

## LeafSpy Help Version 1.3.4 (Android)

**Note:** This **Help** is available as a **PDF** file by sending an email with a subject of "**Android PDF Help**" to [WattsLeft.meter@gmail.com](mailto: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 "Android Help file".

## OVERVIEW

LeafSpy extracts and displays information from the Leaf through a user supplied OBDII adapter plugged into the Leaf's OBDII connector located under the Leaf's dash. OBDII adapters come in three basic types depending on the method used to communications with your Android device. The three types are standard Bluetooth (requiring a pairing step), Bluetooth 4.x LE (no pairing needed) and WiFi. See the **OBDII Hardware** section for recommendations.

Leaf Spy consists of from 2 to 5 main information screens depending on the version of Leaf Spy you have installed.

**Leaf Spy Lite** has two main screens. The Battery Status screen and a second screen that can be toggled between displaying the variation in voltage levels between the 96 cells that make up the High Voltage battery pack (the less variation between cells the better balanced and the more energy the pack can hold) and a display of the four (2011-2012 MY) or three (2013 on up MY) battery pack temperature sensors.

**Leaf Spy** adds three additional graphs to the second screen and adds two additional screens (3 and 4).

In addition to the voltage histogram and temperature chart the second screen can also display a graph of charging power, %SOC, %Gids and if quick charging battery temperature during a charge and an elevation/speed graph. Just tap on the second screen to cycle through these four graphs/charts.

The two additional screens (3 and 4) are a Basic/Custom screen showing key information in a large font with a new option to create your own custom version accessed by swipping up or down and a more detailed summary screen showing much more information such as estimated driving distance remaining, tire pressures and energy usage per function (motor, accessories, heater, A/C).

**Leaf Spy Pro** adds a Service screen (5) that allows viewing and changing service information normally only available to the dealer such as reading/clearing Diagnostic Trouble Codes (DTC) and an experimental Brake monitor/Motor Power screen.

## Overview of Screens

Located in the lower left corner of each screen is an indicator that shows how many screens are available (2,4 or 5) and which screen is currently displayed. Swipe left or right to change to the **next** or **previous** screen. You can also tap the bottom center of the screen to select the **next** screen or do a long tap to select the **previous** screen. First and last screens wrap.

In the upper right corner of most screens are three dashed line. If your device does not have a dedicated key or key sequence to bring up the application's menu then tap this area to bring up the LeafSpy Menu. The Menu has options to select the OBDII adapter LeafSpy should use (go here the first time you start LeafSpy), access the Settings menu, view the trip log, bring up the About screen (from which you can access the change history and built-in LeafSpy help screens) and exit the application.

Pressing and holding down on the three dash lines in the upper right corner of a screen will display an overlay of "hot" areas on that screen that can be tapped along with a short description of their assigned function(s).

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

**Screen 1** is the Battery Pack Status screen. The top of the screen shows the battery AHr rating (which will slowly decline with age), State of Health (SOH), battery pack voltage and current, VIN/pack serial number, 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. In the upper right corner is the voltage difference between the highest and lowest cell in millivolts(mV). Tap top/bottom of the chart to zoom out/in. A Red colored voltage 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 selected mV scale with 50 mV being the smallest. Zooming In and Out changes this scale.

**Screen 2** displays one of five 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 more usable energy.

**Graph 2** displays the battery pack temperature sensors.

**Graph 3** displays the active or last charge cycle monitored by LeafSpy. 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 Android device must have GPS for this function to work.

**Graph 5** is the "Efficiency" graph that displays the last 32 samples of efficiency which occur at 1 km intervals while driving. The most recent sample appears on the right. Swiping up or down selects a Wh/mile(Wh/km) or miles/kWh(km/kWh) display.

**Screen 3** has both a Basic screen and new Custom screen. (Swipe Up/Down to switch)

**Basic Screen:** The Basic screen shows the 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. At the bottom of the screen is a displays of the Climate Control state including HVAC mode, power used, fan speed, air flow direction and set temperature.

**Custom Screen:** This new screen is defined by csv files and can be customized to display selected information. Four sample custom screens are included and any number can be created to display just the information your are most interested in seeing.

**Screen 4** is the Summary screen. It displays battery and energy usage information, power used per function (motor, accessories, PTC 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), reading all the ECU version numbers and battery serial number and changing the auto headlight on/off, interior light on/off and auto door lock/unlock conditions. VSP (sound generator) can also be programmed to disable selected types of sounds the Leaf automatically generates.

## OBDII Hardware

In order for LeafSpy to communicate with a Leaf a user supplied OBDII adapter must first be installed in the Leaf's OBDII socket located under the dash above the driver's left knee. The Leaf must be turned on (dash gauges active, not just ACC mode) and after starting LeafSpy for the first time the OBDII adapter must be selected using the "Select OBDII" option. LeafSpy supports three types of OBDII adapters: Bluetooth 4.x LE, standard Bluetooth and WiFi.

The recommended OBDII adapter type is the newer Bluetooth 4.x LE which is low power and requires no pairing. There are two supported Bluetooth 4.x LE adapters the LELink available from Amazon and the PLX Kiwi 3. Of the two the LELink is the recommended adapter.

The cheap standard Bluetooth OBDII adapters available on ebay and other places are hard to recommend due to two issues. The first is that most standard Bluetooth OBDII adapters are cheap clones of the original ELM327. This was originally not a problem as they supported the required ELM327 commands to communicate with the Leaf. But a year or two ago these cheap adapters started to change as outline below in more detail. They were cost reduced resulting in critical ELM327 commands not needed to communicate with a gas car being dropped. Instead of reducing the version number (fewer commands supported) the version number either stayed the same (1.5) or changed to 2.1. Making the version number meaningless. An adapter that really supported the ELM327 v1.2 or v2.1 command set would work with LeafSpy.

The second issue is with the Bluetooth OBDII adapter that had previously been recommend which was the Konnwei KW-902. This supported the required commands but has recently been cost reduced. However, the cost reduction is not the issue as the supported commands are still there. Instead the wrong resistor is being used to terminate the +/- CAN signals. Due to a design or manufacturing error instead of a 120 ohm resistor being used it was changed to a 20 ohm resistor. If plugged into the Leaf this low resistor value will prevent the CAN bus from functioning properly and can result in an i-Key fault, not being able to drive the Leaf and other strange behavior. If you have a Konnwei KW-902 you should check the resistance between pins 6 and 14. A reading of 20 ohms indicates a defective adapter which should not be plugged into your Leaf. The CAN bus is fault tolerant so if you have plugged it in unplugging should allow the Leaf to resume normal operation.

If you are lucky enough to already have or buy a standard Bluetooth OBDII adapter that still support the full command set the adapter must first be paired with the Android device using the Android Bluetooth Settings menu. The typical PIN is "**1234**". Then when LeafSpy is first started go into the LeafSpy Menu and select the "Select OBDII" => "Bluetooth Paired Devices" to bring up a list of paired device. From the list select the OBDII adapter then reenter the PIN.

Recently cost reduced WiFi OBDII adapters have come onto the market that have also dropped support for the required ELM commands. There is no way to tell these adapters from the ones that work as they use the same case and labeling. Always buy from a place you can return if you should get one that does not work.

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LeafSpy does not look at the version number reported by the ELM327 adapter as it is not a reliable indicator of the ELM commands it supports. It is not until LeafSpy attempts to configure the ELM327 for communications with the Leaf that LeafSpy discover the lack of support for the needed ELM commands. If the ELM327 reporting a version number of 2.1 actually supported the official version 2.1 ELM command set it would work with LeafSpy. This incorrect labeling as version 2.1 gives the impression that LeafSpy does not support ELM version 2.1 which is total incorrect.

## Recent Changes

Added a new custom screen option on screen 3. Swipe up/down to select the default screens. Press the Load button to select other custom screens.

Added support for the new LELink<sup>2</sup>. Support for the special zero power mode, when not being used, will be supported in the future once it has been verified there are no undesirable side effects.

Dropbox support has been updated to Dropbox's new API 2 interface as API 1 is no longer supported. There is also a new **Reset ID** button available when Dropbox is disabled that clears the saved login information, if it exists, so a different Dropbox account can be selected. A **Long** press of the **Reset ID** button is required to active this function.

**Important Note:** In switching from Dropbox API 1 to API 2 LeafSpy will initially disable Dropbox when started. Go into **Settings/Dropbox** and re-enable Dropbox and exit Settings. In a few seconds a new Dropbox login page will appear so you can re-authorize LeafSpy's access to Dropbox using the API 2 interface.

Support for the 2018 Leaf. US and Japanese 2018 model Leafs are automatically detected based on VIN/Chassis number. For 2018 Leafs in other countries please go into Settings and manually select the model year.

SOH (State of Health of the battery) resolution has been increased by a factor of 100 (86% to 86.34%).

New motor/inverter only mode where only data from the motor/inverter ECU is read.

Improved BMS Only mode where screens not providing BMS data are hidden.

The server function now uploads Power Switch status (0/1), Temperature units (C/F) and motor RPM.

Added support for two additional Bluetooth 4.x LE adapters (VEEPEAK and Stalhcar).

Changed the default battery shunt order from "4812" to "8421" which seems to be a better mapping. You will need to go into **Settings/Battery** to manually make this change if you already have LeafSpy installed.

If your Leaf did not come with the Auto headlight feature but you have added the necessary hardware to support it you can now enable Auto headlights as an option of the Headlight service screen.

If your Leaf supports reading the 12v battery current it will be displayed to the right of the 12v battery voltage.

Requested motor torque is now saved to the log file in Nm units.

New Service function (**VSP**) to allow controlling the inside and outside sounds generated by the Leaf.

On screen 1 the difference between the highest and lowest cell voltages is now displayed in a large font in the upper right side of the screen. Optional "monitor" information is displayed on the left side.

## Key Features

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

**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.

**Soft Menu** A soft Menu key (marked by three dashes) is available in the upper right corner of screens 1 thru 4. Tapping this area brings up the menu to Select OBDII, Settings, View Trip Log, About & Help or Exit. This provides a way to bring up this menu on newer android devices that do not have a dedicated menu key.

**Overlay Help** In addition to bring up the Menu the upper right area also serves as a way to overlay the current screen with help information about tap sensitive areas. By pressing and hold down on the upper right corner (marked by the three dashes) an overlay will appear. Areas marked in a gold color are single tap areas and areas marked in green have both a short and long tap function.

**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. The value can also be changed on screen 4 by holding down either the plus (+) or minus (-) button. The font size of these two numbers can be changed by placing the screen in "Screen Frozen" mode (tap lower right status box) and then using the +/- buttons to adjust the font size.

**Background Logging** is supported. This means that if Logging is enabled it will continue even if Leaf Spy loses focus as when another application is started. Depending on your Android device logging may continue even when the Android device is placed in sleep mode.

You can determine if your Android device supports background operation while in Sleep mode by running Leaf Spy until it connects to the Leaf then place the Android device in Sleep mode. Look at the OBDII adapter and if you see a light flash every 5 to 10 seconds the background function is still active. Logging does not need to be active to run this test.

**Brake Force graph & Motor Power graph** are experimental features of **Leaf Spy Pro**. It consists of a new graph screen that can be toggled, by tapping it, between showing a Brake Force screen or a Motor Power screen. **Warning:** If you experience any connection problems or problems moving between screens then **Disable this feature!**

Both screens show regeneration either as a portion of the braking force being applied to the wheels or as power being generated by the motor. To enable this function go to the **Settings/Braking & Motor Monitor** panel and check **Enable**. This panel also has an option to control the Brake **Window** size which controls the number of seconds of Brake history that is displayed. Another option controls whether braking force is displayed at the top of the Motor monitor screen.

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

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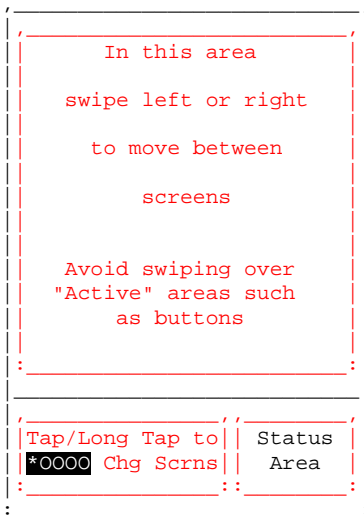
# Navigation

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\*000** 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:

**...status...** Yellow: trying to connect to ELM Adapter

**...status...** Orange: ELM ok, trying to connect to Leaf

**Connected** Green: connected to Leaf, command number

**Screen Frozen** Gray: 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** state 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.



## Menu

The **Menu** button (three stacked lines) is located in the top right corner of the screen. Tapping the **Menu** area will bring up a menu of items across the bottom of the screen. The five menu items are **Select OBDII**, **View Trip Log**, **Settings (Gear)**, **About/Help** and **Exit**.

**Select OBDII** - Use this option when LeafSpy is first installed or when changing to a different OBDII adapter. Select from a list of OBDII types.

### Device list

- Bluetooth 4.x LE
- Bluetooth Paired Devices
- WiFi Devices
- Work Offline

**Bluetooth 4.x LE** - Selecting this option causes LeafSpy to automatically search for one of the two supported Bluetooth 4.x OBDII adapters (LELink & PLX Kiwi 3). There is no pairing needed or possible with a Bluetooth 4.x LE device.

**Bluetooth Paired Devices** - Selecting this options brings up a list of currently paired Bluetooth devices. Be sure to pair any new Bluetooth OBDII device before selecting this option or it will not be in the list. Go to the Android Settings/Bluetooth screen to search for and pair with any new OBDII device. When prompted enter the password used during pairing.

**WiFi Devices** - Selecting this options brings up a list of WiFi networks. From the list select the network of you WiFi OBDII adapter then if needed enter the network password.

**Work Offline** - Select this temporary option if you wish to use LeafSpy to review data without connecting to a Leaf. It does not change the previously selected OBDII adapter. It only disables using it during this LeafSpy session.

**View Trip Log** - Selecting this item displays the Trip Log. Once the trip log appears a single tap will force a jump to the most recently completed trip located at the bottom of the screen.

**Note:** 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 please wait for a beep sound and the word "**Saved**" to be displayed to the right of the trip timer at the top of screen 4. When you see "Saved" and/or hear the beep the trip has been record to the Trip Log.

### Trip data saved

- Start 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

**Settings** - Selecting this item brings up the Settings screen. See bottom of help for all available settings.

**About/Help** - Selecting this item brings up a panel displaying the following information.

#### **About/Help**

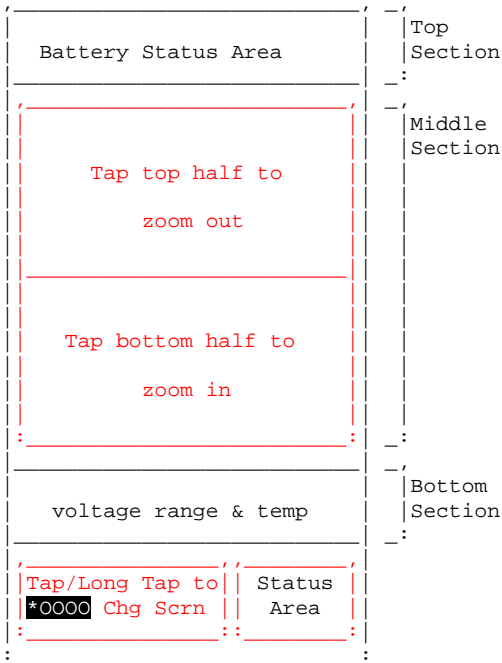
- LeafSpy version (Android version)
- Bluetooth 4.x LE status
- Author's name
- Contact email address
- Button to access Change History
- Button to exit About screen
- Button to access LeafSpy Help

**Exit** - Use this option to exit the LeafSpy application and stop communications with the Leaf.

# Battery Status

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

Pressing the three dashed line area in the upper right corner will bring up the screen help overlay that identifies areas that can be tapped to change what or how things are displayed. **Orange** areas have a single tap function and **Green** areas have both a short and long tap function.



**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/Battery Serial #** 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. If the ECUs have been read

using the **Service** function then the High Voltage battery pack serial number will alternate with the VIN. Use the Freeze Screen function to temporarily stop the alternating.

**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.

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 pack. Highlighted bars in **Red** indicate a 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 present 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.

Overlaying the right top side of the **Middle Section** is the cell difference voltage in a large easy to read font. This difference increases as the battery approaches empty.

**Monitoring** information can be overlaid on the left top side of the **Middle Section**. By default this information is hidden. Tap the area to cycle through the available monitor information.

### **Monitoring Information**

- (blank) - Default
- xx L - Number of Lost frames from OBDII adapter
- x.x sec - Last collection cycle time
- xx - Count records written to log file

The Lost frame count should normally be zero. If not zero the count can be monitored to determine what activity or condition results in lost frames.

The cycle time can be used to compare difference OBDII adapters and devices to gauge their performance. A faster cycle time results in more frequent updating of data on the screen.

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.

The **SOC** field is located at the bottom left corner of the screen.

**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 holds more energy than a 5 year old battery at 50% SOC.

**Note:** The **SOC** displayed here is not the same as the one displayed on the dash of later model Leafs. What is displayed by LeafSpy Pro is the true **SOC** as reported by the battery management computer. The one on the dash is adjusted to respond like a traditional gas gauge. The dash gauge will show 100% and 0% whereas the real SOC never reaches those values in order to protect the battery and extend its life.

**Cell Voltage Loss Inspection** This test is 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 xx yy zz being the weak cell numbers. If the test finds no weak cells the message "**All Cells OK**" will be displayed in green.

## Graphs

Depending on the version of LeafSpy, either two, four or five 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 5" or "2 of 2").

- 1) Voltage Histogram
- 2) Battery Temperature
- 3) Charge Graph
- 4) Elevation Graph
- 5) Efficiency Graph

Pressing the three dashed line area in the upper right corner will bring up the screen help overlay that identifies areas that can be tapped to change what or how things are displayed. **Orange** areas have a single tap function and **Green** areas have both a short and long tap function.

### 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 cell pairs 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.

- <= 65F (18.3C) Blue
- <= 75F (23.9C) Green
- <= 86F (30.0C) Yellow
- <= 95F (35.0C) Orange
- <=105F (40.6C) Pink
- > 105F (40.6C) Red

### 3) Charge Graph

This screen plots charging power and power going into the battery 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. A sample Quick Charge graph is displayed when LeafSpy is first installed.

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 yet 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 yyy 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 colors used to plot the power. 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**. Use two fingers to zoom in/out and a single 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 Android 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. A sample elevation graph is displayed when LeafSpy is first installed.

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. Once GPS has locked on to sufficient satellites, the second title line displays the elevation, (accuracy), speed and (color of speed plot) (**Elevation 285 (+/-13) Speed 19 mph (Red)**).

The left axis label gives the units of elevation and the color of the elevation plot. 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 yy mm dd hh mm being year month day hour minute. Graphs are saved in **csv** format.

Tap on the bottom corner status box to enable **Zoom/Scroll**. Use two fingers to zoom in/out and a single finger to scroll left/right.

## 5) Efficiency Graph

This graph plots the efficiency of each full km of travel displaying up to the last 32 km of travel. To make it possible to identify separate trips the color of the bars alternates between trips. Swipe up or down to switch between graphing efficiency as Wh/distance or distance/kWh. The top line displays the most recent efficiency number followed by the average efficiency of the graph. The bottom of the graph shows the minimum and maximum efficiency values on the graph.

Tap the **Clear** button to bring up a menu to allow clearing just the oldest sample, all samples or to Save the graph in csv format. The file name will be of the form `Eff_last8ofVIN_date_time.csv`.



## Basic/Custom Screen

Swipe up or down to switch between the Basic Screen and Custom Screen modes.

Pressing the three dashed line area in the upper right corner will bring up the screen help overlay that identifies areas that can be tapped to change what or how things are displayed. **Orange** areas have a single tap function and **Green** areas have both a short and long tap function.

### Basic Screen

The Basic screen provides the following information in a large text format for easy viewing. The top of the screen displays information about the battery and energy usage while the bottom displays information about the climate control system.

There are five buttons on this screen. The text on all but the Reset button is used to displays additional information.

**"Reset"** This button only appears if the energy usage counter can be reset. This is controlled with the **Config Wh Counter** pulldown on the **Settings/Battery** panel.

**"F" or "C" & type** Use this button to change the type of temperature displayed to either the maximum, average or minimum battery temperature. The button text shows the units, type and in parenthesis the delta between the highest and lowest sensor readings.

**"miles" or "km"** This button and the following button are only enabled when using the manual method for setting efficiency. They are disable when "Trip" (T), "Since Last Charge" (C) or "Instantaneous" (i) modes are selected. The efficiency mode used is selected on Screen 4. In manual mode use this button to increase the efficiency number used to calculate the range to event. The text shows distance units (miles/km) and the currently select event (LBW, VLBW, x% or x.kWh). The event can be changed on Screen 4 and for the percent or kWh selection on the **Settings/Range** panel.

**Efficiency** Use this button to decrease the efficiency number used to calculate the range to event when using the manual method for determining efficiency. The top line of the button lists the current efficiency number being used. If that number is prefaced with a letter the efficiency is being automatically calculated based on distance traveled and energy used. There are three automatic modes based on distance used for the calculation. The following table lists the letter and distance used in the calculation.

- (no letter) - Efficiency manually entered
- **T** - Distance of current trip
- **C** - Distance since last charge
- **i** - Last km

The text on the bottom of the button shows the units of efficiency (miles/kWh (km/kWh) or Wh/mile (Wh/km)) which can be changed on the **Settings/Range** panel.

**"GIDs"** Use this button to switch between displaying the Gids value or Gids percent to the left of the button. The value not being display to the left of the button is displayed on the button. The percentage is based on the maximum Gids entered on the **Settings/Battery** panel. Default is 281 Gids for the 24 kWh pack and 357 Gids for the 30 kWh pack. In landscape mode this button is moved to the top.

The following information is displayed on the upper section of the screen.

**SOC** = State of Charge: This is being read directly from the Leaf's battery management system (BMS) and is based on the current capacity of the Leaf battery. That means if you charge your Leaf to 80% then at the completion of the charge the SOC will always be 80% 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. (Think of a shrinking gas tank. It can always be filled to the top so 100% full but its size has shrunk from 10 gallons to 5 gallons.)

**Note:** What is displayed here is the true SOC and may differ from the one displayed on the Leaf dash. To protect the battery Nissan prevents the battery from being fully charged to 100% and drained to 0%. However, this would be confusing to drivers expecting a full charge to be 100% so the dash SOC is adjusted to display 100% when in fact the SOC is less. What is displayed here is the true engineering SOC value.

**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 fully charged Ah displayed at the top of screen 1.

**V** This is the voltage of the high voltage battery pack. 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 on 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. What this counter accumulates (Drive/Charge energy) and when it gets reset is configured on the **Settings/Battery** panel.

**Temperature** Battery temperature either in C or F depending on the units selected on 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 through minimum, average and maximum temperature readings.

**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. When using a manually entered efficiency, 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** panel. The choices are Miles/kWh (km/kWh) or Wh/Mile (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.

The following information about the Climate Control system is display on the lower section of the screen.

**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 On 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 has 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. The temperature units used is automatically set. If not correct please cycle the set temperature to its maximum and minimum values which will cause the correct units to be detected and used.

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

## Custom Screen

This new feature allows you to create your own custom screens or use ones generated by others to view only the information you need. The information, size and location on the screen are completely controllable. Important information can be displayed in a large font with less important information displayed in a smaller font. Four sample screens are included. Two for each orientation. Any number of screens can be created. A **Load** button allows easy loading of a new custom screen.

The data used to create a Custom Screen is read from a csv file located in the `/LEAF_BT_CAN/CUSTOM SCREEN` folder. Each line of the csv file defines a label and parameter including size and location of each one on the screen. Each csv file is created for a specific orientation either **Portrait** or **Landscape**. The last character of the file name must be either "P" or "L" and is used to filter which files are displayed when loading a new custom screen.

To allow custom screen definition files to be used on different sized screens the font size and screen scale factor can be increased or decreased while being viewed. The adjustment feature is accessed by tapping the freeze button in the lower right corner twice. The button label will then change from "**TAP to Freeze**" to "**Screen Frozen**" to "**Adjust Font**". Tapping again will select "**Adjust Scale**". Once "**Adjust Font**" or "**Adjust Scale**" is displayed tapping the top or bottom area of the screen increases or decreases the font or scale. The adjustment only affects the screen being viewed and each screen is adjusted individually. These adjustments are saved in a text file named "**CustomAdjust.txt**" stored in the same location as the csv files.

Four sample Custom Screens are built into LeafSpy with two of them being protected and always refreshed when LeafSpy is started so cannot be modified.

- **All Variables L.csv** Originally displayed all the variables for testing but more have been added so it is really "almost all". Protected and refreshed each time LeafSpy is started.
- **Font TestP.csv** This screen shows a selection of font sizes from large to small and can be used to see the effect of the increase/decrease font size function.
- **UserScreenL.csv** Default landscape screen when starting LeafSpy until a different one is selected. It is not protected so the csv file can be modified or copied and renamed as a starting point for a new custom screen.
- **UserScreenP.csv** Default portrait screen when starting LeafSpy until a different one is selected. It is not protected so the csv file can be modified or copied and renamed as a starting point for a new custom screen.

The **Load** button in the lower right corner can be used to load a different custom screen. Each orientation is loaded with its own custom screen. If the file names only differ by the last letter ("P","L") such as the sample "UserScreenL" and "UserScreenP" then both are loaded when any one is selected.

The csv file format is as follows and can be edited with a text editor but is much easier to edit using Excel or compatible program. It is best to start with one of the sample files in order to keep the required first two lines.

The first two lines should not be changed. They are a comment line and a line defining the columns. When LeafSpy reads the file in it always skips the first two lines so if you put definitions on those lines they will be ignored.

The first parameter on each line defines the type of element to be drawn or defines the colors to be used when drawing an element. There are currently nine supported types as follows.

- **L** - Label/Variable (ex SOC 45%)
- **DL** - Draw Line
- **DR** - Draw Rectangle
- **DT** - Draw Text (can be rotated)
- **CP** - Color of Panel (screen background)
- **CL** - Color of Label

- **CV** - Color of Variable
- **CD** - Color of Drawing elements (lines/rectangles)
- **CT** - Color of Text (drawn text)

**Label/Variable (L)**

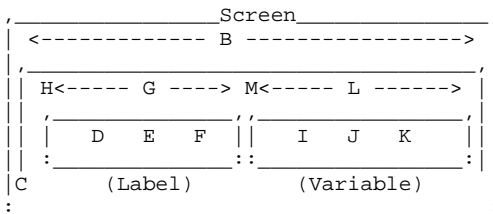
The Label/Variable type defines a label followed by an optional variable. It is possible to define a variable with a blank label or a label with no variable.

The default label colors are Black / LightGray (Day / Night) with a transparent background. The default variable colors are Black / Black (Day / Night) with a LightGray background . These colors/backgrounds can be changed using the **Color of Label (CL)** and **Color of Variable (CV)** elements.

**Example:** "L,25,0,SOC ,11,r,50,48,20,12,c,40,48" Display SOC label and variable.

**Example:** "L,100,0,,0,r,0,35,-30, 80,C, 90,35" Display HV voltage, no label, no units.

**Example:** "L,10,45, Wh,20,L,100,42" Label, no variable.



**Column A: type** - "L"

**Column B: Width** - This floating point value defines in horizontal percentage the amount of space allocated to the field defined by this line. Use 100 if all the space is to be used by this field. If you are making a two column layout then you might use 50 or 33 for a third field layout.

**Column C: Offset** - This floating point value defines in horizontal percentage the starting location of the field defined by this line. If there is only one field then you would typically use an offset of 0.

**Column D: Label** - Defines the text string of the label. It is recommended to add a single space at the end of the text if using right justification to keep the text from coming right up against the following variable.

**Column E: font** - The font size of the text string. You will need to experiment to see what font looks good on your screen.

**Column F: attributes** - Defines the justification and bold attributes of the text label. "L" for Left, "R" for Right, "C" for center and "B" for bold. (ex CB = center bold)

**Column G: width** - This floating point value defines the width of the label box in terms of percentage of the space defined by column B.

**Column H: top** - This floating point value defines the top of the box the label is written into in terms of vertical percentage of the screen.

(The following are only used if you want a variable displayed to the right of the label. )

**Column I: variable** - This integer value defines the variable to be displayed to the right of the label. Making this value negative suppresses displaying any units (V, A, Ahr, PSI...) to the right of the variable.

**Column J: font** -The font size of the variable. You will need to experiment to see what font looks good on your screen.

**Column K: attributes** - Defines the justification and bold attributes of the variable. "L" for Left, "R" for Right, "C" for center and "B" for bold. (ex CB = center bold)

**Column L: width** - This floating point value defines the width of the variable box in terms of percentage of the space defined by column B.

**Column M: top** - This floating point value defines the top of the box the variable is written into in terms of vertical percentage of the screen.

If Columns G and L do not add up to 100% then the label/variable fields will be centered in the area defined by Columns B and C.

Here is the list of currently available variables that can be displayed and their index number (used in Column I).

- 0 = VIN
- 1 = Battery Serial Number
- 2 = Odometer
- 3 = Ambient Temperature
- 4 = Speed
- 10 = Trip Time
- 11 = Distance
- 12 = Range
- 13 = Energy Used
- 14 = Starting Gids
- 15 = Trip Gids
- 16 = Distance Remaining
- 20 = SOC
- 21 = SOH
- 22 = Battery Health
- 23 = Bat Temperature
- 24 = AHr Capacity
- 30 = HV Volts
- 31 = HV Battery Amps
- 32 = AHr Remaining
- 33 = Gids
- 34 = Battery Wh
- 35 = Gids %
- 36 = Wh Counter
- 40 = HV Voltage min
- 41 = HV Voltage max
- 42 = HV Voltage avg
- 43 = HV Voltage delta
- 44 = Bat Temp Rear Center
- 45 = Bat Temp Front Right
- 46 = Bat Temp Middle Left
- 47 = Bat Temp Middle Right
- 50 = Motor Power

- 51 = Battery Power W
- 52 = Aux Power
- 53 = PTC Heater Power
- 54 = A/C Power
- 55 = A/C+PTC Power
- 56 = Motor Power kW
- 60 = Motor Temperature
- 61 = Motor RPM
- 62 = Command Torque
- 70 = L1/L2
- 71 = Quick Charges
- 72 = Plug State
- 73 = Charge Mode
- 74 = Charge Power
- 75 = EVSE Voltage
- 76 = EVSE Max Amps
- 80 = Front Left tire
- 81 = Front Right tire
- 82 = Rear Right tire
- 83 = Rear Left tire
- 84 = Tire delta
- 90 = Power Switch
- 91 = Gear Position
- 92 = Head Lamp status
- 93 = Front Wiper Status
- 94 = Wheel Angle
- 100 = Cycle Time
- 101 = Good Response
- 102 = Bad Response
- 103 = Missing Frames
- 104 = Retries
- 105 = Frame Delay Time

#### Draw Line(DL)

Use this element to draw a line from point x1,y1 to x2,y2 with a specified width. The default line colors of Black/LightGray can be changed with the **Color of Drawing (CD)** element.

**Example:** "DL,0,50,100,50,3" Draw horizontal line in middle of screen, width of 3.

Column A: **type** - "DL"

Column B: **x1** - This floating point value defines, in horizontal percentage of width, the starting point of the line.

Column C: **y1** - This floating point value defines, in vertical percentage of height, the starting point of the line.

Column D: **x2** - This floating point value defines, in horizontal percentage of width, the ending point of the line.

Column D: **y2** - This floating point value defines, in vertical percentage of height, the ending point of the line.

Column F: **width** - Line Width

## Draw Rectangle (DR)

Use this element to draw a rectangle from point x1,y1 to x2,y2 with a specified width. The default rectangle colors of Black/LightGray can be changed with the **Color of Drawing (CD)** element.

**Example:** "DR, 20, 10, 40, #0.5, 0,5" Draw rectangle, thick line.

**Example:** "DR, 30, 20, 40, #, 0, 3" Draw square, thin line.

Column A: **type** - "DR"

Column B: **x1** - This floating point value defines, in horizontal percentage of width, the top starting point of the rectangle.

Column C: **y1** - This floating point value defines, in vertical percentage of height, the top starting point of the rectangle.

Column D: **x2** - This floating point value defines, in horizontal percentage of width, the bottom ending point of the rectangle.

Column E: **y2** or **#** or **#n.n** - This floating point value, "#" or "#n.n" defines the bottom ending point of the rectangle. There are three options for this value.

- Absolute: y2 = % screen height (ex 23)
- Square: y2 = # (ex #)
- Rectangle: y2 = #aspect (ex #0.5)

Setting the aspect to 0.5 will draw a rectangle half as high as wide.

Column F: **fill** - 1=Fill rectangle, 0=no fill

Column G: **width** - Rectangle Line Width

## Draw Text (DT)

Draws text around specified location (anchor point). Text can be rotated around anchor point. The color of the text can be changed with the **Color of Text (CT)** element.

**Example:** "DT ,Sample Text, 55, 18, d, 14, c"

**Example:** "DT ,Sample Text, 55, 18, d, 14, 1, 90" rotate 90 degrees CW.

Column A: **type** - "DT"

Column B: **text** - Text to be drawn. Any leading and trailing spaces are kept.

Column C: **x** - This floating point value defines, in horizontal percentage of width, the anchor point of the text.

Column D: **y** - This floating point value defines, in vertical percentage of height, the anchor point of the text.

Column E: **font** - Defines font used.

- D : Default font
- B : Bold default font



Column F: **size** - Defines font size in points. A typical size would be 14.

Column G: **justification** - Defines the justification around the anchor point. Values are:

- L : Text is drawn with the first character to the right of the anchor point
- C : Text is drawn centered around the anchor point
- R : Text is drawn with the last character to the left of the anchor point

Column H: **degrees** - This optional parameter defines the clockwise rotation of the text around the anchor point.

### Colors

Colors are defined in pairs. The first color is used in day mode and the second is used when in night mode.

Color numbers should be specified in four byte hexadecimal ARGB format, 0xAARRGGBB where

- AA = Alpha (0x00=transparent and 0xFF = solid color)
- RR = Red
- GG = Green
- BB = Blue

#### Examples

- 0xFF000000 = Black
- 0xFF87CEFA = Light Sky Blue
- 0xFFFFFFFF = White
- 0 = Transparent (used for a background color)

### **Color of Panel (CP)**

Use this element to change the background color of the screen. The screen colors must be a solid color so the Alpha byte is internally forced to 0xFF independent of what is actually specified.

The default background colors are White / Black (Day / Night).

**Example:** "CP, 0xFF87CEFA, 0xFF000000" sets the background to light sky blue and black.

Column A: **type** - "CP"

Column B: **day** - Day time background color.

Column C: **night** - Night time background color.

### **Color of Line (CL)**

Use this element to change the color of the label in any Label (L) element that follows this line. Typically the background colors are set to transparent by setting the Alpha byte to zero.

The default label colors are Black / Light Gray (Day / Night).

**Example:** "CL, 0xFF87CEFA, 0xFF000000, 0, 0"

Column A: **type** - "CL"

Column B: **text day color** - Label text color during day.

Column C: **text night color** - Label text color at night.

Column D: **background day color** - Label background color during day.

Column E: **background night color** - Label background color during night.

#### **Color of Variable (CV)**

Use this element to change the color of the variable in any Label (L) element that follows this line. Optionally add a border around the variable.

**Example:** "CV, 0xFFFF0000, 0xFFFF0000, 0x0, 0x0" Display variable in Red.

**Example:** "CV, 0xFF000000, 0xFF808080, 0x0, 0x0, 1, 0" Place border around variable.

The default variable colors are Black / Light Gray (Day / Night).

Column A: **type** - "CV"

Column B: **text day color** - Variable text color during day.

Column C: **text night color** - Variable text color at night.

Column D: **background day color** - Variable background color during day.

Column E: **background night color** - Variable background color during night.

Column F: **border width** - Optional border width around variable. Default is no border. The border color will be the same as the text color.

Column G: **border radius** - Radius of optional border around variable. A zero radius will result in square corners.

#### **Color of Drawing (CD)**

The default color for drawings (lines and rectangles) is Black for day and LightGray for night. Use this element to change the color used for any drawings following this line or to restore the previous colors.

**Example:** "CD, 0xFFFF0000, 0xFFFF0000" Draw lines and rectangles in Red

**Example:** "CD, POP" Restore previous drawing colors

Column A: **type** - "CD"

Column B: **day color** or **restore** - Drawing day color or "POP" to restore the previous colors

Column C: **night color** - Drawing night color

## Color of Text (CT)

The default color for drawn text is Black for day and LightGray for night. Use this element to change the colors used to draw text or restore the previous colors.

**Example:** "CT, 0xFFFF0000, 0xFFFF0000" Draw text in Red

**Example:** "CT, POP" Restore previous drawn text colors

Column A: **Type** - "CT"

Column B: **day color** or **restore** - Drawn Text day color or "POP" to restore the previous colors

Column C: **night color** - Drawn Text night color

# Detailed View

This screen is divided into three sub panels. The largest is the energy panel which displays information about available energy and how that 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 distance to a predefined reserve amount of energy (defined on **Settings/Range** panel). A distance countdown counter can also be activated on the third panel

Pressing the three dashed line area in the upper right corner will bring up the screen help overlay that identifies areas that can be tapped to change what or how things are displayed. **Orange** areas have a single tap function and **Green** areas have both a short and long tap function.

## Energy Panel

This panel can be divided into six sections:

**1**(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**. The **Trip Log** is a csv file that can be read by Excel and automatically uploaded to your Dropbox if Dropbox has been enabled on the **Settings/Dropbox** panel.

**2**(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 values (Gids, % Gids or % SOC) is displayed in that position with the other values being displayed to the right.

**3**(One or 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.



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

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

**Data Set 2:** Motor RPM, Steering Wheel Angle\*, Gids used during trip, Motor, Inverter 2 and Inverter 4 temperatures.

\* When in **Debug** mode the Steering Wheel angle is displayed after motor RPM. The angle ranges from -720 to 720 degrees with negative being left turn.

**Data Set 3:** GPS Speed, Altitude and Altitude change during trip or "GPS not Valid" if GPS has not locked on to sufficient satellites or "GPS not enabled" if GPS has not been enabled on the **Settings/Logging** panel.

**Data Set 4:** Trip distance and efficiency based on Wh counter and current trip distance.

**Data Set 5:** Distance and efficiency since last charge based on Wh counter and distance since last charge. The value in parenthesis is an estimate of the efficiency from "wall to wheel" using Gids with a fixed 82 Wh/Gid value and distance since last charge.

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.

**4(Bar Graph) (SOC, GIDs, DTE) or (Batt, 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 PTC heater is active the graph automatically switches to displaying power used to alert the driver to the amount of power being used by the PTC heater. Automatic switching to this screen can be disabled on the **Settings/Options** panel using the "**Disable forcing energy display**" switch.

**Available energy/range:** 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.

**Power Used by function:** When displaying **power used by function** the following legends are used on the left edge. The kW values in parentheses are power per tick mark and full scale power. The actual power values are displayed on the right edge in Watts

- **Motr** or **Batt** = Motor Power/Regeneration or Battery Power (10kW & 100kW)
- **Aux** = Lights, Rear Defroster... (200W & 2kW)
- **Hetr** = Cabin Heater (600W & 6kW)
- **A/C** = Air Conditioner (includes Hetr if heater active) (600W & 6kW)

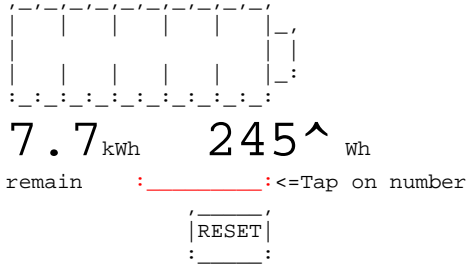
On the **Motr** or **Batt** graph a bar starting from the right side and growing to the left indicates regeneration (power added to the battery).

**5(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 current Gids and the Wh per Gid set on the **Settings/Battery** panel (default 77.5 Wh/Gid).

**6(Right bottom number) xxx Wh or xxx^ Wh or xxx\* Wh Energy counters** This field displays the energy used or only the energy gained from regeneration. The energy counter has four modes of operation. Three modes are automatic as to

what energy is accumulated and when it is reset. The energy for the current drive is always protected and cannot be reset until the end of the drive. The fourth mode allows the user total control as to when the counter is reset. Mode selection is done on the **Settings/Battery** panel using the **Configure Wh Counter** option.

Tapping on the Energy number toggles between the Energy counter and the Regen counter. When in user mode the energy value has an asterisk \* appended to it. When displaying the regeneration energy the value has a "^" appended. The example below shows regeneration energy.



A Reset button is only available when the User controlled counter is displayed or if counter includes energy from a previous drive. The portion of the energy accumulated in the energy counter from the current drive is always protected and cannot be cleared while driving. If no trip is active then pressing the **RESET** button clears all the energy counters.

The energy counter can be set to automatically clear based on the configuration selected **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 the 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

The numbers in this panel will be grayed out when data is not being received from the TPMS units. When you first install Leaf Spy the tire pressures will read **n/a** and be grayed out 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. The panel numbers being grayed out with parenthesis around the tire pressure units (**PSI, Bar or kPa**) indicates 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 which will remove the parenthesis and change the numbers from gray to black. 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 pressure. Another alarm can be triggered if the pressure 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.

When tires are not located in the correct position relative to the Leaf graphic due to tire rotation the **Settings/Tire Pressure** panel can be used to remap their location on the screen. To determine current tire location on the screen either add or remove pressure from a tire and note the corresponding pressure change on the screen.

### 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 with three large numbers on the left side. The top number is the maximum sensor reading, the middle number the average of all sensor readings and the lower 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 and not charging. If the ambient number looks to be in the wrong units go to the **Settings/Units** panel and enable "Convert Outside Temperature" or if already enabled then disable it.

**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 position on 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** and an optional **Trip Countdown Counter**. This sub panel contains two tap sensitive areas and optionally two buttons (+ -). The tap sensitive areas are used to select the event and efficiency mode and enable/disable the **Trip Countdown Counter**. The two buttons are used to change the efficiency if in manual mode and to enable and change the **Trip Countdown Counter** starting value.

Tap the upper area of the panel to cycle through the three event choices

- **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.

A long tap on this upper area will enable and disable the **Trip Countdown Counter**. When the **Trip Countdown Counter** is active the trip distance remaining will be displayed on the left followed by a down arrow and the range to event number will be displayed on the right. The default starting value for the **Trip Countdown Counter** is set on the **Settings/Trip Distance** panel. In addition to setting starting distance there is also an option, by selecting 0 distance, to use the current **Range** estimate as the starting 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 before the event happens.

Tap the middle or bottom (if in Landscape) area to cycle through the four ways to determine the efficiency used to calculate **Range**. The manual method allows the driver to set the efficiency based on their past experience for the route. The selected method is indicated by the leading character before the "@" sign.

- (no letter) - Efficiency manually entered
- **T** - Efficiency of current trip
- **C** - Efficiency since last charge
- **i** - Efficiency of last km

When the manual method is selected the **Plus** or **Minus** buttons appear and are used to increase or decrease the efficiency used to calculate **Range**. The efficiency units used can be changed on the **Settings/Range** panel. When one of the three automatic methods is selected the efficiency is calculated based on the recent history of the distance traveled (trip, charge, last km) and energy used during that distance.

When in manual efficiency mode the **Trip Countdown Counter** can 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.

When in one of the automatic efficiency modes the **Trip Countdown Counter** can be adjusted by tapping or holding down the **Plus** or **Minus** buttons.

**Special Feature:** The font size of the **Trip Countdown Counter** and **Range** can be adjusted by enabling the **Trip Countdown Counter** so it is visible and placing the screen in **Screen Frozen** mode by tapping the status box (lower right corner). In this mode tapping the **Plus** or **Minus** key will increase or decrease the font used to display the **Trip Countdown Counter** and **Range** numbers.



## Service Functions

By **default** the **Service** screen is disabled each time **LeafSpy Pro** is started to prevent unintended service operations from being executed. To enable the **Service** screen go into the **Settings/Service Screen** panel and check "**Enable**".

The Service functions allow you to read and if appropriate clear DTCs (Diagnostic Trouble Codes). Clearing DTCs should only be done if you understand the reason for the fault and feel it has been corrected.

Service functions also allow you to customize your Leaf's behavior such as when doors are automatically locked and unlocked, when Headlights and Interior lights are automatically turned on and off and any delay involved in these actions and when various inside and outside sounds are generated.

For informational purposes there is also a function to display all your Leaf's ECU (Electronic Control Unit) version numbers as well as some serial numbers such as the serial number of your high voltage battery pack.

For the more advanced user there is a function to register the four wheel TPMS sensors and their locations on the Leaf (ex. front left, rear right). This function can be used after the tires have been rotated or if you have seasonal tires you swap during the winter.

### Service functions

- Door Lock/Unlock Settings
- Headlight Settings
- Interior Light Settings
- VSP Settings
- Register Tire Positions
- Read ECU versions
- Read DTCs
- Clear DTCs

## 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 (24km/h)**.

**Out of Park** All doors are locked when 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**.

## Headlight Settings

This function is used to change the automatic on and off function of the Headlights.

If your Leaf did not originally come with the automatic headlight feature you will be given the option to enable it. **However, you must have first install all the necessary hardware to support the automatic headlight feature for this to have any affect.**

There are four controls. The first enables the battery saver function that tries to save the battery by not allowing the headlights to be left on for more than 5 minutes after the Leaf has been turned off. The second controls the delay used to keep the headlights on after the Leaf has been turned off and all doors have been closed. The third controls the sensitivity of the dusk sensor that automatically turns on the Headlights under dim light conditions. The fourth controls under what conditions the headlights are automatically turned on. On this fourth control it appears that not all conditions have been implemented on the Leaf or might vary by model year.

### **Battery Saver (off after 5 minutes)**

- Enable (default)
- Disable (not recommended as you risk draining your 12 volt battery)

### **Auto Off Delay (After all doors closed)**

- 45 Seconds (default)
- Off (0 seconds)
- 30 Seconds
- 60 Seconds
- 90 Seconds
- 120 Seconds
- 150 Seconds
- 180 Seconds

### **Auto On Sensitivity**

- Normal (default)
- More
- Most
- Least

### **Auto On**

- At twilight or wiper INT, LO, HI (default)
- At twilight or wiper LO, HI
- At twilight
- wiper INT, LO, HI
- wiper LO, HI
- Disabled

## **Interior Light Settings**

This function is used to change the automatic turn off behavior of the interior lights. There are three controls. The first enables or disables the delayed auto turn off function. The second sets the delay before the interior lights automatically turns off and the third function controls which door or doors start the auto turnoff delay.

### **Delay Light Turn Off**

- Enable (default)
- Disable

### **Light Off Delay**

- 7.5 Seconds
- 15 Seconds (default)
- 30 Seconds

### **Use Delay with**

- All Doors (default)
- Driver Door

## VSP Settings

For 2013 and newer Leafs this function is used to enable and disable the sounds created by the VSP function. The VSP board generates the sounds for two different speakers. One speaker is located under the dash and makes the sounds heard inside the Leaf. The other speaker is in the engine compartment and makes the sounds heard outside the Leaf.

None of these settings affect the Hazard or turn signal sounds.

- **Drive Start Sound** - Outside sound generated when the Leaf starts to move to alert pedestrians that a vehicle nearby is moving.
- **Drive Sound** - Outside sound generated which the Leaf is moving a low speed.
- **Reverse Beeps** - Outside sound generated when backing up. **It is not recommended that you disable this sound as it is a safety feature for pedestrians.**
- **Vehicle Start Sound** - Inside sound played when Leaf is turned on and off.
- **Sound A** - (Not known to control any sounds at this time)
- **Sound B** - (Not known to control any sounds at this time)
- **Charge Sounds** - Outside sounds generated when opening charge door, plugging in charge cord, starting a charge and manually overriding the charge timer.

## 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 significant 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. Second, if you have seasonal tires with TPMS units you will need to register them or the Leaf will report a solid tire fault since it does not recognize these new TPMS units and so has no pressure information.

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.

**Note:** You must have a way to add air to the tires before starting registration as you will need to restore your tires to full pressure after registration has been completed.

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 status message change and a tune sounding. When done be sure to adjust all the tire pressures back to their recommended pressures (**36 PSI / 2.5 Bar / 250 kPa**).

## Read ECU versions

The function will read all the ECUs (Electronic Control Units) in the Leaf and display their version number and some additional information if available. For example when reading the BMS ECU the High Voltage battery pack serial number is also read and displayed. Here is a example of what the ECU version list looks like.

```
JN1AZ0CP9BT009999
3NA0A BRAKE
3NA1A ABS
3NA0A EPS VA51309095
XXXXX METER
3NA0A HVAC
3NA0B BCM
3NA0D TCU
3NA0B MULTI AV
3NA0A IPDM E/R
3NA0A AIR BAG
3NA0A PARKING BRAKE 36580113008968
3NA0A MOTOR CONTROL 22021113710096H1
3NA0E CHARGER 23511113013941
3NA2A EV/HEV
3NA0D HV BATTERY 230JT1113A009999
3NA0B SHIFT 34001113095
```

## 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. Here is an example of a DTC read with a single fault code of **P1557** caused by disconnecting the 12 volt battery sensor cable.

Use the **Save** button on the DTC screen to save (append) a copy of the DTC screen to the DTC log file. The file name will include the VIN and the DTC data is tagged with a timestamp and current odometer reading

```
Ok None----> ABS
Ok None----> AIR BAG
Ok None----> BCM
Ok None----> BRAKE
Ok None----> CHARGER
Ok None----> PARKING BRAKE
Ok None----> EPS
P1557 00C0 EV/HEV Battery Temp Sensor EVC-173
Ok None----> HVAC
Ok None----> HV BATTERY
Ok None----> IPDM E/R
Ok None----> METER
Ok None----> MOTOR CONTROL
Ok None----> MULTI AV
Ok None----> SHIFT
Ok None----> TCU
```

## 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.

**Warning** Do not clear DTCs unless you understand the cause and feel the problem has been corrected. One example of this would be if your 12 volt battery dies. This will cause numerous DTCs as each ECU detects the out of specification 12 volts coming from the 12 volt battery. Here is an example of what you might see from a dying battery

```
C118C 0108 ABS EV/HEV System BRC-126
Ok None----> AIR BAG
Ok None----> BCM
C1A62 0108 BRAKE Control Mod Pwr Supply BR-53
C1A6E 0108 BRAKE EV/HEV System BR-146
Ok None----> CHARGER
Ok None----> PARKING BRAKE
Ok None----> EPS
P3180 00C3 EV/HEV HV Battery System EVC-249
P317B 00C3 EV/HEV Motor System EVC-247
P31E2 00C3 EV/HEV HV System Interlock Error EVC-308
Ok None----> HVAC
P30FE 0008 HV BATTERY 12v Battery Voltage EVB-94
Ok None----> IPDM E/R
Ok None----> METER
P0A8D 0008 MOTOR CONTROL 14v Power Supply EVC-132/TMS-63
Ok None----> MULTI AV
Ok None----> SHIFT
Ok None----> TCU
```

Since all these DTCs were caused by the dying battery, after replacing or charging the 12 volt battery these DTCs can all be safely cleared.

Clearing the special **P0AA1** DTC is now supported as a separate option on the clear DTC menu. Since the **P0AA1** fault involves the high voltage contactor care should be taken when clearing it. Be sure the condition that caused this DTC have been corrected before attempting to clear it. Take all necessary safety precautions specified in the Leaf Service manual.

[\*\*\*\*O] Screen 5

## Braking & Motor Power Graphs

These graphs are an experimental feature and only available on **Leaf Spy Pro**. They may or may not work correctly depending on you Android Device and OBDII Adapter.

**Warning** When these graphs are selected no other data can be read from the Leaf. This means that none of the data for the other screens will be updated until you exit these screens. This includes **Logging** which will be suspended while these screens are selected.

**Tap** the graph to toggle between the Brake monitor graph and Motor Power graph.

---

# Data Logging

The logging function saves data read from the Leaf to a .CSV file located in directory **/LEAF\_BT\_CAN/LOG\_FILES**. 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 and status that are available there are:

**SD Status & Bytes Available** Before enabling Logging be sure you have an SD card installed and there is sufficient free space available. If the free space drops too low (<1MB) logging will automatically be suspended and an on screen message displayed.

**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.

When **BMS** mode is selected for "Model Year" the 2 second logging rate is increased to the maximum possible which is less than 1 second per sample. This can be done because in **BMS** mode only data from the **BMS** is being read making collecting a complete sample much quick.

**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** If this option is checked once Leaf Spy detects an OBDII adapter GPS will be turned on and kept on until you exit the application. This option overrides the default that disables GPS whenever the Leaf is turned off.

**Force Log** Pressing this button will force a log entry at the next opportunity independent of the interval settings. Use this button if you have selected a long interval but wish to override it. Logging is always conditional on the collection of a new sample set from the Leaf.

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

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

**Append YYYYMMDD 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)\_YYYYMMDD\_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 Android 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 Android 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  $(112 \times 80) = 8960$  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  $(0.474133 \times 55.4385 \times 360) = 9462.68$  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 Judgment 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 Judgment 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" "87.45" 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 Android device as percent full (49% in this example).

**EE** "epoch time" "1401294350.123" This is the time the sample was written in seconds from 1/1/1970 with millisecond resolution.

**EF** "Motor Pwr(w)" "37800" Drive motor power in watt units. For this example 37.8 kW. For 2011 and 2012 models regen power is indicated by a negative number.

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

**EW "Motor Temp" "70"** This field is the drive motor temperature as C+40. To get C just subtract 40 from the value.

**EX "Inverter 2 Temp" "51"** This field is the Inverter 2 temperature sensor value as C+40. To get C just subtract 40 from the value. Only available on 2011-20012 Leafs.

**EY "Inverter 4 Temp" "65"** This field is the Inverter 4 temperature sensor value as C+40. To get C just subtract 40 from the value. Only available on 2011-20012 Leafs.

**EZ "Speed 1" "2495"** This field from Speed sensor 1. Divide by 100 to get speed in km/h (ex 24.95 km/h).

**FA** "Speed 2" "2526" This field from Speed sensor 2. Divide by 100 to get speed in km/h (ex 25.26 km/h).

**FB** "Front Wiper Status" "08" This field is the status of the front wipers. The value is saved in hexadecimal format for easier reading.

- 80 = Front Wiper High
- 40 = Front Wiper Low
- 20 = Front Wiper Switch
- 10 = Front Wiper Intermittent
- 08 = Front Wiper Stopped

**FC** "Motor Torque" "4.25" This field is the requested Motor Torque in Nm.

# Settings

## Settings

Use this panel to **Backup** and **Restore** your settings to the SD Card in directory LEAF\_BT\_CAN/SETUP.

## Units

Use this panel to select temperature, distance/speed, and pressure units. Use the **Convert Outside Temperature** option to convert the outside temperature displayed on screen 4 to the opposite units if the automatically selected units is not correct.

### Temperature

- Fahrenheit
- Centigrade

### Distance/Speed

- Feet, Miles, MPH
- Meters, km, km/h

### Pressure

- Bars
- PSI
- kPa

**CAN Odometer in Miles** - Use this option if the Odometer value is not displayed correctly on screen 1. This option is only available starting with the 2018 Leaf which has switched to using both miles and km for the odometer read from the CAN bus depending on country. It is expected that this option only needs to be enabled for US and UK Leafs where miles are used for distance.

## Language

Use this panel to select one of four languages. Please report any translation errors or suggested improvements to the translation from English.

- English
- Japanese
- German
- French

## 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).

The pack size (**24, 30, 40 or 60 kWh**) 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.

For those using LeafSpy to monitor a standalone Leaf battery pack or Motor/Inverter there are a BMS and MTR/INV options which are located at the top of the list where 2009 and 2010 would have been located. Selecting one of these options forces LeafSpy to read only data from the BMS (Battery Management System) or Motor/Inverter ECU and skips trying to read data from any other ECU. When BMS or MTR/INV mode is selected the words "**BMS Only**" or "**MTR/INV Only**" will flash bottom center as a reminder that only BMS or MTR/INV data is being read.

## 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. There are two ways to adjust this count while on screen 4 depending on whether manual efficiency entry mode has been selected.

**Manual efficiency mode** Press and hold either the + or - button. After a short delay only the trip distance is displayed with a down arrow. When that occurs release the button you were holding down. Then use the + or - button to adjust the value. When done tap the trip distance number.

**Other efficiency modes** Use the + or - button to adjust the value.

## 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: Distance to Low Battery Warning **LBW**, Distance to Very Low Battery Warning **VLBW** or Distance to a pre-selected amount of reserve energy **x% SOC** or **x.kWh**.

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 simpler method uncheck 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**. In manual efficiency mode the plus and minus keys on screen 4 are used to adjust the efficiency used to calculate remaining range to event.

The efficiency used in the above calculations can be either manually entered based on the driver's experience for the current route and adjusted as needed on Screen 4 or there are three automatically calculated efficiencies. The three are **T** the efficiency for the current trip, **C** the efficiency since last charge or **i** the instantaneous efficiency which is recalculated each km.

## 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** (Not available starting with 2018 Leaf) On some 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.

**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 a tire's pressure can be increased or decreased and then a note take as to which tire location on screen 4 actually changes. Once the real location of each tire is determined use one or more of the following three options to remap the tires' positions on screen 4 to match their real 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 and are intended for advanced users.

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

- Shunt Order = 8421
- Nominal Pack Voltage = 360 volts
- Maximum Gids = 281 Gids (24 kWh), 357 Gids (30 kWh), 500 Gids (40kWh), 750 Gids (60kWh)
- 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 that make 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.

(**Warning** this gets complicated.) 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 8421 results in a cell mapping to bits of 0123 4567.

**Nominal Voltage** Use this field to change the nominal voltage used to calculate the energy change in the battery for the Wh counter. 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 ranges for each size battery are list in this table

- 24 kWh : 200 to 300 Gids
- 30 kWh : 300 to 380 Gids
- 40 kWh : 425 to 500 Gids
- 60 kWh : 675 to 759 Gids

Typically the value is set to the original maximum Gids value after a full charge when the Leaf was new and should not normally be changed as the battery degrades.

**Wh/Gid** This pulldown menu allows the energy associate with each Gid to be varied between 65 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. In order to log, a real or virtual **SD Card** must be available. If one is present, the **SD Status** will indicate "**mounted**". If none is detected, consult your device's operating manual to see how to enable SD storage. If an **SD Card** is mounted the **Bytes Available** field will show the currently available free space. To prevent LeafSpy from using up all available storage space Logging will stop when free space drops down to 1 MB or less.

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

**Append YYYYMMDD to file name** This option should normally be checked and enables 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 that spans midnight will be saved in the file that started the trip.

**Always keep GPS Active** Normally this option should be left unchecked as additional power will be used to keep GPS active even when not connected to a Leaf.

**Enable GPS** This option is available even when not logging as the elevation and speed data is also used for the elevation and speed graph on screen 2. This option should normally always be selected. Logs containing GPS data can be uploaded to the [leaflogger.com](http://leaflogger.com) web site which allows you to visualize your trips on Google maps. Contact the owner of the leaflogger web site for an ID to access the web site.

**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 after one hour there will be two entries in the log. One entry for time zero and then a second entry an hour later. If **BMS** mode is active then the minimum log interval is changed to be less than one second as only data from the **BMS** ECU is being read.

At the faster sample rates log entries may actually occur at a slightly slower rate. This depends on the cycle time it takes to read one full set of data from the Leaf. If the cycle time to read one full set of data is longer than the selected log interval then the read cycle rate is the log rate. For example if the actual cycle rate is 3 seconds and the selected log interval is 2 seconds data is logged at the 3 second rate. 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.

- Default
- Month Day Year
- Day Month Year
- Year Month Day

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

- **Apps/LeafSpyPro/** - for the Trip/Charge log
- **Apps/LeafSpyPro/Log Files** - for Log Files
- **Apps/LeafSpyPro/DTC** - for DTC 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

**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**, **Eff\_xxx.csv** and **DTC Log [vin].txt** 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.

When Dropbox is not enabled a **Reset ID** button will appear to the right. A long press on that button will clear the registered Dropbox ID allowing a different ID to be used when Dropbox is enabled again.

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

## Server

Enable this option to activate periodic data transfers to a Server while LeafSpy is connect to the Leaf. As a reminder that this feature has been enabled a "." will be appended to the date displayed bottom center of most screens. If the server responses with an error ":(\" will be appended to the date.

This feature requires a data plan if you are going to use it while driving. Each send contains about 250 bytes of data. For a 20 minute trip at the fastest send rate of every 5 seconds it would result in 75 KB (250 x 12 x 20) of data transferred or 2.25 MB per month if done every day against your data plan.

The send interval can be selected to be once every 5 seconds to one every 10 minutes. Any one of up to four user defined Servers can be selected with optional user id and password. The URL type is set to "Http://" by default but can be changed to "Https://" if secure mode is supported by the server. Use the Server pulldown to select the active server (A, B, C or D)

and to enter configuration information (id, password, URL) for each Server. Use the **Lock** switch to prevent accidentally changing configuration information. The **Hide** option can be used to obscure the passwords displayed on the screen.

#### Send Interval

- 5 seconds
- 10 seconds
- 15 seconds
- 20 seconds
- 30 seconds
- 1 minute
- 2 minutes
- 3 minutes
- 5 minutes
- 10 minutes

#### Server

- A
- B
- C
- D

#### Type

- Http://
- Https://

The following data is sent to the Server in REST format (URL?parm1&parm2&parm3...). The server must respond with "status":"0" (quotes around status and 0) or a non zero status if an error is detected. **Note:** The User ID and Password are sent in plain text (not encrypted). The below table's format is parameter string (ex user=xxx) followed by any comments. Only the parameter string is sent. (FB),(EL) and (EM) notations refer to parameters defined in the corresponding columns under the **Logging** section of this document.

- user=xxx User ID
- pass=xxx Password
- DevBat=xx Device Battery %
- Gids=xxx
- Lat=xxx.xxxxx
- Long=xxx.xxxx
- Elv=xxx Elevation in meters
- Seq=xx Sequence number of transfer
- Trip=xx Trip number
- odo=xxx Odometer in km
- SOC=xx.xx State of Charge
- AHr=xx.xxxx Current AHr capacity
- BatTemp=xx.x Average Battery Temperature
- Amb=xx.x Ambient Temperature
- Wpr=xx Front Wiper Status (FB)
- PlugState=x Plug State (EL)
- ChrgMode=x Charge Mode (EM)

- ChrgPwr=xxxx Charge Power in watts
- VIN=xxxxxxxxxxxxxxxxxxx
- PwrSw=x Power Switch state 0=off 1=on
- Tunits=x Temperature Units (C/F)
- RPM=x Motor RPM
- SOH=xx.xx State of Health

Use the **Lock** option to prevent accidentally making changes to the server settings.

If the Server supports secure transfer select **Https** instead of **Http**.

If you wish to test out the Server function visit the website **www.leaf-status.com** and register. The URL to enter into **Settings/Server/URL** for this website is **www.leaf-status.com/api/vehicle/update/**. One use I make of this website is to have my Wife access it when I am going to pick her up and she can monitor my location to see I am really on my way and exactly where I am in the Leaf.

## System

This panel is used to control various Android system functions.

**Stay Awake** When checked disables the timeout used to blank the display. This should normally be checked or the screen will go blank while driving when the timeout expires.

**Display Bright** When checked this option forces the display to be set to high brightness making it easier to read in sunlight.

**Auto Enable & Disable Bluetooth** This option is used when you wish to save power by not having Bluetooth enabled when not running LeafSpy. It allows LeafSpy to automatically enable Bluetooth on startup and turn it off when exiting the app. If this option is not checked and Bluetooth is not enabled before starting LeafSpy then a popup message will appear asking if Bluetooth should be enabled.

**Bluetooth Port=** After pairing the Bluetooth OBDII adapter is given a virtual serial port number by the operating system (OS). Unfortunately there is no way for LeafSpy to know which of three possible ports the OS has assigned to the OBDII adapter. The normal default is **Port 1** however if you are using the handsfree phone feature with the Leaf the OS may assign the OBDII adapter to **Port 16**. There are also times when the OS supports a **Secure** Bluetooth link.

If when trying to connect to the OBDII adapter LeafSpy gets stuck at state **00** as shown in the lower right status area try a different port number. If the status area shows a state number higher than **00** that indicates the port is set correctly. If the state number cycles around **10** to **14** that indicates the Leaf is not turned on. Normally the Leaf must be turned ON (not ACC mode) for LeafSpy to be able to communicate with it.

**On Exit force BT off** If you would always like to have Bluetooth turned off when exiting LeafSpy check this option.

**Enable Auto BT Pairing** Some Bluetooth adapters require a pairing each time they are plugged in. If this is the case then checking this option will allow LeafSpy to automatically perform the pairing without user interaction. The **key** used is the one entered when the OBDII adapter was selected and is shown on the panel.

The current screen size, scale used and resolution is also displayed on this panel.

## 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).

**Enable slow Leaf transfer mode** Use this option if you experience problems staying connected to the Leaf. This option instructs the Leaf to transfer data with a small delay between each frame of a multi frame transfer. The delay can be from 10 msec to 70 msec and is selected using the slider. This option is disabled when **Cyanogenmod** mode is selected.

**Cyanogenmod** This mode uses handshake on each frame of a multi frame transfer from the Leaf. It is available as a workaround for devices that have had their stock operating systems replaced by Cyanogenmod. The Cyanogenmod OS is not able to handle the type of transfer needed to stream data from the OBDII adapter so instead this very slow handshake mode can be used. It is not recommended that you run LeafSpy on a device with Cyanogenmod. This option is disabled when **Enable slow Leaf transfer mode** is selected.

**Exit after Trip/Chrg saved** Selecting this option will cause LeafSpy to automatically exit after saving a trip or charge event to the log file.

**Disable forcing energy display** Use this option to prevent LeafSpy from automatically selecting the energy display on the Summary screen whenever the heater is being used.

**Disable Sound** Disable LeafSpy from making any sounds.

## Braking & Motor Monitor

This panel controls the experimental **Braking Monitor** screen and **Motor Energy Monitor** screen. The **Braking Monitor** screen displays a horizontal status bar at the top that shows the amount of regeneration (in green) and friction braking (in red). A lower windows graphs the last few seconds of braking data. The **Motor Energy Monitor** screen displays a horizontal status bar at the top showing accelerator position and optional brake data. The lower window graphs the motor energy used or regenerated and accelerator position.

**Enable Brake & Motor Screens** Use this option to enable a fifth screen which can be toggled between a **Braking Monitor** screen and a **Motor Monitor** screen by tapping on it. The **Service Menu** screen takes precedence over these screens so be sure you have not enabled the **Service Menu** before you select this option.

Due to the large amount of data being processed while monitoring the Leaf, not all devices and OBDII adapters can support this level of data flow. If you experience LeafSpy problems, such as screen updates stopping and/or LeafSpy not responding, then please disable this feature.

**Brake & Motor Combined** While viewing the **Motor Energy Monitor** screen you can also view braking data in the top status bar. This requires a slightly higher data rate due to the addition data being monitored. If you experience problems then disable this feature.

**Change Window Size** Use this pulldown menu to change the number of seconds of braking history data displayed on the brake monitor screen. The pulldown menu allows you select from the last 10 seconds to the last 60 seconds of data.

## Screen

Use this panel to control various aspects of the screen.

**Screen Orientation** Use this pulldown menu to select from one of seven screen orientation modes.

**Auto (Sensor)** The screen automatically adjusts the orientation based on the sensor (default).

**Landscape** Force Landscape mode with the top of the device on the left.

**Portrait** Force Landscape mode with the top of the device on top

**Landscape - Sensor** Force Landscape mode with top of the device on left or right depending on how the device is held.

**Portrait - Sensor** Force Portrait mode with the top of the device on the top or bottom depending on how the device is held.

**Reversed Landscape** Force Landscape mode with the top of the device on the right.

**Reversed Portrait** Force Portrait mode with the top of the device at the bottom.

**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.

**Adjusting Colors** Changing colors is a two step operation. The first step is to select one of 12 items to change.

**Background** Change the background color for screens 3 and 4. The default is white.

**Text** Change the text color for screens 3 and 4. The default is black.

**Chart Background** On screens 1 and 2 change the color of the background. The default is white.

**Chart Bars** On screen 1 and 2 change the color of the bars. The default is [Blue](#).

**Chart Axis** Change the axis color for all graphs. The default is Black.

**Chart Shunts** On screen 1 change the color used when a shunt is active. The default is [Red](#).

**<=65** On screens 2 and 3 change the color used to display the battery pack temperature when it is <=65 degrees.

**<=75** On screens 2 and 3 change the color used to display the battery pack temperature when it is <=75 degrees.

**<=86** On screens 2 and 3 change the color used to display the battery pack temperature when it is <=86 degrees.

**<=95** On screens 2 and 3 change the color used to display the battery pack temperature when it is <=95 degrees.

**<=105** On screens 2 and 3 change the color used to display the battery pack temperature when it is <=105 degrees.

**>105** On screens 2 and 3 change the color used to display the battery pack temperature when it is >105 degrees.

After the area to change has been selected next select one of the three color selectors and then select a color.

**Pick** This color picker gives you 15 predefined colors to choose from.

**RGB** The RGB color picker lets you select a color based on its RGB value.

**HSV** The HSV color picker lets you select a color based on Hue, Saturation and Value.

There are three **Reset** buttons, one below each sample panel. Tapping the **Reset** button will undo any change made while still on the settings screen. A long tap on the **Reset** button will restore the default color values.

**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.

## 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.

**Lost** Counts the number of Lost frames when receiving a multi frame response. This value can also be monitored on screen 1 in the monitor area.

## Debug

The debug panel gives access to some special features.

**Enable** Checking this option replaces screen 3 with a raw frame display. The frame data displayed is from one of four possible message types:

**SOC/AHr** Display raw frames from group 1 of the BMS ECU

**Cell Pairs** Display raw frames from group 2 of the BMS ECU

**Temps** Display raw frames from group 4 of the BMS ECU

**Shunts** Display raw frames from group 6 of the BMS ECU

**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 SD Card in folder **LEAF\_BT\_CAN/DEBUG\_FILES** 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.