

# EVc

**WORLD CLASS  
BATTERY  
RECONDITIONER**

AVAILABLE CONFIGURATIONS:

**12**

CHANNEL

**30**

CHANNEL

**120**

CHANNEL



EVc-30 battery reconditioning unit connected in parallel to a 28-module Prius pack. One parallel connection does the job.

## The EVc-30 differs from other tools as follows:

1. The EVc-30 is designed for simplicity-of-use. No attendance required during reconditioning.
2. The battery pack modules (e.g., 28 in a Prius) connect to the EVc-30 unit in only one way for charge and discharge. No re-connecting required between steps.
3. Just connect the battery pack to the EVc-30 and then press the start button. Less than 90 minutes of labor required to yield one reconditioned pack per day.
4. The EVc-30 provides a state-of-health report on each module including:
  - a) Amp hour capacity, Watt hour capacity, Internal resistance
  - b) The order in which reconditioned modules are positioned in a refurbished pack
5. Module are separately charged and discharged (parallel processing): Modules cannot be refurbished in series (as they are during vehicle use) because module voltages cannot be controlled when in series.
6. Lithium ion battery recipes in development
7. EVc-30 owners can join the hybrid battery support forum. Regular updates and problem-solving sessions are provided for EVc-30 owners only.

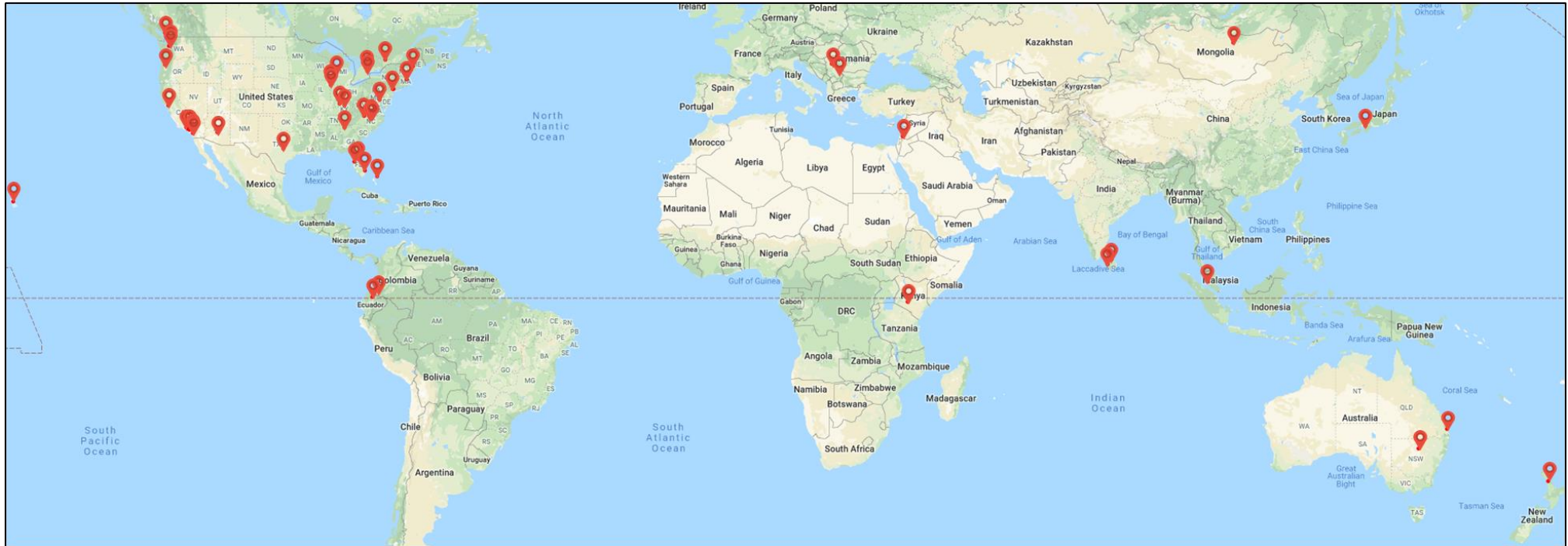
The NuVant mission is to “Bring electrochemistry to the streets.” Everyone can learn to use NuVant battery refurbishing equipment. Do not worry if you know nothing about batteries. Many shops using the EVc-30 had no prior knowledge.

### List of compatible hybrid battery vehicles:

Toyota Camry	Lexus CT200H
Toyota Prius (and Prius C)	Lexus GS450H
Toyota Avalon	Lexus GS450H
Toyota Highlander	Lexus RX400H
GM Tahoe	Honda Civic
GM Escalade	Honda Insight
GM Yukon	Ford Escape

\*other vehicles (including Li-ion) coming soon

## EVc User Locations:



- Over 100 EVc units worldwide
- Found in over 13 countries
- Over 250,000 modules have been reconditioned

## EVC-30 Specifications

A 30-channel battery cycler that recovers capacity, and balances battery pack modules. A National Instruments DAQ card enables current interrupt measurement of internal resistance, relaxation times and galvanostatic intermittent titration. Free software sorts modules for pack remanufacturing.

<b>Load</b>	
Max Load Voltage	+12V (Optional +18V)
Max Load Current	5A per channel
Number of channels	30
Applied DC Current Ranges	5A
Applied Current Accuracy	0.5% of Full scale resolution
Applied Current Resolution	0.3 mA
<b>Potential Measurement</b>	
Measured DC Potential Ranges	±20V
Resolution	0.6mV
Accuracy	0.08 or 0.03% of FSR
<b>Current Interrupt (Serial Resistance Measurement)</b>	
Minimum Sampling Interval	4us
Serial Resistance Precision	0.5%
Measurement Logging time	1 second
<b>Step Impedance Spectroscopy</b>	
Maximum Current Amplitude	5A
Minimum Sampling Interval	4us
Minimum Pulse Width	40us
<b>Data Acquisition</b>	
Acquisition Speed	500 kS/s aggregate Distributed over 1 to 30 channels
DAC Resolution	16 bits
<b>Accessories</b>	
Laptop	MS Windows
Cooling box	Accommodates up to 40 modules
Cables	30-cable set, 7 ft each
<b>Physical dimensions and weight</b>	
EVC-30: L x W x H: Weight	25" x 20" x 26": 170 lbs
Laptop	5 lbs
Cooling box: L x W x H: Weight	38" x 15" x 6": 20 lbs
30 Cables	30 lbs

## EVC-12 Specifications

A 12-channel battery cycler that recovers capacity, and balances battery pack modules. A National Instruments DAQ card enables current interrupt measurement of internal resistance, relaxation times and galvanostatic intermittent titration. Free software sorts modules for pack remanufacturing.

<b>Load</b>	
Max Load Voltage	+12V (Optional +18V)
Max Load Current	5A per channel
Number of channels	10
Applied DC Current Ranges	5A
Applied Current Accuracy	0.5% of Full scale resolution
Applied Current Resolution	0.3 mA
<b>Potential Measurement</b>	
Measured DC Potential Ranges	±20V
Resolution	0.6mV
Accuracy	0.08 or 0.03% of FSR
<b>Current Interrupt (Serial Resistance Measurement)</b>	
Minimum Sampling Interval	4us
Serial Resistance Precision	0.5%
Measurement Logging time	1 second
<b>Step Impedance Spectroscopy</b>	
Maximum Current Amplitude	5A
Minimum Sampling Interval	4us
Minimum Pulse Width	40us
<b>Data Acquisition</b>	
Acquisition Speed	500 kS/s aggregate Distributed over 1 to 12 channels
DAC Resolution	16 bits
<b>Accessories</b>	
Laptop	MS Windows
Cooling box	Accommodates up to 40 modules
Cables	12-cable set, 7 ft each
<b>Physical dimensions and weight</b>	
EVC-10: L x W x H: Weight	18" x 20" x 18": 60 lbs
Laptop	5 lbs
Cooling box: L x W x H: Weight	38" x 15" x 6": 20 lbs
10 Cables	10 lbs

## Hybrid vehicle battery reconditioning: The process

### What is a hybrid battery module?

Modules are nickel metal hydride (NiMH) cells connected in series. NiMH cells have a nominal voltage of 1.2 V. A Ford Escape module has 5 cylindrical NiMH cells in series. A Toyota Prius module has 6 prismatic NiMH cells. A hybrid vehicle traction pack battery consists of modules configured in series. A Ford Escape has two 25-module traction packs. A Prius has a single 28-module pack.

	cells/module	module V	type	modules/pack	pack V
Ford Escape	5	6	cylinder	25	150 V
Prius	6	7.2	prismatic	28	202 V
Honda	6	7.2	cylinder	26	187 V

### What does “out of balance” mean?

The driving cycle of a hybrid vehicle subjects the battery pack to repeated shallow depths of discharge of less than 10% of the battery capacity. The unused capacity undergoes a correctable degradation process that reduces battery capacity. This failure process (i.e., module-to-module variation of amp-hour (Ah) capacity) is referred to as an “out of balance” pack. The modules have a memory of the small capacity demanded, thus resulting in the term “memory effect”.

### What is battery cell balancing?

Reconditioning recovers lost capacity. When reconditioned modules are sorted and positioned for optimum performance, the battery pack is balanced. The steps are:

1. Extract the hybrid battery pack from the vehicle
2. Remove the high voltage cable
3. Connect modules in parallel to the EVc-30 (see photo above)
4. Press the start button.

The output report:

- a) Identifies high resistance modules
- b) Enables sorting and selecting of modules for pack assembly based on amp-hour or watt-hour capacity
- c) Pairs up modules into blocks based on module rest voltage
- d) Archives all data for your warranty management program

### What tools are required for hybrid battery reconditioning and repair?

The required tools are (1) a menu driven charge discharge cyler, (2) software for analysis of amp-hour capacity and midpoint voltage data on every module maintained in inventory, (3) a QR code reader and (4) a 50 inch-pound torque limited nut driver.

### How long does it take to recondition a hybrid battery pack?



High quality cell balancing requires a minimum of 20 hours instrument time. NiMH modules have system parameters specific to the form factor (e.g., prismatic versus cylindrical) and number of cells in series (e.g., Ford Escape: 5; Prius prismatic: 6; etc.). These parameters govern the choice of recipe parameters. Balancing recipes and their automated implementation are covered in the NuVant battery reconditioning course. The business model is to build up an inventory of reconditioned modules for replacement of customer packs and recovery of a core from the customer.

### What cell balancing data does the EVc archive as Excel files?

The EVc provides internal resistance, amp-hour, watt-hour capacity and real-world nominal voltages for every module. The chart below is a real time display of module parameters during the cell balancing process.

### How do I learn more about hybrid battery repair prior to purchasing an EVc?

The hands-on hybrid electric vehicle battery reconditioning short course allows participants to connect Prius pack modules to an EVc reconditioning unit for cell balancing. During the reconditioning process, the terminology required for understanding cell balancing will be thoroughly explained. On the second day, results of the overnight process are thoroughly discussed along with data processing.

### How much money can I make with an EVc-30?

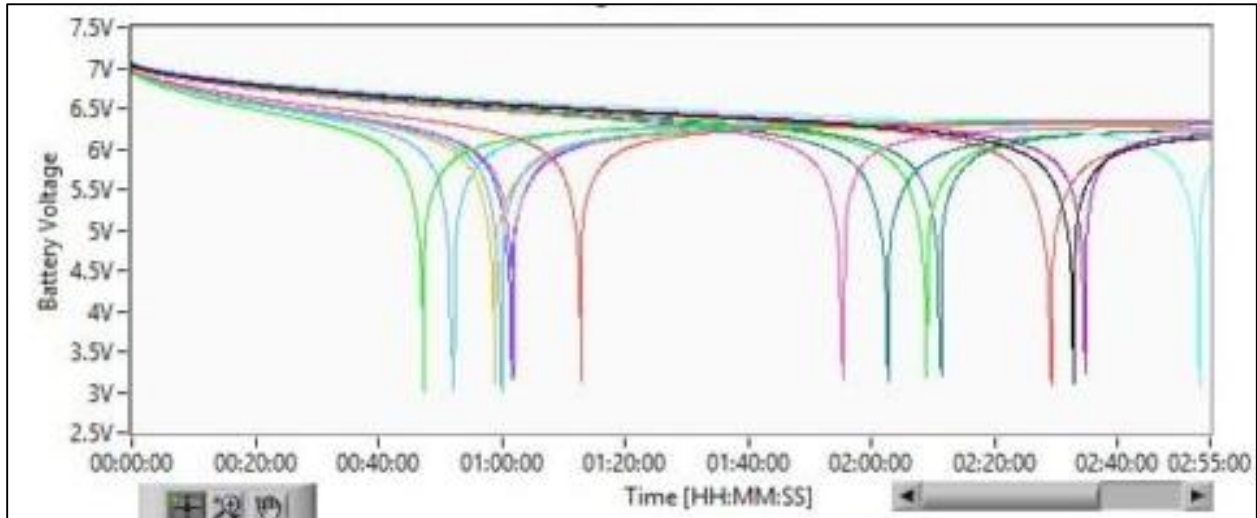
An EVc-30 is capable of reconditioning 30 Toyota Prius battery packs per month. Assuming:

- a) Processing 20 packs per month
- b) 80% module recovery rate
- c) \$1200 margin per pack

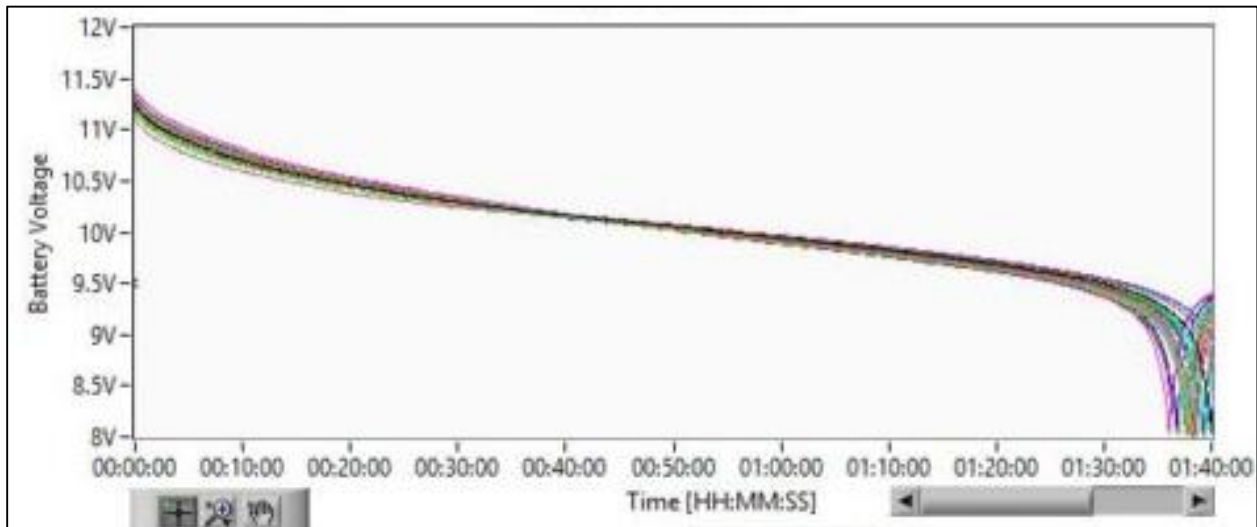
The instrument amortization is achieved in less than 2 months, and a monthly revenue of \$19,000.

Disclaimer: The above calculations, while sincere and based on discussions with our current EVc owners, are only suggestive. NuVant cannot and will not guarantee the above results. Owners must maintain their own data and modify the calculations as needed. NuVant takes no responsibility for how the above calculations are used. NuVant makes no guarantee for any level of revenue over any time period. We believe that the above calculations are reasonable calculations based on the stated assumptions. The calculations do not consider the time for pack extraction and re-installation, and the time required for copper bus bar cleaning. Assumptions and calculations should be refined to better fit the buyer's business plan.

## Real time display of comparative battery parameters and charge/discharge curves



EVc-30 data: Hybrid battery pack before reconditioning



EVc-30 data: Hybrid battery pack after reconditioning



## Hands-on hybrid electric vehicle battery course

The 2-day nickel metal hydride (NiMH) hybrid battery class demonstrates split current charge-discharge cycling, internal resistance measurements and hybrid battery cell balancing. No prior knowledge of hybrid batteries is required. The hands-on experience includes use of the [EVC-30 hybrid vehicle battery reconditioning unit](#). Anyone can learn!

### Hybrid battery class benefits:

- Experienced instructors provide in-depth knowledge on hybrid battery cycling, reconditioning and safety issues.
- Real time demonstration of charge-discharge cycling and battery internal resistance measurements.
- Learn to identify bad modules prior to reconditioning.
- The dangers of over-charging and over-discharging.

### Course registration includes:

- Course work materials
- Hotel accommodations and breakfast
- Use of NuVant EVC units for charge-discharge, internal resistance measurements and complete reconditioning.

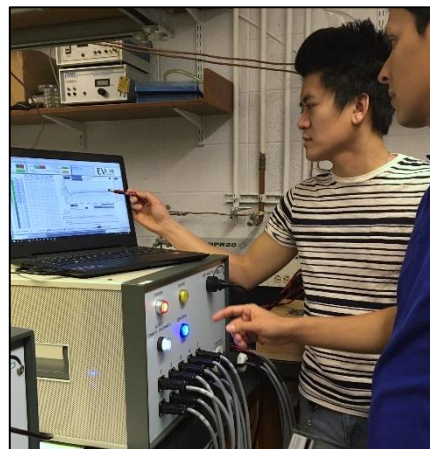
### Crown Point, IN

### Course time schedule

Day 1	8:30AM – 3:30PM (EST)
Day 2	8:30AM – 1:30PM (EST)

### Syllabus

- Part I: Introduction  
 Part II: Terminology, definitions and usage  
 Part III: Underpinning science behind battery reconditioning  
 Part IV: Hands-on experience with the EVC-30 reconditioning tool  
 Part V: Interpreting EVC-30 data output  
 Part VI: Summary



Call us at 219-644-3231 or visit our website at [NuVant.com](http://NuVant.com) today!