Elevation logs
- **Apps/LeafSpyPro/Trace Files** - for ELM traces
- **Apps/LeafSpyPro/Debug Logs** - for debug files

Notification While running in the background notifications can be enabled. A notification is triggered based on a change in Gids or by a selectable time interval of 1, 2, or every 4 minutes. Sound can be enabled when a notification is posted.

The notification displays the following information:

- Trip duration
- Gids remaining
- Gids used
- Energy used
- Trip Distance
- Distance since last charge

Alternate Method to Read Tire Pressures Use this new option on the **Settings/Tire Pressure** panel when the default method does not work (seen on 2015 UK Leafs).

Remap Tire Pressures As an alternative to doing a **Tire Registration** this option on the **Settings/Tire Pressure** panel allows you to simply move the pressures readings around to match their actual location on the Leaf.

Virtual Tire Registration This option on the **Settings/Tire Registration** panel is used after the tires have been rotated to automatically remap the tires to their new locations based on the type of rotation selected. To use this option the tires must have been displayed in their correct position before the tires were rotated.

Bar Pressure Tire pressures can now be displayed in Bars.

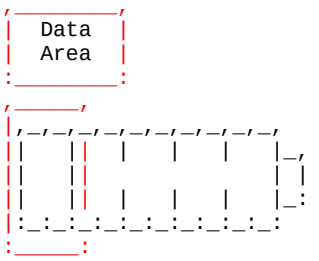
Trip Recorder A trip **Start** occurs when the app first detects the Leaf's drive motor rotating. A trip **End** occurs when the app detects the Leaf has been turned off. To ensure correct detection of the end of a trip, after turning the Leaf off a beep will sound and the word "**Saved**" will be displayed to the right of the trip timer at the top of screen 4. Once you see "Saved" and/or hear the beep the trip has been record to the Trip Log in the iTunes accessible shared folder.

Trip Log Viewer A log of previous trips can be viewed by selecting **View Trip Log** from the menu. Trip data entries include:

- Date / Time
- Starting Odometer
- Duration of trip/charge
- Distance of trip
- Elevation change from start to end of trip
- Energy used in watt/hours
- Gids used during trip
- Starting / Ending Gids
- Battery AHr rating
- State of Health
- Hx
- Starting / Ending Battery voltages
- Drive / Regen / Charge energy counters
- L1/L2 and Quick Charge counts

Countdown Counter On screen 4 a user settable distance Countdown counter can be displayed by doing a long tap on the distance remaining to event number. When enabled the Countdown counter will be displayed to the left of the distance to event number. The Countdown counter number will also have a down arrow to its right. The default starting distance is controlled on the **Settings/Trip Distance** panel. To adjust this count while on screen 4 press and hold either the + or - button and after a short delay only the trip distance is displayed with a down arrow. Then use the + or - button to adjust the value. When done tap the trip distance number.

User Selectable Data On screen 4 a user selectable data area is located just above the left side of the graphic. It can display one of five sets of data.



Tap over the above RED areas to step through displaying the following sets of data:

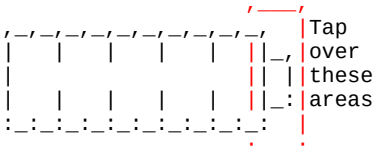
- High Voltage Battery Voltage/Amps/Watts/HP
- Motor RPM / Gids used during trip
- GPS speed/elevation/elevation change during trip
- Distance of current trip/energy efficiency of trip
- Distance since last charge and energy efficiency

Cell Voltage Loss Inspection added to screen 1. Run automatically anytime the Leaf is ON (not ACC mode), in Park and the minimum cell pair voltage is below 3.713 volts (i.e. below low battery warning level).

This "Cell Voltage Loss Inspection" test is based on Nissan's originally published algorithm (2011 April Service Manual, section EVB-67) with the addition that there must be at least a 200 mV difference between the maximum and minimum cell pair voltage to run the test. The results of the inspection replace the battery temperature sensor status line just below the x axis on screen 1. Any weak cells are listed as "Weak Cells: xx yy zz" in red with x y z being the weak cell numbers. If the test finds no weak cells the message "All Cells OK" will be displayed in green.

Charging/Elevation/Speed Graphs - Tap the second screen to cycle to the new Charging and Elevation/Speed graphs which display a graph of charging power, % SOC and % Gids or Elevation/Speed. A long tap will cycle to the previous graph. An example QC and Elevation/Speed graph are included. By tapping the right corner status box you can enable Zooming and Scrolling of the two new graphs. Tap the top or bottom area of the screen to zoom in or out and a single finger to slide left or right. These two new graphs are available in Leaf Spy and Leaf Spy Pro.

Power Usage Display - The Battery Graphic that normally displays SOC, GIDs and DTE can be toggled to instead display Energy Usage by tapping the right side of battery graphic over the plus terminal.



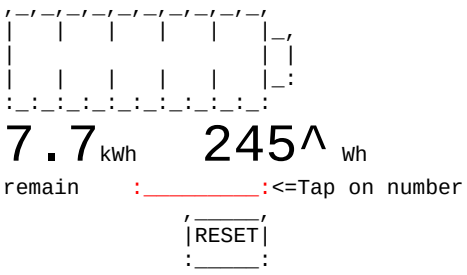
The four power usages displayed are:

- Motr = Motor Power/Regeneration

- Aux = Lights, Rear Defroster...
- Hetr = Cabin Heater
- A/C = Air Conditioner (includes Hetr if heater active)

The Motor bar graphic grows from the left for power used by the motor and from the right for energy generated by the motor (regeneration). Full scale for the motor graph is 100 kW.

Display Regeneration Energy - By tapping on the right side number area just below the graphic the energy counter you can toggle the number displayed between the energy used and the amount of energy that was recovered through regeneration. When the number displayed ends with the ^ symbol it is the regeneration energy. If the energy for more than one trip is being accumulated then a **RESET** button will be displayed. Pressing the **RESET** button will clear the energy used for all but the current trip. If no trip is active then pressing the **RESET** button clears all the energy counters.



Background Operation is now supported. When enabled, this means that LeafSpy can continues to operate when not on screen. To enable background operation go to the **Settings/Logging** panel and enable **Always keep GPS active**. Background operation starts when first connected to the Leaf (Leaf must be on) and continues until the WiFi connection with the Leaf WiFi adapter is broken.

If you have the **Service Screen** enabled it will override displaying these graphs. To see these graphs just disable the **Service Screen** in Settings.

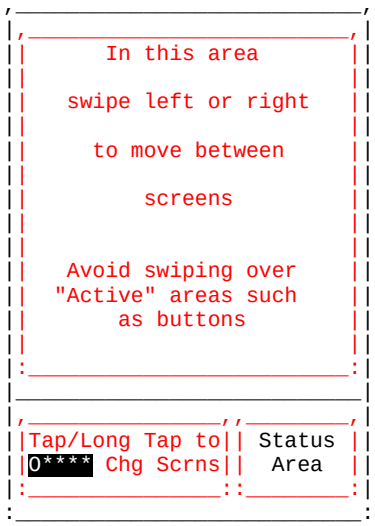
Navigation

There are two ways to move between screens.

Swiping - Use your finger to Swipe left or right. Choose an area of the screen that does not have active touch areas (Buttons). Starting your swipe off the active screen also seem to work better.

OR

Tapping - To move to the next screen **Tap** the *O*** area at the bottom left half of the screen. To move to the previous screen **Tap and hold** your finger down.



Status Area

The bottom right corner of most screens contains a status box. This colored status box indicates the current state of the connection to the ELM OBDII adapter and the Leaf. The general meaning of the colors is:

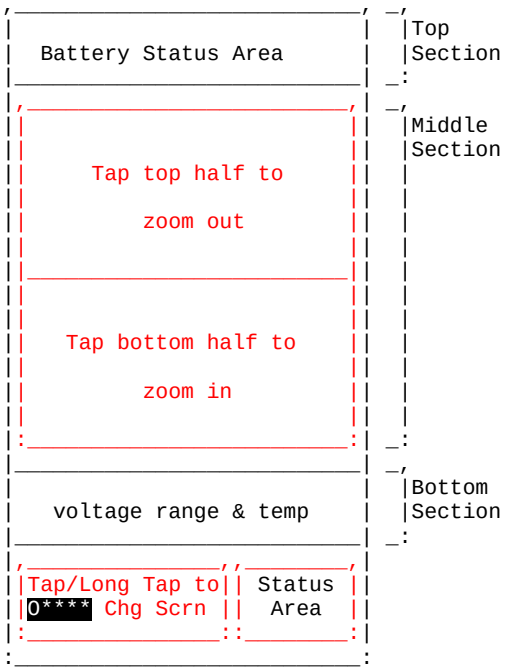
`Looking 4 ELM` Yellow means trying to connect
`Connected` Green means connected follow by a state number
`Screen Frozen` Gray means the screen is frozen for viewing
`Offline` Blue means the link is Offline

Tapping the colored status box will toggle between showing status and the **Screen Frozen** state. When in the **Screen Frozen** updates to the screen are suspended. Data is still read from the Leaf but is not updated to the screen. Use this mode to study the data on the screen without it being updated with another sample. This mode also suspends displaying the periodic connection retry messages.

[O**] Screen 1**

Battery Status

The **Battery Status** screen can be divided into three sections: top, middle and bottom.



Top Section has the following information:

AHr Ampere/Hour is a rating of the present battery capacity. This is determined by the Battery Management Controller in the Leaf and decreases as the battery ages. It gives an estimate of the battery's capacity to hold energy when fully charged, not how much energy is currently in the battery. Think of it as the size of the tank not how much is currently in the tank. As the battery ages this number will decrease indicating that less and less energy can be stored in the battery when fully charged. If you have a laptop you have seen this happen. The amount of time the laptop can run on a fully charged battery decreases as the batteries get older.

SOH State of Health is another indication of the battery's ability to hold and release energy and is reported as a percentage. When the battery is new SOH=100%. When SOH drops to 85% for a month or so the Leaf loses the first capacity level segment displayed on the right side of the Leaf's central dash display. The capacity gauge is the rightmost outer curved column of segments next to "1" at the top and "0" at the bottom with the last two segments being colored red.

xxx.xxV Voltage of high voltage battery. Example "380.21V" or 380.2V depending on which ECU provided the reading.

xxx.xA Amperage of the high voltage battery is displayed in landscape mode and also in portrait mode if you have a high resolution screen. A positive value indicates current out of the battery and a negative value current into the battery (Regen or charging).

VIN The vehicle identification number indicates which vehicle the data came from. It is surrounded by parentheses if the data being displayed is saved data as opposed to data just read from a Leaf.

Hx The meaning of this number is not fully understood but it appears to be inversely related to the battery internal resistance. As the internal resistance of the battery pack increases it is thought this percentage decreases. As internal resistance increases more energy is lost within the pack and the pack heats up more under load.

xA yV Example 31A 244V or 31A 5V (Only available on Models 2011/2012) When an EVSE is plugged into the Leaf these numbers indicate the maximum available current the EVSE can provide the Leaf and the voltage supplied by the

EVSE. For the first example the EVSE can provide up to 31 amps of current and is supplying a charge voltage of 244 volts. The second example shows the reading when the EVSE is attached to the Leaf but the Leaf is not charging. In this case a voltage reading of around 5 volts can be expected.

Odo Odometer reading in either miles or km depending on units selected in Settings/Units.

QCs Number of Quick Charges. Each time a Quick Charge occurs this number increments by 1.

L1/L2s Number of L1/L2 connections and charges. This number increases each time the J1772 charge cord is plugged into the Leaf. It also increases by one for each delayed charge that takes place. If the Leaf charge timer is not active, so charging starts immediately when the charge cord is plugged in, then the count will increase by only one. But if the timer is active then the count will increase by two. Once when the charge cord is initially plugged in and a second time when the timer starts the delayed charge.

SOC State of Charge indicates the amount of charge currently in the battery. The amount of energy this represents is not fixed but decreases over time as the battery ages. Since capacity decreases with age a new battery at 50% SOC hold more energy than a 5 year old battery at 50% SOC.
The SOC field is located at the bottom left corner of the screen.

The **Middle Section** of the screen contains a bar graph showing the voltage for each of the 96 cell pairs that make up the High Voltage battery. Highlighted bars indicate the shunt is active for that cell pair which drains a small amount of energy to balance the cell with the others. To **Zoom Out** tap on the top half of the graph. To **Zoom In** tap on the bottom half of the graph. The current scale is shown on the left side and can range from 50 mV to 1600 mV with a scale of 4500 mV automatically selected if a shorted cell (0 Volts) is reported.

The **Bottom Section** shows the minimum, average and maximum cell pair voltages with the difference between minimum and maximum voltage in parentheses. The second line shows each of the battery temperature sensor readings (3 or 4 depending on model year) with the difference between low and high in parenthesis. The units used are selected by the Settings/Units panel.

[*O*] Screen 2**

Graphs

Depending on the version of LeafSpy, either two or four graphs can be viewed on screen 2. **Tap** the center of the screen to cycle to the next graph or do a **long tap** to move back one graph. The currently selected graph's number is shown in the lower left corner of the screen in **x of y** format (e.g. "**2 of 4**").

1) Voltage Histogram

This graph gives a visual representation of how well the 96 cells making up the battery pack are balanced. For a perfectly balanced pack all cells would have exactly the same voltage which would be represented on the histogram as a single bar with a height of 96 cells.

The minimum, average and maximum cell voltages are listed at the top of the screen and the voltage difference between the highest and lowest cells is listed below the x axis in millivolts (thousands of a volt). The y axis is in units of cells and auto scales. The y axis label shows the current magnification level of the x axis and ranges from 50mv to 1600mv. To change the magnification level go to screen 1 and tap on the upper (zoom out) or lower (zoom in) half of the screen.

2) Battery Temperature

This graph shows either 4 (2011/2012 models) or 3 battery temperature sensors. If the incorrect number of sensors is displayed go to **Settings/Model Year** panel and make sure the Leaf model year is set correctly for your Leaf. Displayed units (Fahrenheit or Centigrade) can be changed on the **Settings/Units** panel.

The top of the screen lists the available sensors. Starting in 2013 Nissan removed sensor 3. The maximum, minimum temperatures and in parentheses the temperature difference between the highest and lowest sensors is displayed below the x axis. The y axis auto scales depending on the temperatures. The color of each bar changes based on the temperature of the corresponding sensor.

3) Charge Graph

This screen plots charging power in kW, percent State of Charge (SOC) and percent Gids during an L1/L2 or Quick Charge. During a Quick Charge the battery temperature is also plotted. Depending on your Leaf you may be able to keep LeafSpy running while charging even with the Leaf off. Graphs can be saved and loaded for later viewing. Files are saved in **csv** format in folder iTunes accessible shared folder.

The first title line displays two power numbers in kW. The first number is the power in kW going into the battery pack and the second number is the power the charger is reporting. Normally these numbers are the same or almost the same. Following the two kW numbers is the file name if the data has been saved. If the data has not been saved the words "**Not Saved**" will be displayed. The data is automatically saved at the end of a charge session. For an L1/L2 charge session the file name will be of the form Qxx_Lyyy where xx is the number of Quick Charges and yy is the number of L1/L1 charges/connections. For a Quick Charge the file name will be of the form Qxx_yyy (without the "L") where xx and yyy are the same as for an L1/L2 charge. The name difference makes it easy to distinguish an L1/L1 file from a Quick Charge file.

The second title line and optionally third title line show the current (charge in progress) or last (if charge has ended) SOC percent, Gids percent and if a Quick Charge the battery pack temperature. The color used to graph each of these parameters is also given.

The y axis label lists the color used to plot the power going into the battery pack. The left side y axis numbers auto scales in units of kW. The right side y axis label is in percent 0 to 100 and is used to read %SOC and %Gids. There is no scale for the battery pack temperature but the 100% mark corresponds to 150F/65.6C and the 0% mark to 0F/-17.7C.

Press the "**Save/Load**" button to force a save or to load a previously saved charge file for viewing. Graphs are saved in **csv** format.

Tap on the bottom corner status box to enable **Zoom/Scroll**. Tap the top or bottom area of the screen to zoom in/out and slide a finger to scroll left/right.

4) Elevation Graph

Since elevation changes can affect driving range this graph allows you to see the elevation changes along the route as you drive. The elevation and speed data does **not**come from the Leaf but instead from the iOS device's GPS. Therefore this graph only applies to devices that have a built in real GPS function. Accuracy of the plotted data is dependent on the number of satellites and how long it takes the GPS controller to acquire these satellites. As a result, the graph will give a general idea of the topography driven over but is not an absolute indication in terms of elevation plotted.

Due to the inherent inaccuracies of GPS determined elevation it is not uncommon when driving a round trip for the starting and ending elevation to not match up even though you returned to the exact same spot.

The graph will automatically clear at the start of each drive and can also be manually cleared by tapping the **Save/Load** button and selecting **Clear**.

The top title line displays the file name if the data has been saved. The second title line displays the elevation, accuracy and speed (**Elevation 285 (+/-13) Speed 19 mph**) information from GPS once GPS has locked on to sufficient satellites.

The left axis label gives the units of elevation and the color of the elevation plot with speed being plotted in the other color. The right y axis units are mph or km/h. The x axis automatically scales as more data is added to the graph.

Plots can be saved and loaded by using the **Save/Load** button. The plot name is automatically assigned in the format **ES_yymmddhhmm** with y m d h m being year month day hour minute. Graphs are saved in **csv** format.

Tap on the bottom corner status box to enable **Zoom/Scroll**. Tap the top or bottom area of the screen to zoom in/out and slide a finger to scroll left/right.

[O**] Screen 3**

Simple Summary

The Simple summary screen provides the following information in a large text format for easy viewing. There are four buttons on this screen.

GIDs button Use this button to make either the Gids value or Gids percent the large number.

Temperature Units button Use this button to display either the max, avg or min battery temperature. The button also displays the delta between the highest and lowest sensor reading in parenthesis.

miles/km button Use this button to increase the efficiency used to calculate the range to event. The currently select event is listed on the bottom of the button.

Efficiency button Use this button to decrease the efficiency used to calculate the range to event. The top line of the button lists the current efficiency selected and the bottom gives the units of the efficiency.

SOC = State of Charge: This is read directly from the Leaf and is based on the current capacity of the Leaf battery. That means if you charge your Leaf to 80% then SOC will always equal 80% at the end of the charge even after 8 years when the battery capacity has dropped to say half its original capacity. It is not an indication of the energy contained in the battery.

Ah This is a prorated Ah number based on full charge Ah times present %SOC. So if SOC=50% then Ah displayed here would be half the full charge Ah displayed at the top of screen 1.

V This the voltage of the high voltage battery. Depending on screen resolution may need to be in landscape mode to see this value. A voltage format of xxx.xx indicates the reading is coming from the BMS unit and a format of xxx.x indicates the reading is coming from the VCM unit. When the BMS is not responding the VCM value is reported instead.

kWh = Approximate energy currently stored in the battery. This number is calculated by multiplying the number of Gids read from the Leaf times the Wh/Gids set in the **Settings/Battery** panel. The default Wh/Gids is 77.5. The calculated kWh gives the best indication of available energy in the battery.

Wh Resettable counter that keeps track of energy changes in the battery. As the available energy in the battery changes this number is updated. In general as you drive this number will increase giving an estimate of the energy used. While charging or during motor regeneration this number will decrease indicating an energy increase in the battery. If present, tapping the **Reset** button while a trip is active will clear all but the energy for this trip. If no trip is active then pressing the **Reset** button will clear all energy used.

Temperature Battery temperature either in C or F depending on units selected in the Settings/Units panel. The number in parenthesis is the difference between the minimum and maximum sensor reading. Tapping the label to the right of the number cycles the number displayed between minimum, average and maximum temperature reading.

Range Is an estimate of the remaining range to event based on the selected efficiency. The selected units of the distance (miles or km) is displayed on the first button. The current efficiency selected is displayed on the second button. Pressing the first button increases estimated efficiency and pressing the second button decreases estimated efficiency used to calculate the remaining range to event. The units of efficiency are set on the **Settings/Range**. The choices are **Miles/kWh Wh/Mile km/kWh Wh/km**. The distance remaining may include a selectable reserve determined by the **Settings/Range** panel.

GIDs This field indicates the remaining energy in the battery in terms of Gids. Gids is the name given to a value found on the Leaf CAN bus that tracked closely with the amount of energy remaining in the Leaf Battery. It was first discovered by Gary Giddings. Later it was determined that Nissan uses this field to indicate the amount of usable energy in the battery by multiplying it by 77.5. On a new 2011 Leafs the maximum Gids is typically 281 or (281 x 77.5) 21.78 kWh of usable energy from the 24 kWh battery. Tapping the label to the right of the value will toggle the value between Gids and percent Gids.

CC Mode This field displays the climate control (CC) mode which can be in one of the following nine modes:

- **blank** Status of the climate control system has not yet been read by LeafSpy.
- **Off** Climate control system is off
- **On** Climate control system is on but there is no air flowing because the fan is off and recirculate mode is active.
- **Vent** Outside air will flow through the Leaf while it is in motion.
- **Fan** The fan is active.
- **Heat** Climate control heating and cooling system is off
- **A/C** Cooling system is active
- **HVAC** Cooling & Heating systems are active
- **AUTO** Cooling system is under automatic control
- **AUTO#** Heating/Cooling system is under automatic control
- **nn** If a two digit hexadecimal number is displayed please report this and the Climate Control settings that cause it to appear.

Recirculate Air When this icon appears the Climate Control system is recirculating the air and closed off the fresh air intake.

CC Power Displays the current power being used by the Climate Control system. This appears above the fan icon.

Fan Speed When the fan is active the fan icon will appear. In the center will be the current fan speed (1 to 7).

Set Temperature The Climate Control set temperature will appear above the air flow icon

Air Flow The air flow icon will indicate the currently selected air flow direction(s) and if air is flowing to the windshield.

[*O*] Screen 4**

Detailed View

This screen is divided into three sub panels. The largest is the energy panel which displays information about available energy and how the energy is being used. A second smaller panel alternates between displaying tire pressures and battery temperatures. The third panel displays a distance to event estimate where the event can be either Low Battery Warning, Very Low Battery Warning or to a predefined (defined on **Settings/Range** panel) reserve amount of energy. A countdown counter can also be activated on the third panel

Energy Panel

This panel can be divided into six sections:

(Top Line Right of Center) **00:00:00** Trip/Charge Timer This timer automatically resets at the start of each drive or charge. At the end of a trip, when the Leaf is turned off, the current trip statistics will be appended to the **Trip Log**. A successful append to the **Trip Log** is indicated by the word "**Saved**" displayed to the right of the timer and a beep will sound. The **Trip/Charge Log Viewer** is accessed from the **Menu**.

(Large Top Left & smaller Right two numbers) **xxx / yyy / zzz** Battery Energy in Gids, %Gids and %SOC Tapping the large upper left number cycles which of the three numbers (Gids, % Gids or % SOC) is displayed in that position.

(Two lines below Top Left number) **Data Lines 1 & 2** User selectable Data Area This area can display one of five sets of extra data. Tap this area or the left side of the bar graph to cycle between each of the five choices.

Data Set 1: HV Battery Voltage & Current, Battery Power in kW and HP

Data Set 2: Motor RPM, Gids used during trip, connection retry countdown timer [x]

Data Set 3: GPS Speed, Altitude and Altitude change during trip

Data Set 4: Trip distance and efficiency based on Wh counter and odometer

Data Set 5: Distance and efficiency since last charge based on Gids used and odometer

For **Data Set 5** the distance traveled since last charge automatically resets when LeafSpy detects either a charge cycle that added more than 6 Gids or that the current Gid level has increased by more than 6 Gids from the Gid value at the end of the previously logged trip. The distance can be manually reset before the start of a trip by doing a long tap on the left side of the bar graph while **Data Set 5** is displayed. If a trip has already started the long tap will not reset but load the current trip distance. This is useful if you notice the distance did not get cleared but you have already started the first trip since charging.

(Bar Graph) **(SOC, GIDs, DTE) or (Motor, Aux, Heater, A/C Watts)** Bar graph of available energy and range or power used by function Tapping the right side of the graph toggles between the two sets of data that can be displayed. Any time the heater is active the graph automatically switches to displaying power used to alert the driver to the amount of power being used by the heater.

The top green bar on the graph indicates the State of Charge (SOC) of the battery with full scale being 100%. The middle magenta bar indicates the Gid level with full scale being the maximum Gids defined on the **Settings/Battery** panel. The bottom blue bar represents the remaining range with full screen being either 100 miles or 160 km depending on the units defined on the **Settings/Units** panel. At the start of each trip three white triangular markers are placed on the energy and range graph indicating the starting level of energy and range.

For the power display full scale power is:

- **Motor** 100 kW
- **Auxiliary** 2 kW
- **Heater** 6 kW
- **A/C** 6 kW

(Left bottom number) **xx.x kWh** Remaining battery energy This is the absolute energy remaining in the battery (no reserve). It is calculated based on Gids and the Wh per Gid set on the **Settings/Battery** panel (default 77.5 Wh/Gid).

(Right bottom number) **xxx Wh or xxx^ Wh or xxx* Wh** Energy used or Regen Energy This number is the energy used or if the symbol "^" is append it represents only the amount of energy added to the battery by regeneration. Resetting the Energy used counter is controlled on the **Settings/Battery** panel. The four reset options are:

Reset Manually, Drive+Chrg The counter is only reset manually and the counter accumulates both energy used to drive (+) and energy replaced by charging (-). A reset button will appear below the number when the counter can be reset. The energy used during the current drive or charge is protected and can not be cleared until the drive or charge has ended. Pressing the reset button during a drive or charge will only clear the energy accumulated from previous drives or charges.

Reset Manually, Only Drive The counter is only reset manually and accumulates only energy used while driving and not while charging. A reset button will appear below the number when the counter can be reset. The energy used during the current drive is protected and can not be cleared until the drive has ended. Pressing the reset button during a drive will only clear the energy accumulated from previous drives but not he current drive.

App Start & 1st Connect, D+C The counter automatically resets at the start of each drive or charge. The counter accumulates energy used while driving or charging.

User Wh Counter* This energy use counter can be reset by the user at any time even while driving or during a charge. The counter accumulates energy used while driving and charging.

Tire/Battery Temperature Panel

This panel displays either the pressure of each of the four tires or the battery temperature sensors. Use the control on the **Settings/Tire Pressure** panel to enable automatically alternating between the two displays. A tap on the panel will disable automatic alternating and additional taps will switch between the Tire and Temperature displays. A long tap will enable automatic alternating.

Tire Display

When you first install Leaf Spy the tire pressures will read **n/a** until you drive the Leaf a few hundred feet. This is because the TPMS (Tire Pressure Monitoring System) unit in each wheel sleeps to save battery life until it senses the Leaf is moving or senses a sudden change in pressure. Parenthesis around the tire pressure units (**PSI or Bar**) signals the reading are not current but from a previous drive. Drive the Leaf for a few hundred feet to wake up the TPMS units to get fresh pressure readings and remove the parenthesis. If instead of parenthesis the pressure units are surrounded by "< >" this indicates the pressures are simulated values and the Test Mode option has been enable on the **Settings/Debug** panel.

Two alarms can be enabled on the **Settings/Tire Pressure** panel. One alarm can be triggered if any tire is at or below a set amount. Another alarm can be triggered if the difference between any two tires is equal to or greater than a set amount. When an alarm is triggered screen 4 is automatically displayed with the low tire(s) and/or delta amount highlighted in flashing Red. Tap the panel to temporarily disable the alarm.

Battery Temperature Display
The battery temperature readings can be displayed in one of two formats controlled by the **Settings/Battery Temperature** panel.

max/avg/min This format displays an active thermometer surrounded by three large numbers. The top left number is the maximum sensor reading, the middle right number the average of all sensor readings and the lower left number the minimum sensor reading. The small number in the lower right corner is the ambient outside temperature and is only valid while the Leaf is on.

Sensors This format displays the 3 or 4 temperature sensors depending on the Model Year of the Leaf. In 2013 Nissan removed one of the four original temperature sensors from the battery pack. The sensors are located as follows relative to their positing in the panel:

- **Upper Left -** Center of block of 24 modules located under the rear seat. Normally this is the hottest.
- **Upper Right -** Right side of modules under front right seat
- **Lower Left -** Left side of modules under rear left floor. Removed on 2013 and later year Leafs.
- **Lower Right -** Right side of modules under rear right floor.

Range & Trip Countdown Counter panel

This panel displays an estimated **Range** to one of three **events** plus two buttons used to adjust the efficiency used to estimate this **Range** and an optional **Trip Countdown Counter**.

Tap the **Range** number to select one of the following **events**:

- **LBW** Low Battery Warning
- **VLBW** Very Low Battery Warning
- **Predefined %SOC or kWh level** Where SOC range is 0 to 25% and kWh range is 0.5 to 1.0 kWh and is selected & defined on the **Settings/Range** panel.

The efficiency used to calculate the remaining **Range** is set by the user using the **Plus** and **Minus** buttons. The efficiency units used can be changed on the**Settings/Range** panel.

A long tap on the **Range** number will enable and disable the **Trip Countdown Counter**. When active, the **Range** number will be replaced with two numbers, a distance to go number with a down arrow and then the **Range** number. The default starting value for the **Trip Countdown Counter** is set on the **Settings/Trip Distance** panel. In addition to miles/km distance there is also an option, by selecting 0 distance, to use the current **Range** estimate as the Trip distance. This can be used to gauge the accuracy of the **Range** estimate by using it as the starting trip distance and driving to see if the estimated **Range** is reached.

The **Trip Countdown Counter** can also be adjusted up and down by holding down the **Plus** or **Minus** button. The rate of change will increase after holding the button down for more than 5 seconds.

[**O] Screen 5**

Service Functions

The Service screen is enabled on **Leaf Spy Pro** by going into the **Settings/Service Screen** panel and checking "**Enable**". Since the Service functions are not normally used Leaf Spy Pro disables the screen whenever it is started to prevent unintended service operations from being executed.

Door Lock/Unlock

Use this option to change how all doors are unlocked and to change the automatic door lock/unlock settings of the Leaf.

Presses to unlock all doors This option determines how many presses of the door button are needed to unlock all doors. The factory default is one press to unlock the driver's door and two presses to unlock all doors. Use this option to have one press unlock all doors or to change back to having two presses unlock all doors.

Automatic This option is the master control for the automatic lock and unlock functions.

Lock & Unlock Both door locking and unlocking will be controlled automatically based on conditions set below.

Unlock Only door unlocking will be controlled automatically based on conditions set below.

Lock Only door locking will be controlled automatically based on conditions set below.

Off Automatic door locking and unlocking is disabled.

Auto Lock This option is enabled if either automatic Lock & Unlock or just Lock has been enabled. Select one of the two choices to control when all the doors are locked.

At 15 MPH All doors are locked when the Leaf reaches a speed of **15 MPH**.

Out of Park All doors are locked with the Leaf shifter is taken out of **Park**.

Auto Unlock This option is enabled if either automatic Lock & Unlock or just Unlock has been enabled. Select one of the four choices to control when all the doors are unlocked.

All Doors - Ign On->Off Unlock all doors when the Leaf is **Turned Off**.

All Doors - Shift into Park Unlock all doors when the Leaf is **Shifted into Park**.

Driver Door - Ign On->Off Unlock only the driver's door when the Leaf is **Turned Off**.

Driver Door - Shift into Park Unlock only the driver's door when the Leaf is **Shifted into Park**.

Read DTCs

When a fault is detected by one of the Leaf's ECUs (Electronic Control Units) one or more check codes called Diagnostic Trouble Codes (DTC) are set internally and a dash warning light turns on. Use this option to read out the five character DTCs. Included with the DTC is a short description and a reference to the Service Manual section describing the problem and action to be taken to correct it. A page number is also included but this is only valid for the 2011 Service manual. Do a search of the DTC to find the correct section in later versions of the Service Manual.

Register Tire Positions

Each wheel on the Leaf includes a TPMS (Tire Pressure Monitor System) unit that senses and broadcasts the tire's pressure. Each TPMS unit broadcasts with a unique ID number which the Leaf uses to identify each of the four wheels and their positions on the Leaf. To extend the TPMS's battery life (sealed unit can not be changed) the TPMS only transmits data when the wheels are turning or a pressure change is detected.

If the wheels are rotated the Leaf should be made aware of the new locations of each wheel. This procedure, called Tire Registration, can be done by the dealer with an expensive dedicated tool or with the normal service tool (Consult 3 Plus) by temporarily setting each tire to a unique pressure in a specific order. However, since the Leaf only reports low pressure tires with a single warning light tire registration is not typically done by the dealer.

If the wheels are not correctly registered it causes two problems. Since LeafSpy displays tire pressures relative to the wheel's position on the Leaf if the wheels are not registered correctly the order of the pressures displayed will be wrong. If you have seasonal tires with TPMS units you will need to register them or the Leaf will report a solid tire problem since it does not recognize these new TPMS units.

Before starting a Tire Registration be sure to check that you have the latest version of LeafSpy Pro as several improvements have been made to make the process easier and more reliable. With the new version, while adjusting tire pressures, LeafSpy can now report the pressure changes when the Leaf is turn on (not ACC mode) eliminating the need for a pressure gauge. You must have a way to add air to the tires before starting registration.

Use this function to register your tires after a tire rotation or when swapping seasonal tires. The method used is the same procedure as the one used by the dealer's Service Tool. Each tire is set to a unique pressure starting with 35 PSI in the front left tire and going clockwise around the Leaf with 3 PSI less for each one (35 32 29 26 PSI) ending with the left rear tire at 26 PSI.

If you are swapping wheels you will need a fairly accuracy pressure gauge to setup the pressure sequence. If you have only rotated your tires and LeafSpy can still display the tire pressures (just not in the correct order) then you can use LeafSpy to set the tire pressures while parked by turning the Leaf on (not ACC mode) and running LeafSpy. To test go to the Tire Registration screen and then add a few PSI to the front left tire. In about 15 seconds you should see the pressure reported on the Tire Registration screen to the right of the TPMS ID. If you see the increase you can then start letting air out slowly and waiting 15 seconds until the change is reported. Use this procedure to set the other four tires to the required pressures. Once the pressures are set you can get in the Leaf, press the **Start Tire Reg** button and start driving. In about 5 to 10 minutes registration should complete with a tune sounding. When done be sure to adjust all the tire pressures back to their recommended pressures (**36 PSI / 2.5 Bar**).

Clear DTCs

Clearing DTCs is only enabled after a Read DTC has reported at least one DTC. If there are no DTCs then this function is disabled. DTCs are reset by ECU. Select the ECU you would like to have the DTCs cleared and then press Clear DTC & FFD. Repeat for any remaining ECUs that have DTCs.

Data Logging

The logging function saves data read from the Leaf to a .CSV file located in the **LeafSpy** directory which can be accessed using iTunes. This file can be imported/read into an Excel spreadsheet for later analysis.

The various logging function options are controlled on the **Settings/Logging** panel. The options that are available there are:

Enable Data Logging Enables the data logging function.

Logging Interval The target logging interval range can be set from once every 2 seconds to once per hour. It is a target because the actual interval depends on how long it take to collect a complete sample set of data from the Leaf. A difference between target and actual sample rate is most visible with targets from 2 to 10 seconds. At these fast times the time to collect a complete set of data can be longer than the target interval.

Enable GPS Enables GPS so that location information can be saved in the log file. This option also needs to be enabled for the Elevation/Speed graph to function since the data plotted comes from GPS.

Always keep GPS Active Use this option to allow LeafSpy to run in the background.

Date Format The format of the date saved to the log file is controlled by this option. The four options are:

- Default = Current iOS device default
- Month/Day/Year
- Day/Month/Year
- Year/Month/Day

Append YYMMDD to file name This option will append the date to the end of the log file name creating a new file for each day you log data. While you are driving the date will not change. If you drive through midnight new data will be appended to the previous day's file not start a new one at midnight. The default log file name is "Log_(last 8 characters of VIN)_DeviceID.csv". With this option checked the file name will be "Log_(last 8 characters of VIN)_YYMMDD_DeviceID.csv".

Why are some cell pair voltages negative in the CSV file? When a Shunt is active the corresponding cell pair voltage is saved to the log file as a negative voltage. Use the ABS(xx) function to create a separate column if you wish to plot a cell pair's voltage over time. To sum a row of cell pairs use **=SUMPRODUCT(ABS(your range))**

Log File Format (csv)

[Column Label Example Description]

A "Date/Time" "05/28/2014 9:41:44" Date/Time in either the default format or user selected format. **Warning** Time is saved as HH:MM:SS but when imported into excel the default display format is HH:MM. This means if you then export the file you will lose the seconds information. This can be avoid by changing the display format for time to be HH:MM:SS after importing the file.

B "Lat" "123 12.12345" Latitude in ddd mm.mmmmm format. Note that minutes has 5 digits of precision. **Warning** Be sure to check that all significant digits of minutes are displayed before saving the file otherwise you will lose location accuracy.

C "Long" "-123 12.12345" Longitude in ddd mm.mmmmm format. Note that minutes has 5 digits of precision. **Warning** Be sure to check that all significant digits of minutes are displayed before saving the file otherwise you will lose location accuracy.

D "Elv" "308" Elevation in the currently selected units (feet or meters). Elevation is received from the GPS hardware in the iOS device. Not from the Leaf

E "Speed" "34" Speed in the currently selected units (mph or km/h). Speed is received from the GPS hardware in the iOS device. Not from the Leaf.

F "Gids" "112" Gids which indicates the energy in the Leaf battery. Nissan multiplies this value by 80 Wh to get current capacity of the HV Battery. For this example that would be (112 x 80) = 8960 Wh.

G "SOC" "474133" State of Charge (SOC) of the HV Battery. Divide this number by ten thousand (10000) to get % SOC (47.4133% in this example).

H "AHr" "554385" Capacity of HV Battery. Divide by ten thousand (10000) to get AHr rating (55.4385 AHr in this example). This is how much energy the battery could hold when fully charged. You can get an estimate of energy currently in the battery by multiplying SOC% times AHr times 360 volts (nominal HV battery voltage) = WHr. For the example data that would be (0.474133 x 55.4385 x 360) = 9462.68 WHr or 9.462 kWhr.

I "Pack Volts" 373.82 HV Battery voltage calculated by multiplying average cell pair voltage by 96. During charging of a 2013 or newer Leaf this value will be read directly from the Leaf.

J "Pack Amps" "0" HV Battery amperage, positive =from battery (driving), negative when Regen or charging.

K "Max CP mV" "4033" Millivolts of highest cell pair. Divide by one thousand (1000) to get the highest voltage of any cell pairs in Volts. In this example the highest cell pair has a voltage of 4.033 volts.

L "Min CP mV" "4017" Millivolts of lowest cell pair. Divide by one thousand (1000) to get the lowest voltage of any cell pair in Volts. In this example the lowest cell pair has a voltage of 4.017 volts

M "Avg CP mV" "4025" Millivolts of average cell pair. Divide by one thousand (1000) to get the average voltage of all 96 cell pairs in Volts. In this example the average cell pair voltage is 4.025 volts.

N "CP mV Diff" "16" Millivolts difference between highest and lowest cell pairs. The lower this number the better balanced is the pack.

O "Judgement" "0" This value, if not zero, is used to determine which, if any, cell pair needs to be replaced. Any cell pair whose millivolt reading is less than or equal to the Judgment millivolt value needs to be replaced. The Judgement value is only calculated when the minimum cell pair voltage is less than or equal to 3712 mV. This means that the HV battery must be mostly discharged before a Judgement value is calculated.

P "Pack T1 F" "78.4" HV Battery temperature sensor 1 in degrees Fahrenheit which is located in the center of the rear battery block. Normally the highest temperature.

Q "Pack T1 C" "25.8" HV Battery temperature sensor 1 in degrees Centigrade which is located in the center of the rear battery block. Normally the highest temperature.

R "Pack T2 F" "77.9" HV Battery temperature sensor 2 in degrees Fahrenheit which is located in the front right hand battery block.

S "Pack T2 C" "25.5" HV Battery temperature sensor 2 in degrees Centigrade which is located in the front right hand battery block.

T "Pack T3 F" "78.4" or "na" HV Battery temperature sensor 3 in degrees Fahrenheit which is located in the left hand center battery block. Not present starting with model year 2013.

U "Pack T3 C" "25.8" or "na" HV Battery temperature sensor 3 in degrees Centigrade which is located in the left hand center battery block. Not present starting with model year 2013.

V "Pack T4 F" "77.5" HV Battery temperature sensor 4 in degrees Fahrenheit. For model years 2011/2012 it is located on the right hand side of the rear battery block. For later model year it has been moved to the right hand center battery block.

W "Pack T4 C" "25.3" HV Battery temperature sensor 4 in degrees Centigrade. For model years 2011/2012 it is located on the right hand side of the rear battery block. For later model year it has been moved to the right hand center battery block.

W thru DO "CP1" thru "CP96 "3893" These are the 96 cell pair voltages measured in millivolts. Negative values indicate that the corresponding shunt is active. During pack balancing the shunts are used to drain a small amount of energy from the cell pair.

DP "12v Bat Amps" "-7.72A" 12 volt battery current. Minus is drain and positive is charging. Only available on 2011/2012 Leafs otherwise "na".

DQ "VIN" "JN1AZ0CP9BT123456" This is the VIN number of the Leaf.

DR "Hx" "88.51" This is an indication of the HV Battery's health. A value of 100 would be a battery in factory new condition. The number is thought to be an indication of battery internal resistance with 100 indicating a new battery with lowest resistance. As the value decreases the internal resistance is increasing. As the internal resistance increases more energy is wasted as heat inside the battery instead of powering the Leaf.

DS "12v Bat Volts" "11.84V" The voltage of the 12 volt battery as read by the Leaf's VCM ECU.

DT "Odo(km)" "57604" Odometer reading in kilometers.

DU "QC" "17" Number of Quick Charges.

DV "L1/L2" "4287" Number of time a J1772 connector has been plugged into the Leaf. If the charge timer is enable so charge does not start when immediately plugged in the count may increase by two. One count when the charge cord is plugged in and a second count when/if the charge starts.

DW "TP-FL" "39.25" Tire pressure (PSI) of front left wheel assuming wheel locations have been properly registered with the Leaf. Quarter PSI steps.

DX "TP-FR" "39" Tire pressure (PSI) of front right wheel assuming wheel locations have been properly registered with the Leaf. Quarter PSI steps.

DY "TP-RR" "38.75" Tire pressure (PSI) of rear right wheel assuming wheel locations have been properly registered with the Leaf. Quarter PSI steps.

DZ "TP-RL" "38.50" Tire pressure (PSI) of rear left wheel assuming wheel locations have been properly registered with the Leaf. Quarter PSI steps.

EA "Ambient" "65" Ambient temperature comes from the Leaf's outside temperature sensor and is saved in degrees Fahrenheit. This value is only valid when the Leaf is ON (not ACC mode and not when charging)

EB "SOH" "87" The State of Health of the Battery in percent. After reaching 85% for several weeks the first capacity bar on the right most side of the dash will be lost.

EC "RegenWh" "-539" This is the current value of the Resettable regeneration energy counter displayed on the summary screen. Units are Watt/hours. This value also counts energy during charging.

ED "BLevel" "49" Battery level of iOS device as percent full (49% in this example).

EE "epoch time" "1401294350" This is the time the sample was written in seconds from 1/1/1970.

EF "Motor Pwr(100w)" "378" Drive motor power in 100 watt units. Multiply value to 100 to get watts or divide by 10 to get kW. For this example 37.8 kW.

EG "Aux Pwr(100w)" "2" Power used by the auxiliary equipment (Lights, Radio, Navigation system, rear defroster...) in 100 watt units. Multiply by 100 to get watts. For this example 200 watts.

EH "A/C Pwr(250w)" "3" Power used by the Air Conditioning System power in 250 watt units. This includes the power used by the cabin Heater. Multiply the value by 250 to get power in watts. For this example 750 watts.

EI "A/C Comp(0.1MPa)" "25" A/C Compressor high side pressure in 0.1 MPa units. Multiply by 14.50377 to get PSI. For this example 362.6 PSI.

EJ "Est Pwr A/C(50w)" "17" Estimated Air Conditioning System power in 50 watt units. Multiply by 50 to get power in watts. For this example 850 watts.

EK "Est Pwr Htr(250w)" "8" Estimated Cabin Heater power in 250 watt units. Multiply by 250 to get power in watts. For this example 2,000 watts.

EL "Plug State" "2" Plug state of J1772 (L1/L2) charge port.

- 0= Not plugged
- 1= Partial Plugged
- 2= Plugged

EM "Charge Mode" "2" Charging mode.

- 0= Not charging
- 1= Level 1 charging (100-120 volts)
- 2= Level 2 charging (200-240 volts)
- 3= Level 3 Quick Charging

EN "Chrg Pwr" "3300" Charging power coming into the Leaf in watts.

EO "Gear" "7" Gear position.

- 0= not read yet
- 1= Park
- 2= Reverse
- 3= Neutral

- 4= Drive
- 7= B/Eco

EP "HVolt1" "381.5" High Voltage Battery voltage in volts. It is not clear if HVolt1 and HVolt2 are values taken at different times by the Leaf or from different places in the Leaf. Values come from the BMS ECU.

EQ "HVolt2" "381.4 High Voltage Battery voltage in volts. (See above for why there are two values)

ER "GPS Status" "37F" This hexadecimal number indicates the state of GPS and the current accuracy. The high byte is the accuracy in meters. The low byte is a bit significant encoded number based on the following table. Used to debug GPS problems. The value of "37F" means the current accuracy is 3 meters and GPS is fully functional and all reading are valid.

- 01 = GPS Hardware available
- 02 = GPS Hardware enabled
- 04 = GPS Logging enabled
- 08 = GPS on
- 10 = GPS Accuracy is Valid
- 20 = GPS Altitude is Valid
- 40 = GPS Speed is Valid

ES "Power SW" "1" This field will be "1" if Leaf Spy has read the Power Switch and found it active otherwise it will be "0".

ET "BMS" "1" This field will be "1" if Leaf Spy has been communicating with the BMS ECU otherwise it will be "0".

EU "OBC" "0" This field will be "1" if Leaf Spy has been communicating with the OBC ECU otherwise it will be "0".

EV "??" "0x80" This field is used for debug information which can vary depending on the build version. An example would be the Power Switch status.

Settings

Settings

Use this panel to **Backup** and **Restore** your settings to the iTunes accessible shared folder.

Units

Use this panel to select distance, temperature and pressure units.

Language

Use this panel to select either English or Japanese.

Model Year

Normally the Leaf Model year is automatically selected based on information embedded in the US VIN. For countries not following the US VIN format use this panel to select your model year. At the moment this information is only used to select the number of Battery temperature sensors displayed (3 or 4).

An option to specify the battery pack size (**24 or 30 kWh**) has been added to support the new 30 kWh battery available on the SV and SL 2016 MY Leaf. The pack size is automatically detected when connected to the Leaf but can be changed when not connected to the Leaf to review data captured from a Leaf with a different size battery.

Service Screen

Use this panel to enable the **Service Screen**. By default the **Service Screen** is **Disabled** each time LeafSpy is started. This is done to protect against accidentally making changes to the Leaf.

Trip Distance

Use this panel to set the default trip distance loaded into the trip countdown counter when you do a long tap on the distance to event number on screen 4. To adjust this count while on screen 4 press and hold either the **+** or **-** button and after a short delay only the trip distance is displayed with a down arrow. Then use the **+** or **-** button to adjust the value. When done tap the trip distance number.

Range

Use this panel to configure the distance to event panel on screen 4. The three **events** that can be cycled through by tapping on the remaining distance number are: to Low Battery Warning **LBW**, to Very Low Battery Warning **VLBW** or to a pre-selected amount of reserve energy **x% SOC** or **x.xkWh**.

Use the radio buttons to select whether the reserve amount is based on **%SOC** or **kWh** then use the pull down menu to select the amount of energy to be reserved (0 to 25% SOC or 0.5 to 1 kWh).

There are two ways to calculate remaining distance: one simple (available energy divided by efficiency) or a more complicated formula taking into account battery temperature and ambient temperature developed by Tony Williams. The default is to use the temperature adjusted formula. To select the more advanced method check the **Use Temperature (Bat & Air) to adjust DTE** check box.

When miles is the selected units efficiency can be expressed as either **Miles/kWh** or **Wh/Mile**. When km is the selected units efficiency can be expressed as either**km/kWh** or **Wh/km**. The plus and minus keys on screen 4 are used to adjust the efficiency used to calculate remaining range to event.

The user is responsible for setting the appropriate efficiency number based on the current dash display and the driver's experience for this route.

Tire Pressure

Use this panel to control the tire pressure alarms and adjust the tire pressure locations on screen 4 to match their actual position on the Leaf without going through the**Tire Registration** process.

Alternate Tire/Temp Display This option controls whether upon LeafSpy startup the Tire Pressures and Battery Temperature readings on screen 4 alternate. This settings can temporarily be changed on screen 4 by tapping the Tire Pressure/Battery temperature display panel. If alternate is active it will be stopped. If it is not active a tap will toggle between the two display formats. A long tap will activate alternating between the two display formats.

Sound Alarm This option control whether a tune is played when a tire warning pressure or delta warning pressure has been reached. Tapping on the tire pressure panel on screen 4 will silence the alarm.

Use alternate method to read Tires On some newer model Leafs Nissan has changed the method to read the tire pressure. If that is the case then the normal method will not work and the tire pressures will display **n/a**. Select this option to use an alternate method that works on all Leafs.

Enable Tire Remapping Use this option to rearrange the tire pressure readings on screen 4 to match the tire's actual location on the Leaf. This is an alternative method from doing a **Tire Registration** accessible through the **Service Menu**. To determine each tire's actual location the pressure in a tire can be increased or decreased and then a note take as to which tire location on screen 4 actually changes. Once the true location of each tire is determined use one or more of the following three options to remap the tires to their correct location on the Leaf.

Swap Front/Rear positions This option will do a straight front to back and back to front swap leaving the left/right positions unchanged. This option, if checked, is done first. Then either or both of the following options are applied.

Swap Front Left/Right This option swaps just the front two tires left to right and right to left.

Swap Rear Left/Right This option swaps just the rear two tires left to right and right to left.

Enable Virtual Tire Registration Once you have the tires correctly displayed on screen 4 this option can be used whenever the tires are rotated to automatically make the adjustments to screen 4.

Reset Use this option if you have done a **Tire Registration** to reset the tires to their default post registration position.

Swap Front/Rear Tires Use this option if you are rotating the tires according to Nissan's recommendation of a straight front to back swap keeping left on left and right on right.

Swap Cross Front Use this option if you are doing a straight to back then cross to front swap.

Swap Cross Back Use this option if you are doing a straight to forward then cross to back swap.

Battery

These options can be used to customize your battery's characteristics.

Restore Defaults Pressing this button will resort the battery characteristics to their default values.

- Shunt Order = 4812
- Nominal Pack Voltage = 360 volts
- Maximum Gids = 281 Gids
- Wh/Gid = 77.5 Wh/Gid

Shunt Order This option controls the highlighting in **Red** of the cell voltage bars on screen 1. A **Red** battery voltage bar indicates that the **Shunt** is active for that cell.**Shunts** are small resistors that can be switched in to drain a small amount of energy from one or more of the 96 cells making up the high voltage battery pack. This is the method used by Nissan to balance the pack by draining energy from the high energy cells. This works because charging stops to prevent overcharging the highest energy cell. So by reducing the energy in the highest energy cell all the other cells are able to be charged to a higher level.

Shunt status (on or off) is reported by the Leaf in 24 groups of four bit numbers (0 to 15). However, the ordering of the cells within the group of four bits is not known for certain. The **Shunt Order** field allows for the reordering of the cell mapping within the group of four bits. The four shunts are given labels representing their binary position (8 4 2 1) with 8 being the most significant or highest location bit and 1 being the least or lowest position bit.

For the first two groups of 4 bits which defines the mapping for battery cells 0 thru 7 the default mapping value of 4812 results in a cell mapping to bits of 1032 5476.

Nominal Voltage Use this field to change the nominal voltage used to calculate the current energy in the battery. It is not recommended that you change this value unless the battery chemistry used by the Leaf changes requiring a different nominal voltage be used.

Maximum Gids This pulldown menu allows you to set the maximum Gids used to calculate percent Gids remaining. The default value is 281 which is valid for 2011/2012 Leafs but newer Leafs have a higher maximum Gid value. This value should be set to the original maximum value after a full charge when the Leaf was new and should not be later changed as the battery degrades.

Wh/Gid This pulldown menu allows the energy associate with each Gid to be varied between 70 to 80 Wh per Gid. This number is used to calculate the available kWh of energy in the battery when calculated from Gids.

Configure Wh Counter Use this option to configure when to reset the Wh counter on screens 3 and 4. The four choices are:

Reset Manually, Drive+Chrg The counter is only reset manually and the counter accumulates both energy used to drive (+) and energy replaced by charging (-). Under perfect conditions (which never exist) after a drive then charge the counter would return back to zero. The energy used during the current drive or charge is protected and can not be cleared until the drive or charge has ended.

Reset Manually, Only Drive The counter is only reset manually and accumulates only energy used while driving and not while charging. The energy used during the current drive or charge is protected and can not be cleared until the drive or charge has ended.

App Start & 1st Connect, D+C The counter automatically resets at the start of each drive or charge cycle and accumulates either Drive or Charge energy.

User Wh Counter* This energy use counter can be reset by the user at any time even while driving or during a charge. The counter accumulates energy used while driving or charging.

Battery Temperature

This option controls how the battery temperature sensor data is displayed on screen 4.

max/avg/min Displays the maximum, average and minimum battery temperatures with a thermometer graphic displaying maximum temperature along with the outside ambient temperature in the lower right corner. Ambient temperature is only valid when the Leaf is on and not while charging.

Sensors Displays the three or four (2011/2012) battery pack temperature sensors.

Logging

This panel controls the **Logging** feature in LeafSpy.

Enable Data Logging This option enables **Logging**.

Always keep GPS Active This option is used to instruct iOS to let **LeafSpy Pro** continue to run in the background.

Enable GPS This option is available even when not logging as the elevation and speed data used for the elevation and speed graph come from GPS data. This option should normally always be selected. Logs containing GPS data can be uploaded to the **leaflogger.com** web site which allows you to visualize your trips on Goggle maps. Contact the owner of the leaflogger web site for an ID to access the web site.

Append YYMMDD to file name This option should normally be checked and controls adding a date stamp to the log file name. This also breaks the log file into files by day instead of just one big file. It makes managing your log files much easier to have them broken up by day. A trip the spans midnight will be saved in the file that started the trip.

Log Interval This pulldown menu is used to specify the log interval from once every 2 seconds to once per hour. One log entry is always made at the start of logging so if a one hour interval is selected at the one hour time there will be two entries in the log. One for time zero and then a second an hour later.

At the faster sample rates log entries may actually occur at a slightly slower rate. This is depended on the cycle time to read one full set of data from the Leaf. If the sample rate is faster than the time to read one full set of data then the cycle rate controls the log interval. The cycle time is dependent on the speed of the device and OBDII adapter.

Log Date Format This pulldown menu controls the format of the date saved in the log file. The default value is set to the same format as the device but can be changed using this option.

Dropbox

This panel controls the **Dropbox** file synchronization feature. It is not necessary to have **Dropbox** installed on the device to use this feature as the feature is self contained within LeafSpy. A new folder will be created in your **Dropbox** named **Dropbox/Apps/LeafSpy Pro** with subdirectories **Debug_Logs**, **Charge & Elevation Logs**, **Trace Files** and **Log Files**.

Enable This option enables file synchronization with your **Dropbox**. When this option is checked the **TripChrgLog** file is automatically synchronized. To sync other files select one or more of the following options.

Log Files Select to sync **Log_xxx.csv** files.

Charge & Elevation Files Select to sync **ES_xx.csv** and **Qxx.csv** files.

Trace & Error Files Select to sync **TRC_xxx.txt** and **ERRdata.txt** files.

Sync Interval Use this pulldown menu to select the synchronization interval (every 1, 2, 5, 10 or 15 minutes) but sync only occurs if a file has changed size.

Use only WiFi Select this option to prevent using your data plan for file synchronization. File synchronization will only be done over a WiFi network when not connected to the Leaf.

Notification

Enable this option to activate notifications while **LeafSpy Pro** is running in the background.

A notification can be triggered based on a change in Gids or at a selectable time interval of 1, 2, or every 4 minutes. Sound can be enabled when a notification is posted.

By default a notification is always given at the end of a trip even if both Gid change and an interval are not selected.

The notification displays the following information:

- Trip duration
- Gids remaining
- Gids used
- Energy used
- Trip Distance
- Distance since last charge

System

This panel is used to select which WiFi network is connected to the Leaf.

Register Current SSID as an OBDII Adapter Press this button when the displayed **Current SSID** matches the SSID of the WiFi OBDII adapter connected to the Leaf.

The registered SSID can be cleared by doing a long tap on the Registered SSID name. Use this option when switching from a WiFi OBDII adapter to a Bluetooth 4.0 LE adapter. This will prevent LeafSpy from trying to connect to the registered SSID and displaying the current WiFi SSID message.

Screen

Use this panel to control various aspects of the screen.

Hide Connect Status Checking this option will hide the state number displayed in the lower right status window which cycles as commands are sent to the Leaf.

Obscure VIN Use this option to obscure the VIN on screen 1 by replacing the lower five characters of the VIN with five characters from the device ID.

Default Night Mode Use this option to force **Night Mode** when LeafSpy first starts up. If you drive mostly at night this option will prevent the screen from switching to bright mode before the headlight status is read.

Options

This panel is used to control program options.

Skip Reading Headlight Status Select this option to disable the automatic switching of the display into and out of **night mode**. If you always keep your headlights on this feature should be selected. When selected there is also a slight shorting of the cycle time to read all data from the Leaf since one command/response sequence is skipped (giving slightly better performance).

Adjust outside temp offset This option allows an offset of -5 to +5 degrees to be added to the outside temperature reading displayed on screen 4 to bring it into alignment with the Leaf dash display. Keep in mind that the Leaf dash temperature display responds very slowly to outside temperature changes. It is best to make this adjustment only after the Leaf has been sitting at the same temperature for at least an hour to give time for the dash display to stabilize.

Disable forcing energy display Use this option to stop the automatic selection of the energy usage display on screen 4 whenever the PTC heater is active.

Disable Sound Disables all sounds from the LeafSpy.

Statistics

This panel displays statistics on the quality of data received from the OBDII Adapter. These statistics are reset each time a new connection is made.

Good Frames Counts the number of good frames received.

Bad Frames Counts the number of bad frames received. A bad frame is defined as one where the data length does not match the received data bytes.

Successful Is the percent success rate (Good frames/(Good+Bad frames)).

Retries Counts the number of times a command had to be re-sent due to a timeout in receiving a response from the Leaf.

Bad Hex Counts the number of frames received that had non-hexadecimal characters in it.

Debug

The debug panel gives access to some special features.

Enable Checking this option enables a **Console** screen located to the left of screen 1.

Testmode Generates test data while not connected to the Leaf.

Trace ELM (on LeafSpy restart) This option is used to capture a trace of the ELM interface to help isolate a problem.

If directed to take an ELM trace, check this option then exit and restart LeafSpy. Upon restart the words **"Logging ELM"** will flash at the bottom center of the screen. While the trace is active try to recreate the problem letting LeafSpy run for a minute then exit LeafSpy. A text file will be created on the iTunes accessible shared folder with a name of **TRC_yymmddhhmm.txt** where yymmddhhmm is year month day hour minute. Send this file along with the **ERRData.txt** file located in the same directory to **WattsLeft.meter@gmail.com** for analysis.