Intelligent 1-phase charger with Anti Trip of Breakers (16A, 32A)

1-phase charger User Manual
(Firmware v2.18)

Index:

Thank you for choosing our EVSE – Accelev v2.
We believe that our portable wall box is the best choice for your car.

1. Overview

Accelev v2 EVSE is a processor-controlled, advanced AC wall box with features not available in other chargers.

Along with the ability of speed reducing, when other load detected - your tripping breakers will be history.

Battery Balancing procedure may increase the usable capacity of your battery and state of health (SOH) - perfect for Nissan Leaf and Jaguar i-Pace battery SOH improvement.

Forget about stupid Chinese chargers - use the touchscreen, update new functions via USB. Monitor the health of your home energy grid with a spectacular SOP (State of Power) parameter (read more here).

This EVSE/charger/energy converter can be flexibly completed according to customer wishes (both cables are detachable/replaceable).

We believe that Accelev v2 is the most modern EVSE home station of our times.

2. Standard features

- Grid monitoring (immediate load reduction while grid overload detected – no more tripped off breakers)

- BatteryCare™ - unique full charging / no full charging modes with maximum life protection for your battery
- Current Boost - automatic current adjusting to find the maximum possible speed of charging.
- SOP - State of Power for monitoring of your home electric grid performance
- Updateable - flash most recent firmware via micro USB extension port.
- 2.8-inch touch screen - human interface with „geek mode” - you can monitor all parameters while loading.
- Safety first - RCD Type A protection (Type B as an option), advanced overload and overheat protection.

3. Precautions & Installation

Maintenance and cleaning can be done only if a power source is disconnected. It is not permitted to wash the unit with a direct stream of water. Use cleaning wipes for notebook/tv screens instead.

4. Do/Don’t

You can:
- Switch off a power source of Accelev while not charging, also by its input connector (you can use it also to reset counter – in such situation, please switch off for at least 5 seconds).
- Disconnect your car at any moment.
- Press button at the delivery plug to restart charging
- Use Accelev as a portable charger while putting on the ground on the back

You should not
- Switch off a power source of Accelev while charging.
- Open Accelev, modify or change its firmware
- Pour water, wash it with water, etc.

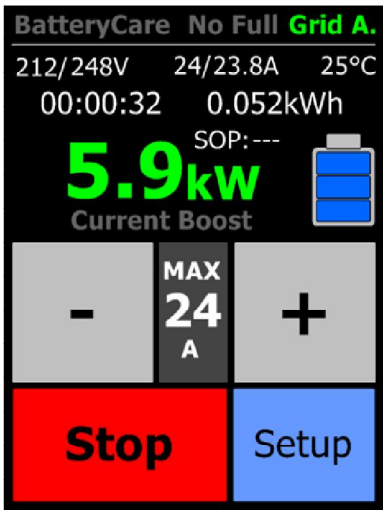
5. Charging speed

Accelev EVSE is capable of charging any electric car, that uses Type1 or Type2 input. Even if your car is not listed below, Accelev will charge it correctly.
Accelev EVSE tries to optimise your charging speed and load automatically, therefore, the following situations may occur:
- your AC network is not loaded, the car battery is not fully – charging speed is maximised
- your AC network is overloaded – charging speed is reduced by Accelev
- your car battery is almost full – charging speed is reduced by car.

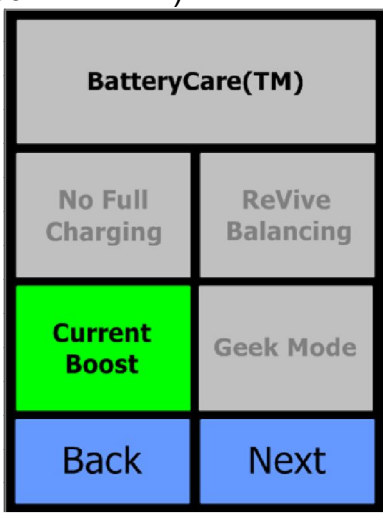
Notice, that car may charge slower or faster due to battery temperature and power supply voltage & load.

6. Main Screen

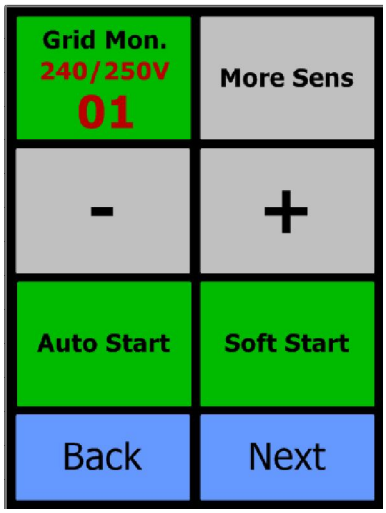
Values, Statuses (from top left):
(See “Usage and functions” chapter below to learn more about all options)



BatteryCare – BatteryCare option status (Green - ON, Gray - Off)
NoFull – no full charge option status. (Green - ON, Orange - Triggered, Gray - Off)
GridM – grid monitoring status (Green - ON, Orange - Triggered, Gray - Off)
212/248V – voltage of shedding (Green - Autoset) / actual voltage
24/23.8A – actual max. amperes / actual amperage
25C – the core of charger temperature
00:00:32 – total charging time
0.052kWh – total kWh charged
SOP - State of Power. Quality of your charging network, presented after 40 seconds of charing. Also, the long-time average is presented at the last screen of Setup
5.9kW – actual charging power (if Orange - Grid Monitoring reduced it)
Current Boost - orange = Current Boost Active. Gray = Off, Green - current adjusted
Battery symbol – shows the phase of charging and if BatteryCare is on or off. You can also click it to set the number of kWatts you want to charge (10, 20, 30 or no limit)
MAX 24A – max. amperes permitted
[-] [+] - change max. amperes: 6, 9, 12, 15, 18, 21, 24 (27, 30, 32 - for 8kW)
Start – starts charging or idle, resets counters. If “Auto” or “Soft” visible at button surface - it means they are active.
Setup – opens Setup screens:



BatteryCare(TM) – enables and disables BatteryCare routines and functions
No Full Charging – self-described, perfect for battery life.
ReVive Balancing – a special pulse balancing of battery to cure and recover lost capacity.
Current Boost - charger adapts charging current to be maximum possible by adjusting control signal to the car
Geek Mode - if off, the main screen is simplified.



Grid Mon – enables and disables grid monitoring (shedding)
More Sensitive/Auto Sensitive/Less Sensitive – Grid Monitoring mode - a standard is Auto Sensitive and it will work n most situations optimally.
[-] [+] - sets the level of grid monitoring in More/Less Sensitive mode
240/250V – actual prediction for power shedding start/actual voltage
01 – tolerance of grid monitoring (01 = smallest gap, quickest reaction, 20-highest gap)

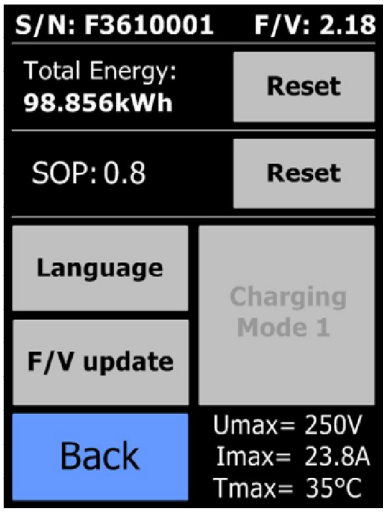
Grid monitoring depends on actual voltage in your electric grid. It is suggested to use Auto Sensitive mode, but if you want to do that manually in More/Less Sensitive mode, it is a good idea to set it more conservative. 08 is a typical setting, good for most situations, but you ought to set the trigger (left number) to be about 2-3V lower than unloaded grid voltage (right number on the Grid Monitoring button surface). Please remember to do manual settings while the network is unloaded with other loads except your car. Your car must be charging with full speed

In the case of electric breakers tripped off please decrease tolerance first. If you see, that charger reacts to load and reduces the speed of charging, but this amperage reduction is not enough for your fuse system - please switch “More Sens” on to increase the amount of amperage reduction by twice.

Auto Start - If enabled, forces charger to stay ready to charge even if not plugged, unplugged from car, stopped from the car. No need to start charging every time. **It must be off for firmware update.**

Soft Start - enables low current start with step-by-step load increase and grid monitoring, to find the maximum possible current from an unknown power source. Analysis of source capabilities may take up to 8 minutes.

S/N: xxxx – serial number of charger
F/V: 2.18 – firmware version installed
Total Energy – global energy counter
Reset – resets global energy counter
SOP: 0.8 - Average SOP
Language - choose language here
F/V Update – switches to boot mode,
waits for an update via USB port
Charging Mode 1 - special mode for old Mitsubishi i-Miev
(car without communication to charger)
Umax – highest voltage ever measured
Imax – highest amperage ever measured
Tmax – highest temperature ever measured

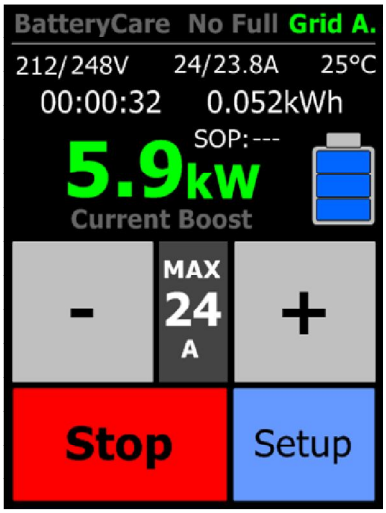


7. Usage and functions

The status line shows the actual status of three main functions:

BatteryCare:

BatteryCare – off, the charger is a standard Mode2 charger
BatteryCare – enabled and idle
BatteryCare – enabled and in action



BatteryCare, once switched on, focuses on start charging speeds and finalising of charging, with constant voltage phase, to reduce the risk of single battery cell over-voltage to a minimum. It seamlessly reduces the speed of charging before the battery voltage reaches the maximum - and thus it protects cells much better, than any OEM EVSE, still permitting full charge. SOH (State Of Health) of your car battery will drop slower.
BatteryCare enables No Full Charging button. See more explanation in chapter 9.

No Full Charging

Battery symbol stays green if BatteryCare is enabled. Otherwise – it is blue.

No Full – off, the charger is a standard Mode2 charger
No Full – enabled and idle
No Full – enabled and almost full battery detected

No Full Charging can be switched on via the Setup menu, while BatteryCare is enabled. This function is preventing your battery to be fully charged. Once finalising (constant voltage) phase is detected, the car charge stops. For your information status “No Full” stays orange until reset with Start button.

We highly suggest to use BatteryCare on with No Full Charging on for everyday use and commuting, and BatteryCare on with No Full Charging off for occasional, long trip occurrences.
Charging battery full, along with its high temperature may reduce faster your battery's usable capacity and the State Of Health.

Maximum amperage setting/display:
User can set and change maximum amperage at any moment of charge or idle.
Please notice, that maximum amperage set by USER and ACTUAL maximum amperage (presented below status bar, along with actual current) may differ (be reduced) if BatteryCare is on or Grid Monitoring is on.

Update
Please remember to load your notebook fully and use USB cable provided with your charger.
If you encounter any problems with starting Updater, please install drivers and C++ Runtime libraries (download from https://evtun.com/chargers.html) prior to next steps.
For update please disconnect your Accelev from the power source. Connect micro-USB cable between your Accelev and Windows PC. MicroUSB (covered with plastic plug) port is on the right side of Accelev. Go to Setup, **switch off Autostart (if it is on)** and then press **Firmware Update** button. Install Accelev Updater on your PC and start it with **Administrator privileges**. Choose proper update file and wait till Update Accelev button will be enabled (verification of data occurs). After the update is finished, disconnect USB and re-connect Accelev to power. Update program and new firmware versions are available at EVTUN.COM page or your distributor/shop page, once published.
If there is no update possible (the device is not detected) - this means your PC has no drivers installed (it should work automatically with Windows 8, 8.1, 10, but for older versions, or when no internet available - you can use our drivers instead of letting Windows to download them automatically.
If you see any errors of missing libraries, DLLs - this means you have forgotten to install C++ Runtime libraries.

8. FAQ – Frequently Asked Questions

1. What is a typical setup of charger you suggest?

We highly suggest to use BatteryCare with No Full Charging for everyday use and commuting, and BatteryCare without No Full Charging for occasional, long trip occurrences. Charging battery full, along with it's high temperature reduces usable capacity and State Of Health of your battery.

2. Can I restart ReVive balancing again after it finished to balance and cure my battery even more?

Yes, this is ok and it will work for you.

3**. Can I have longer/shorter cables for supply/car connection?**

Of course. Just tell us what you need and we will produce that.

4. DO I need to install current meter at the house power input to use grid monitoring?

No. Grid monitoring in Accelev uses voltage drop algorithm, based on a rule, that voltage drop is proportional to the current load. You can use grid monitoring and Soft Start (special for unknown capability power sources) at any time and place. This simplifies the usage of grid monitoring.

More Questions? News? Updates? Extensions? Other charger types? Ideas for updates?
Go to http://www.evtun.com

9. Specifications & Technical Data

Parameter	
Dimensions (in mm)	180 x 130 x 77
Weight (net, in kg)	2
Human interface	2.8 inch colour TFT screen with touchscreen
Update/extension port	USB micro B (USB 2.0 or higher)
BatteryCare™	Installed, factory disabled (refer to manual)
Housing	PC + GFS
Installation method	Indoor, Outdoor
Input voltage range	200 ~ 240 V (AC)
Input cable length (in m)	2 (other options available)
Typical power	3,7 kW/7.4kW
Rated max. current (release ver)	16 A/32 A
Output plug type	Type2 (IEC 62196) or Type1 (J1772). Replaceable.
Output cable length in m	5 (other options available)
Output voltage range	200 ~ 240 V (AC) single phase
Charging standards/modes	Mode 3 (with power shedding), Mode 2.
Protection	Overvoltage, under-voltage, overload, grounding, over temp.RCB Type A or Type B installed internally
Efficiency	≥95%
Power factor	≥0.99
Working temperature	-30 ° C ~ +50 ° C
Working humidity	5% ~ 95% (no condensation)
Housing protection level	IP54
Measuring accuracy (power)	1%
Branding	Possible, contact us for MOQ

Standard delivery includes Type 2 EVSE-to-car cable. If you need Tesla USA plug or Type 1 plug, please inform us or your distributor.

10. More technical explanation:

10.1 BatteryCare

One of the main problems while charging till 100% is a battery ageing, caused with a full charge. It seems that (depending on chemistry) single complete charging causes about four times more damage than discharging a battery to 0% capacity (maintaining "safe" voltage of 2,5V or higher.

Also, charging is controlled via a battery controller, with a passive (resistive) balancer. Such balancer cannot monitor every single cell or pouch inside a battery. Cells are stacked in groups of parallel-serial modules. Such complete modules consisting of few cells are controlled via balancer as a single energy storage units.

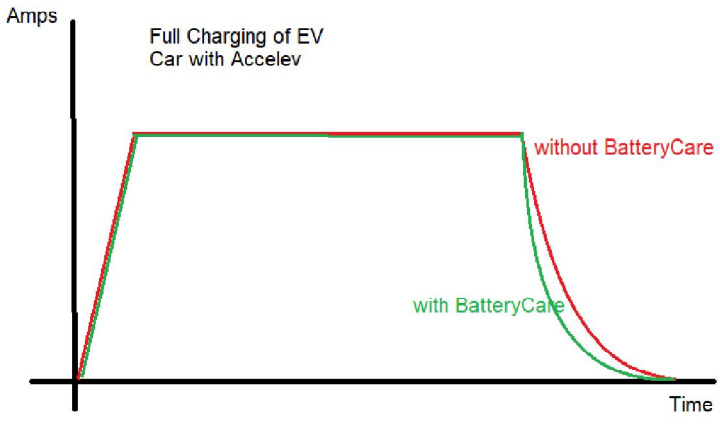
Different cell temperatures, state of their health or even accidental damages or production differences between them may cause different internal resistance of them and finally cause to overvoltage a single cell, while the whole module, that consists of such cell look appropriately powered. It is almost impossible to avoid that during battery life without adding monitoring and balancing units to every single cell.

Car manufacturers solve this via charging during final phase with constant voltage, that is set below 4,2 V (like 4,12V or so) to decrease the chance of overvoltage occurrences.

What to do?

First, the simple answer is: do not charge fully! Some cars (like Tesla) can be configured to stop charging at 90% or lower state of charge (Tesla highly suggest this to users to avoid battery depleting). You can also try to monitor your state of charge and switch off charging at a proper level.

Alternatively, you may use Accelev v2 and switch on BatteryCare group of functions. One of them is "No full charging". When the charger detects near-full state, it stops charging (usually at a level of 90-95%). This manner will be excellent for the longevity of your battery, primarily as a charging mode for daily commuting.



Sometimes we need to have a full available capacity (for example - before a long trip). In such a case, we can start charging without button "no full charging" pressed. A charger will charge till near-full state, and then - it will control current with steps down, to keep lower voltage than the typical one. Last charging phase may be more extended (slightly), but the battery will stay at about 4V per cell (not 4,12V). A charger will learn proper finalising characteristics so that the next full charges can be even smoother and shorter.

We believe that BatteryCare can help with prolonging your battery life.

BatteryCare focuses on finalising of battery charging. This phase starts when the voltage reaches the maximum permitted (usually 4,12 V per cell). During that phase, when

imbalance, different cell temperatures along with a group of cells controlled by single BMS node, or just partial cell failure occurs, it is quite possible to cause overvoltage at some individual cells, and through that - cause ageing and breakdown of whole battery (after some time).

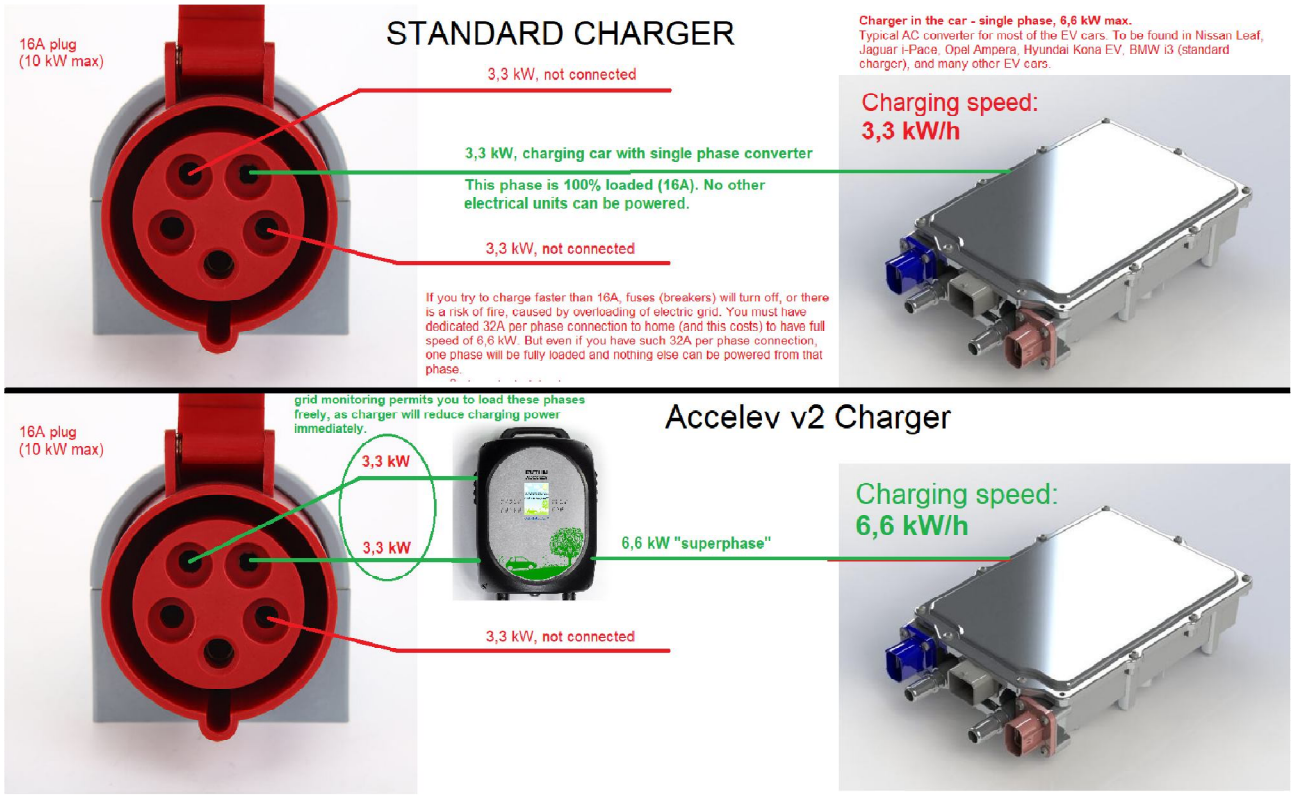
BatteryCare during the first pass (first full charge) tries to learn car charging characteristics, and memorise it. Also, it reduces charging amps to minimise the time of being at full voltage to about 15% of the original time. Such finalising stage can be up to 15% longer than conventional charging.

When learning is done, BatteryCare charges the car till full with current adapted to keep not more than 4,0V during finalizing. This adaptive method reduces time loss at the finalising stage to 5-10% while the battery will be less than 5% of finalising time in "danger zone".

When we compare factory BMS behaviour, it would be focused on a maximum speed of charge within a safe zone (4,12V or so). This safe zone is calculated as an optimal balance between speed of charging and risk of damage - for all cells staying in the exact same condition. As it is impossible to measure internal resistance and temperature of every single cell (most of the batteries have 2-4 thermosensors), such manner is good within laboratory conditions.

Car manufacturers want to advertise faster charging. Reducing the max. voltage per cell to 4,0V (with BatteryCare) delays charging during last phase (finalizing) but highly increases safety (especially when the car is intensively used, it is warm, or very cold). It may not help, when the battery is new (first 5000 - 10000 km), but it starts to be positively influential later, when cells are not as equal, as they were at the start of their life.

As we have received dozens of questions about how Accelev compares to typical 16A or 32A single-phase charger (EVSE), there is a simple graphic explanation.



Typical 16A charger connected to 16A x 3 phase home grid (10 kW max capability, standard in Europe), drains one phase totally. Charging speed is about 3,3 - 3,5 kW. Nothing else can be connected to that phase (breaker will turn off the power). Also, no 3-phase tool can be used while charging an EV car.
With Accelev two phases are equally loaded. So with 3,3 kW charging speed, each phase will be loaded with half of its capability (about 8A)
But you can load two phases fully and charge 6,6-7,0 kW because Accelev includes Grid Monitoring. If any additional load is detected, charger reduces charging speed (or stops charging) for a period of the additional load operation. It gives you the fastest possible home charging for cars with single-phase onboard charger. Among these cars, we can find Nissan Leaf, Jaguar I-Pace, Opel Ampera, Hyundai Kona EV and many many others.
32A charging from a single phase with a conventional charger is possible when you own a dedicated 32A per phase home supply. It costs.

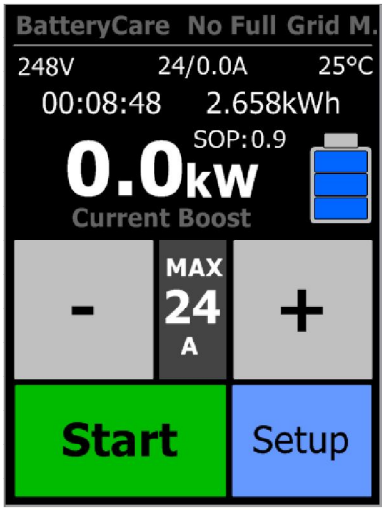
10.2 ReVive balancing

This function is intended to balance battery and revive missing capacity. Such curing bases on pulse charging algorithm and slow balancing and may take up to 10 hours to finish. It can be interrupted at any moment, but the battery will be not entirely balanced. A car may not be fully charged after the end of ReVive.
A car should be discharged till <10% state of charge before using ReVive (you can discharge your car stationary, using a heating system and setting it to a max. temp.).
During charging with this function enabled, grid monitoring can be activated, but BatteryCare is off.
BMS (Battery Management System), which is installed in every electric or PHEV car (sometimes called alternatively by the producer of a vehicle) beside of controlling critical parameters, like the maximal voltage, or current, spends some time on balancing of cells. Basically, it is simple. The most common method uses passive energy reducement via resistive load. Most powerful cell (qualified mainly via highest voltage) or usually - a group of such cells are connected to small resistors to reduce their total energy stored and thus - to reduce voltage to be similar (more or less equal) to most of the cells.
This process is not continuous, and also it uses quite low energy consuming resistors to avoid generating heat.
The most crucial problem is that it is not entirely sure (but most probable) that the cell with the highest voltage has the highest capacity. As this may change while the voltage of the whole battery (and state of charge, SOC) would be lower, BMS tries to store some information about the behaviour of cells at various SOC level to be better prepared and predict future needs of balancing. In simple words - a cell with the highest voltage at SOC=100% may be the weakest one at SOC = 10% - so it would be a nonsense to discharge it (balance it), when BMS knows, that this cell will loose that high voltage, along with SOC going down.
As all this information stored in BMS is used to predict the total capacity of the battery, it may start to be inaccurate. Sometimes it is just caused by an error (bug) in the software of BMS (like Nissan Leaf 30kWh before the update, that corrected that mistake). In most cases, it is just because the car is not fully loaded or discharged to help BMS to collect more data and predict real capacity better.
ReVive Balancing uses a semi-random "Pulse-Relax" algorithm, well known from modern 12V battery chargers with reconditioning of battery. The car should be discharged to <10% of SOC (shown at car dashboard). Then - charger pumps battery for a short period, then - relax it with slowest charging speed possible. It repeats with some time variations.
With this schema of charging, all weak cells show their behaviour at various SOC and BMS learns quickly and accurate, how to balance them in the future. We may say it

"resets" but to be honest - it just updates all the info about cells behaviour at various SOC. Last period (usually after 8-10 hours) is just slow charging of the car.
In most cases, usable capacity will be improved, and SOH (State of Health) may go up. Please use that function overnight, at least twice a year, and you will recondition your battery and keep better usable capacity.

10.3 SOP

The SOP is State of Power (similar to SOC - state of charge, SOH - state of health).
It is displayed at the main screen of Accelev EVSE electric car charger. It represents the quality and capability of your power source (home grid).
It will alarm you, when your grid may fail or connection is bad (not only at the charger, just whole electric network in house or garage).



The SOP uses an electric car as a load to test the grid under stress and is calculated as:
- (voltage drop per kilowatt charge power)*(250/voltage at the start)
Smaller values = better energy source.
It will change slowly intentionally. But charger will detect an unexpected increase in SOP as potential damage/failure of a network. So chargers will be able to detect ageing of cables, sockets, plugs, bad contact, water penetration in home grid etc.
Values:
0-1 perfect
1-2 typical
2-3 bad
3-4 very bad, consult your electrician
4+ do not use this grid for car charging, consult your electrician

11. Errors and Troubleshooting

Errors are presented as a separate red screen with the error code and an explanation. There is a button “Dismiss” visible. It can be used for a technician, to bypass the error. Following errors may occur:

01 - Input voltage too high.
It means that your grid voltage is above 240V at the input. Standard voltage is 220-230V per single phase. Please contact us if you see this error.
02 - Input voltage too low.
Your grid voltage is below 200V per phase. It is an unusual situation, as a standard voltage is around 230V while the grid is not loaded. Contact your local electrician or energy delivery company to solve this problem.
03 - Current too high.
It means that your car sinks more energy than is permitted by the charger. It must be a shortcut or energy leak somewhere at the battery. Please contact your car dealer to solve the problem.
For cars, that start heating immediately after waked from sleep being charged with a full-speed a problem of overcurrent (thus finally - error 03) may occur in winter. Please install software v2.18 or newer to solve that problem. Notice, that this is not a fault of a charger, but improper energy handling procedure in the car.

04 - Temperature too high.
The core of your charger has a too high temperature. Let it cool down, cover from direct sun. Contact us if all seems ok, but the error occurs.
05 - Temperature too low.
It seems that ambient temperature is below -30C. Please use your charger in a sheltered area, or at least, let it warm up somewhere at home, inside of your car etc. Electronics dislike working in the excessive cold.
06 - PE protection.
PE line error/grounding error detected or your PE/grounding in power socket is not correct. Contact your electrician.