

# FUV Basics



An easy overview of the Arcimoto FUV, for Newbies

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## **SAFETY WARNING!**

***Read, understand, and follow all of the instructions and safety precautions in this Owner's Guide and on all product labels. Failure to follow the safety precautions could result in serious injury or death.***

## **NOTICE**

*The FUV is NOT a car. The FUV complies with Federal Motor Vehicle Safety Standards (FMVSS) and regulations of the United States Department of Transportation (DOT) applicable to motorcycles in the USA. The FUV does NOT comply with Federal Motor Vehicle Safety Standards (FMVSS) and regulations of the United States Department of Transportation (DOT) applicable to passenger cars and multi-purpose passenger vehicles in the USA.*

## **Vehicles Covered By This Owner's Guide**

- 2019 FUV Evergreen Edition
- 2020 FUV

## **Patent Information**

The vehicle in this guide is covered by one or more patents listed at <https://www.arcimoto.com/patents>.

## **Zero-Emissions Vehicle (ZEV)**

The FUV is a freeway-capable zero-emissions vehicle (ZEV) under U.S. Federal (EPA), California Air Resources Board (CARB), and European Union standards. The FUV runs solely on electricity; it uses no gasoline or other liquid fuel, and has no tailpipe, exhaust or evaporative emission.

The ARCIMOTO VEHICLE EMISSION CONTROL INFORMATION decal is located on the right-side of the Battery Bay.

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# Table of Contents

Overview .....	1
Plug It In! .....	1
The FUV Battery System in a Nutshell .....	2
High-Voltage (HV) Battery Pack .....	2
Battery Management System (BMS) .....	3
12V Battery .....	4
Charging .....	5
Charging at Home .....	5
Charging at a Public Charging Station .....	6
What is "Level 1", "Level 2" and "Level 3" Charging? .....	7
Charging DO's and DON'Ts .....	8
Understanding REGEN Power .....	11
Watch the Power Meter .....	12

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Extended Range Mode .....	15
Using Extended Range Mode .....	15

## Overview

The FUV is an all-electric vehicle (or "EV"). At Arcimoto, we understand that your FUV may be the first EV that you've ever owned and, as a first time user, you might have some basic questions about charging and maintaining the battery system in the FUV.

There are just a few things to understand in order to get the most out of your FUV. This short guide explains the simple basics of charging and using the electrical system in your FUV, but the concepts described in these pages apply to all EVs.

## Plug It In!

These three words are the best advice we can give you. To get the maximum lifespan out of your HV Battery Pack, just keep the FUV plugged-in when not in use. The electronics in the FUV will keep the battery full, well balanced and ready for use without any risk of overcharging. Thermal sensors continuously keep an eye on the battery temperature to avoid overheating.

When you finish a drive, plug the FUV into a charging station right away, while the Battery Pack is still warm from the drive. This way, it can be charged at full power, even when the outside temperature is very low.

# OVERVIEW

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This is good for the long-term health of the HV Battery Pack, it helps ensure that the FUV is always fully charged and ready to roll.

## The FUV Battery System in a Nutshell

Put simply, the FUV Battery System consists of three main components:

- **High-Voltage (HV) Battery Pack**
- **Battery Management System (BMS)**
- **12V Battery**

## High-Voltage (HV) Battery Pack

The FUV uses a high-voltage (HV) Battery Pack to power the motors. This Battery Pack is sealed inside the Battery Bay, which runs along the center of the FUV (under the seats).

The HV Battery Pack is what gets charged when the FUV is plugged into a charging station.

*This HV Battery Pack has no user-serviceable parts. You should never attempt to access the HV Battery Pack.*



## Battery Management System (BMS)

The HV Battery Pack is connected to a computer called the Battery Management System or "BMS". It is one of the brains of the FUV.

The BMS controls the HV Battery Pack and the charger: it uses lots of sensors to constantly control and monitor the status of the FUV Battery System.

- *While driving*, the BMS constantly monitors the battery state to ensure it is not operated beyond its specifications, so you can focus on driving.

- *While plugged-in*, the BMS protects the HV Battery Pack from overcharging and other issues that could damage the Batteries. For example the BMS will prevent the Battery Pack from being charged if it is too hot or too cold to do so without damaging the Battery Pack. It also will replenish the small self discharge of the Battery Pack and the small standby energy use of the electronics.

The BMS does its job without any input - you don't have to think about it. However, it helps to understand that it exists and what it does - every EV uses some kind of Battery Management System.

# OVERVIEW

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## 12V Battery

One standard 12V Battery powers just about everything except the motors on the FUV. This is a standard 12V Battery, like what you might see on a scooter or motorcycle.

On the FUV, the 12V Battery powers the lights, controls, display and accessories.

*Note that the 12V Battery powers the controls that turn the FUV on. Therefore, the FUV cannot start if the 12V Battery is dead, even if the HV Battery Pack is fully charged.*

## Charging

If you've never charged an EV before, don't let all the high-tech terminology scare you: charging your FUV is easy (not to mention convenient and cheap)!

## Charging at Home

### **Can I charge my FUV at home?**

Yes! In fact, the easiest way to keep your FUV charged is to charge it home - overnight, using the Charging Station that was provided with your FUV.

It is easy and convenient, and the FUV will be charged and ready to drive each morning.

### **Use the Provided Charging Station**

The Charging Station that came with your FUV plugs right into a standard (120V) wall outlet , like the one in your garage.

Plug the Charging Station into a wall outlet, then plug the charging cable into the FUV to charge.

For longer trips, consider taking the Charging Station with you. That way, you can use it to recharge when you reach your destination.

Note that there is an optional Charging Station that works with both 120V and 240V outlets. Charging from a 240V outlet is roughly twice as fast as charging from a 120V outlet.

# CHARGING

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If you have the optional charger and a 240V outlet available, consider using it to charge the FUV.

## Charging at a Public Charging Station

### Can I Charge My FUV at Any Public Charging Station?

Yes! The FUV uses a standard charging technology known as "Level 2" charging, which is offered at most public charging stations.

The FUV will not accept a charge from a Charging Station that is not compatible. So, as long as the charger fits the charging port on the FUV, you are safe to plug in and charge.

### Do I Need Any Adapters to Plug In my FUV for Charging?

Typically, no adapters are required.

The FUV uses a standard charge port (called "J-1772"), which fits the provided Charging Station, and is used at most public charging stations.

### How Do I Find a Public Charging Station In My Area?

There are lots of free mobile apps available that make it easy to find the nearest charging station, wherever you are. One example is "PlugShare" offered by Recargo Inc.

When you check it out, you might be surprised at how many charging stations there are, in your area. More charging stations are opened everyday.

## What is "Level 1". "Level 2" and "Level 3" Charging?

There are three different "Levels" of charging available for EVs, usually called "Level 1", "Level 2", and "Level 3". Each Level represents a different charging rate. Here's how they work:

### **Level 1 Charging**

"Level 1" refers to charging from a standard 120-volt household power outlet.

This is the slowest method of charging, but it will still fully re-charge the FUV overnight.

It takes around 12 hours to fully charge the FUV from empty on Level 1 charging.

### **Level 2 Charging**

"Level 2" refers to charging from a 240-volt power outlet, either at home or at a public charging station. Level 2 charging is available at most public chargers,

Many homes have 240V outlets available (often in the garage), since they are used for

# CHARGING

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high-power appliances such as ovens, clothes dryers, water heaters, and air-conditioners.

Level 2 charging is typically at least twice as fast as Level 1 charging. So, if you have access to a 240V outlet at home, consider using it for charging your FUV.

It takes less than 6 hours to fully charge the FUV on Level 2 charging.

## **Level 3 Charging**

Level 3 charging is an emerging high-current charging method, reserved for use by Tesla™ and other manufacturers of larger EVs.

The FUV does not support Level 3 charging.

## Charging DO's and DON'Ts

### **Avoid Extreme Temperatures**

Extremely hot (above 110°F) and cold temperatures (below freezing) can affect the HV Batteries in the FUV when charging.

### **Very Hot Temperatures**

Avoid storing the FUV in a very hot environment (an ambient temperature of 110°F/ 43°C, or hotter).

To prevent battery damage, the charger reduces its charge current if the HV Batteries reach 110°F (43°C). This will result in an increased time to charge. The higher the ambient temperature, the greater the effect.

As a safety feature, the FUV will not charge at all if the HV Battery Pack reaches 122°F (50°C).

If your FUV will not take a charge, try to reduce its internal temperature and help it stay below 122°F (50°C). For example, allow the FUV to cool down by parking it in a shady location with good ventilation. Let it cool off for about 30 minutes and try again.

If the FUV has recently been operating near maximum output and/or in hot conditions it may be too hot to take a charge. In this case, let the FUV cool off for about 30 minutes and try again.

## **Very Cold Temperatures**

Avoid storing the FUV in a very cold environment (an ambient temperature below -5°F/ -20°C).

If the HV Battery Pack is exposed to prolonged sub-freezing temperatures, some of the chemicals inside the Battery Pack can crystallize. If this happens, charging the Battery Pack while it is below freezing will cause permanent damage.

As a safety feature, the FUV will not charge if the HV Battery Pack reaches 32°F (0°C).

If your FUV will not take a charge, ensure that the internal temperature is above 32°F (0°C).

# CHARGING

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In addition, under low temperature conditions, the maximum rate of charge or discharge of the Battery Pack is greatly diminished and the available capacity of the Battery Pack is substantially reduced.

Always plugging the vehicle in helps with this. Starting from a full charge, the initial capacity might be reduced but there is enough capacity left to drive, warm up the Battery Pack and recover the previously inaccessible capacity.

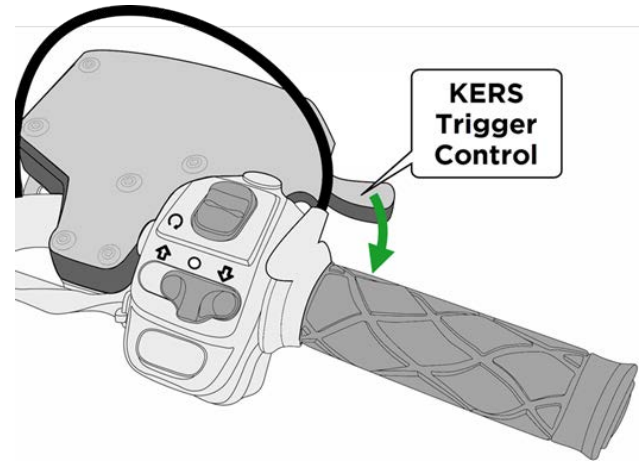


## Understanding REGEN Power

Like most EVs, the FUV features a Kinetic Energy Recovery System (or "KERS"). This feature allows you to harness kinetic energy from the moving FUV to recharge the HV Batteries as you drive.

Effective use of the energy recovery system will substantially increase your overall driving range.

On the FUV, the energy recovery system is activated by squeezing the KERS Trigger Control on the right hand grip:



When the KERS Trigger Control is squeezed, the FUV feeds energy back to the HV Batteries, and increases the charge level (and therefore increases your driving range). This is known as REGEN power.

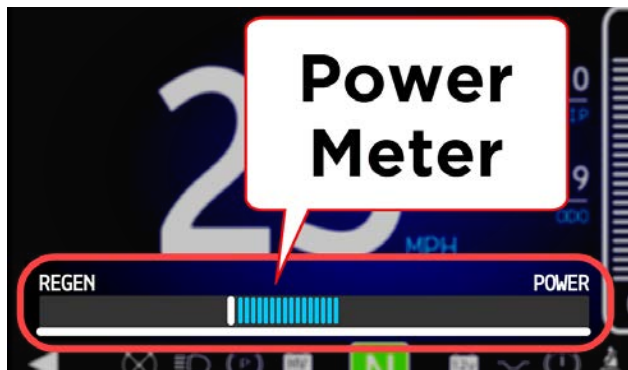
# UNDERSTANDING REGEN POWER

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When the Trigger Control is squeezed, the FUV slows down.

## Watch the Power Meter

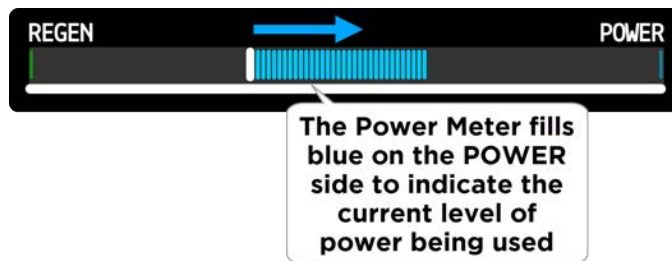
Keep an eye on the Power Meter (along the bottom of the Display) to monitor your power usage in real time, as you drive:



## Power Meter: POWER (blue)

The right side of the Power Meter (labeled "POWER") indicates the level of charge currently being used (in blue).

As you apply more throttle, the amount of POWER used will increase.



As POWER is used, the Charge level gradually goes down.

# UNDERSTANDING REGEN POWER

## Power Meter: REGEN (green)

The left side of the Power Meter (labeled **"REGEN"**) indicates how much REGEN power is being fed to the Batteries via the energy recovery system.

When the KERS Trigger Control is squeezed, the amount of REGEN power indicated on the Power Meter (in green) will increase.



**The Power Meter fills green on the REGEN side to indicate the current level of power being fed back into the Batteries**

Keep an eye on the Power Meter and adjust your riding habits as you go. With practice, you'll be able to maximize your range by re-charging the HV Batteries while you drive.

## Using REGEN Power - An Example

Here's a simple scenario to illustrate how REGEN power can increase driving range:

Imagine driving the FUV up a long winding mountain road. As you drive, you notice that the Power Meter indicates that you are using a fair amount of charge (the blue POWER level on the right side of the Power Meter will increase).

As you climb, you may notice the overall Charge level gradually decreasing.

# UNDERSTANDING REGEN POWER

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Then, when you get to the top and head back down the other side, you realize that you don't need to apply much throttle.

What's more, there are some fun curves that require you to slow down as you descend.

Since you are only controlling your speed (and not necessarily trying to brake quickly), squeeze the Trigger Control to slow the FUV.

While the Trigger Control is squeezed, the FUV slows down, and the energy recovery system is activated: the Power Meter indicates that REGEN Power is increasing.

As REGEN power is fed back to the Batteries, the overall Charge level will increase.

By the time you arrive at the bottom of the mountain, you should have recouped some of the power used to climb up the mountain.

Of course, you don't have to be on a mountain to take advantage of the Energy Recovery System.

Use the Trigger Control (rather than the Brake Pedal) to control your speed as you drive, and you can generate enough REGEN power to extend your overall driving range.

Always use the Brake Pedal to bring the FUV to a stop.

### Extended Range Mode

The **Extended Range Mode** feature allows the FUV to travel approximately 20% further than usual on fully charged Batteries.

For optimal battery life, the HV Batteries should never be allowed to be fully charged or fully discharged and allowed to sit in this state for any extended period of time.

Letting the HV Batteries sit while either fully charged or fully discharged - even only a few times - can dramatically reduce the lifespan of the HV Batteries.

For that reason, the FUV normally stops charging the HV Batteries at 90%, and indicates empty when there is approximately 10% of charge left.

### Using Extended Range Mode

Use Extended Range Mode sparingly - it is not intended to be used on a daily or regular basis. Use of Extended Range Mode will accelerate battery wear.

However, there may be specific occasions when you want to reach a destination that is slightly outside of the normal range. *Extended Range Mode* allows you to unlock all of the energy in the HV Batteries to get the extra miles you need.

# EXTENDED RANGE MODE

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However, to avoid damaging the Batteries, only use *Extended Range Mode* as follows:

**When Extended Range Mode is activated, it is crucial that you begin driving immediately after the FUV is fully charged.**

*Letting the FUV sit with Extended Range Mode activated while fully charged can permanently damage the HV Batteries. Battery damage due to improper use of Extended Range Mode is not covered by the Warranty.*

Do not activate Extended Range Mode unless you intend to drive away as soon as the FUV is fully charged.

**When Extended Range Mode is activated, it is crucial that you recharge the FUV immediately after arriving at your destination.**

*Letting the FUV sit with Extended Range Mode activated while fully discharged can permanently damage the HV Batteries. Battery damage due to improper use of Extended Range Mode is not covered by the Warranty.*





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